STATE OF WASHINGTON
DEPARTMENT OF NATURAL RESOURCES
BRIAN J. BOYLE, Commissioner of Public Lands
ART STEARNS, Supervisor

DIVISION OF GEOLOGY AND EARTH RESOURCES
RAYMOND LASMANIS, State Geologist

INFORMATION CIRCULAR 57

HANDBOOK FOR GOLD PROSPECTORS IN WASHINGTON

By

WAYNE S. MOEN and MARSHALL T. HUNTTING

1975
Reprinted 1983

For sale by the Department of Natural Resources
Price $2.00

PREFACE

Because of increases over the past several years in gold prices, gold panning and prospecting is becoming increasingly popular. Few people realize that a small nugget about the size of a match head contains around $1.50 in gold, whereas a nugget the size of a navy bean may sell for as much as $20.

Any able-bodied person, equipped only with a gold pan and shovel, can work the gold-bearing streams of the state. Very few will get rich panning gold, but the lure of gold and the challenge to find it will always attract some individuals. Although the richest placer gold deposits in Washington were worked out by 1900, the early-day placer miner failed to recover all the gold and some still remains hidden in stream gravels waiting to be found by a new generation of placer miners.

In 1955, "Gold in Washington," by Marshall T. Huntting, was published by Washington Division of Mines and Geology. Although this publication has been out of print for several years, the demand for it remains constant. Rather than reprint this publication in its original form, it was decided to publish a new improved version of "Gold in Washington" under the new title of "Handbook for Gold Prospectors in Washington." The contents of this new publication are basically the same as what appeared in "Gold in Washington"; however, much subject matter has been updated, the lists of the gold occurrences have been condensed, and the distribution of gold in streambeds and methods used to recover placer gold are covered in greater detail.

The writers realize that only the basic principles of placer mining are covered in this book; however, if the amateur placer gold miner follows the instructions contained herein, he should experience the thrill of recovering a nugget or two from the streams of Washington.

CONTENTS

ILLUSTRATIONS

TABLES

I wanted the gold, and I sought it;
I scrabbled and mucked like a slave.
Was it famine or scurvy—I fought it;
I hurled my youth into a grave.
I wanted the gold, and I got it—
Came out with a fortune last fall,
Yet somehow life's not what I thought it,
and somehow the gold isn't all. . . .

There's gold, and it's haunting and haunting;
It's luring me on as of old;
Yet it isn't the gold that I'm wanting
So much as just finding the gold.
It's the great, big broad land way up yonder,
It's the forests where silence has lease;
It's the beauty that thrills me with wonder,
It's the stillness that fills me with peace.

From: "The Spell of the Yukon"
—Robert Service (1874-1958)

HANDBOOK FOR GOLD PROSPECTORS IN WASHINGTON

By

Wayne S. Moen and Marshall T. Huntting

INTRODUCTION

Gold, throughout the ages, has been synonymous with wealth. For thousands of years, it has been the foremost medium of exchange in most countries. Everyone is familiar with gold and with the romance associated with its recovery from occurrences in nature. In fact, it is probable that gold is the first, and to many the only, metal thought of when mining is mentioned. Certainly, it is the metal first thought of under ordinary conditions when a person decides to become a prospector and seek his fortune on the streams and in the mountains. This is easily understood, for, of all metals, gold is the most simply and easily recovered from its containing formation, whether it occurs as a lode or as a placer deposit. A minimum of experience and equipment is required to pan for gold; and, when won, gold is tangible wealth, requiring little or no treatment to be exchangeable for goods.

Small-scale gold-mining operations, with limited investment, find gold mining attractive. That such operations are still more attractive and profitable in periods of depression is obvious, and the fear of "hard times" is the motivation for much of the interest constantly shown in gold prospecting.

This report is designed mainly for the amateur prospector and answers questions most commonly asked as to how and where gold occurs in Washington. In the inquiries received by the Division of Geology and Earth Resources, gold has been the metal most frequently asked about, and the purpose of this report is to provide some of the data most often requested, including a list of the more important gold occurrences, both lode and placer, in the State of Washington. Most of the general data in this report are from various published sources, which are indicated in the list of references. The section on occurrences is abstracted from the chapters on lode and placer gold in Bulletin 37, Inventory of Washington Minerals, Part 2, Metallic Minerals, published by the division in 1956.

PROPERTIES OF GOLD

Gold is bright yellow when pure, but, as originally found, most gold is naturally alloyed with silver, and the color varies through lighter shades of yellow to yellowish white as the silver content increases. Much less commonly gold is found naturally alloyed with copper. Such alloys are reddish yellow. Gold has also been found naturally alloyed with iron, plat-

inum, bismuth, and mercury. Although gold does not tarnish, nuggets and flakes of the metal are often covered by reddish, brown, or black films of iron and manganese oxides.

Gold is the most malleable and ductile of metals and is one of the softest. Its hardness is 2.5 to 3—harder than lead but softer than copper or silver. It can be hammered out into leaves thin enough to be transparent and so thin that more than 500 of them would be required to equal the thickness of this page; also it can be drawn out in wire so fine that one troy ounce would produce a wire more than 37 miles long. Gold weighs 1,206 pounds per cubic foot, and the specific gravity of pure gold is 19.32 at 17.5° C. However, the specific gravity of natural gold may be as low as 12.5, owing to the presence of alloy metals. Because gold weighs around 1,200 pounds per cubic foot, it occupies a minimum amount of space. The estimated 3.25 billion ounces of total gold production throughout world history could be contained in a cube, each side of which would be 60 feet. The world's current yearly production of around 44 million ounces could be contained in a cube, each side of which would be $13\frac{1}{2}$ feet. Currently, gold production in the United States is around 1.5 million ounces yearly. This gold could be cast into a single cube, each side of which would be only $4\frac{1}{2}$ feet. Gold is a good conductor of heat and electricity, its electrical conductivity being exceeded only by silver and copper. Its electrical resistivity is 2.4×10^6 ohms per cubic centimeter. The melting point of the metal is 1063° C., and the boiling point, 2600° C. The thermal coefficient of linear expansion of gold at 20° C. is 14.2×10^6, and the magnetic susceptibility at 18° C. is -0.15×10^6.

Gold crystallizes in the isometric system, but distinct crystals are comparatively rare. Usually those found are small, more or less distorted, and in dendritic or branching groups. The most common crystal forms are cubes, octahedrons, and dodecahedrons, but usually gold occurs as disseminated scales or grains, as filiform, dendritic, spongy, or reticulate particles, or in larger irregular lumps or nuggets. The individual particles are commonly submicroscopic in size but may range up to nuggets weighing several pounds each. Crystalline gold has been recovered in Washington from some lode deposits in the Swauk district of Kittitas County.

The chemical symbol for gold is Au, the atomic weight is 197.2, and the atomic number is 79. Gold is both univalent and trivalent, but is not very active chemically and forms very few compounds. It is one of the most permanent and least active of the metals; because of its resistance to oxidation the alchemists called gold a "noble metal" in contrast to the base metals, which oxidize when heated in air. Gold is not affected by air or most reagents and does not dissolve in any of the common single acids but does dissolve in aqua regia, a combination of hydrochloric and nitric acids. Also, it is soluble in alkali cyanides in the presence of air.

USES

Gold has been desired and used by man from before the beginning of written history. Its color, ease of recovery from its ores, extreme malleability, chemical stability, and rarity have combined to create man's early and continued interest in the metal, and these same properties account for its preeminence in its current uses for monetary and ornamental purposes. Since earliest historical time gold has been used for currency or as a monetary standard, and at the present time these are the principal uses of the metal.

In the arts, gold is used in the manufacture of jewelry, watches, and gold foil for lettering and decorative purposes. Lesser amounts are used in dentistry and in the electrical and chemical industries. Because of their nonoxidizing characteristics at high temperatures, gold alloys are used in some special electrical contact points; also, on account of its high resistance to chemical attack, gold is used in technological and laboratory equipment used for handling corrosive fluids. Gold-platinum alloys are used in the textile industry in spinnerettes, which form the filaments of rayon and other synthetic fibers. Small quantities of gold are used in medicine and photography. In 1972, the domestic consumption of gold was 7.28 million ounces, 60 percent of which was used in jewelry and arts, 30 percent for industrial, space, and defense purposes, and 10 percent for dental purposes.

For most of its uses gold is alloyed with other metals, generally to increase its hardness. The metals commonly used in the alloys are copper, silver, nickel, tin, aluminum, iron, zinc, lead, platinum, and palladium. Gold-mercury alloys are known as amalgams.

TABLE 1.—World monetary gold stocks, 1973

	Million troy oz	Value at $42.22 (million $)	Value at $150.00 (million $)
United States	275.9	$ 11,648	$ 41,385
West Germany	117.6	4,965	17,640
France	100.9	4,259	15,135
Switzerland	83.2	3,513	12,480
Italy	82.5	3,483	12,375
Holland	54.2	2,288	8,130
Belgium	42.2	1,782	6,330
Latin America	30.2	1,275	4,530
Middle East	28.3	1,195	4,245
Canada	21.9	925	3,285
Britain	21.3	899	3,195
Japan	21.1	891	3,165
South Africa	18.9	798	2,835
Other Europe	81.0	3,420	12,150
Other Asia	18.4	777	2,760
Rest of World	11.5	486	1,725
Int'l Organizations	160.2	6,764	24,030
Total	1,169.3	$ 49,368	$ 175,395

Gold holdings of the United States Treasury in 1973 were 275.9 million troy ounces, which is about 23 percent of the world's total. Gold holdings of the United States and other countries are shown in table 1. In addition to the United States monetary gold stocks, 4.4 million ounces are held by domestic refiners and fabricators, and large amounts are held by private investors in the form of jewelry, coins, and bullion.

GOLD ORES AND ORE MINERALS

Although gold is one of the scarcer elements, it is widely distributed in nature and has been found in minute quantities in various kinds of igneous, metamorphic, and sedimentary rocks in places remote from known ore deposits. Gold is known to concentrate in certain plants and in some marine animals. The ashes of Equisetum (commonly called the "Horsetail" rush) have been reported to contain up to 610 grams of gold per ton (Rankama and Sahama, 1950, p. 707). Sea water has been variously reported to contain from 5 to 65 milligrams of gold per ton (Clarke, 1924, p. 124-125), and on the basis of such assays one estimate of the total content of gold in all the oceans is 10 billion tons.

Gold occurs by far most commonly as the native metal, which always is alloyed with varying amounts of silver, generally 10 to 20 percent. Any alloy in which the silver content exceeds 20 percent is known as electrum. Usually the gold in ores is in particles too small to be seen with the unaided eye; commonly it is of submicroscopic size. Other than the native metal and its alloys, the only naturally occurring gold minerals are the tellurides, the most common of which are calaverite, $AuTe_2$, containing 43.5 percent gold; sylvanite, Au,Ag,Te_2, containing 24.5 percent gold; and petzite, Au,Ag_3,Te_2, containing 25.2 percent gold. These minerals are rather rare, and none of them has been recognized in Washington.

Other gold minerals even less common are the gold-silver-mercury tellurides, kalgoorlite and coolgardite; the silver-gold tellurides, muthmannite and gold-schmidtite; the gold telluride, krennerite; and the gold-lead-sulpho-telluride, nagyagite.

Gold accompanies selenium and particularly tellurium, the latter association being illustrated by the gold tellurides in sulfide ore deposits. In the presence of both sulfides and arsenides or antimonides gold usually is found concentrated in the arsenides or antimonides rather than in the sulfides (Rankama and Sahama, 1950, p. 705). In sulfide deposits gold is usually associated with pyrite and less commonly with arsenopyrite; it may be found also in chalcopyrite, stibnite, pyrrhotite, sphalerite, and other sulfides. The most common gangue mineral is quartz, but other gangue minerals in gold ores include carbonates, fluorspar, tourmaline, and barite.

Gold deposits are of three main types: veins or other lode ore bodies of hydrothermal origin, ordinary placer deposits, and consolidated placer deposits (gold-bearing conglomerates and sandstones).

PROSPECTING FOR GOLD

As the old saying goes, "gold is where you find it," and the places where it is found are many and varied. Some very unlikely looking rocks carry gold in paying quantities, and other rocks that are mineralized and look very favorable for the occurrence of gold have none. However, there is another old saying that advises the prospector to "look for bears in bear country." In other words, the best areas in which to prospect for gold are those where gold has been found previously. This is axiomatic, of course, yet it is surprising how much effort is wasted each year by people who, for reasons of their own, persist in prospecting some of the least likely areas. The maps (figs. 12 and 13) show the locations where placer and lode gold have been found in the state, and, although in the future a few discoveries will no doubt be made in areas remote from previously known occurrences, the great majority of the new finds will be in areas shown on the maps where gold has been found most commonly in the past. Thus, the maps are probably the best, and yet simplest, guides to prospecting this report can furnish.

As noted before, there are few rock types that may be eliminated as possible hosts for gold ore deposits, but most lode gold is in quartz veins closely associated with intrusive or extrusive igneous rocks of intermediate to acidic composition, such as diorite, granodiorite, granite, andesite, or rhyolite. This fact suggests, as an aid in prospecting for gold, the use of geologic maps showing the areas underlain by these rocks. The Washington Division of Geology and Earth Resources has published a geologic map covering the whole state and various other geologic maps of specific areas within the state.

The application of geological principles and the study of geologic maps and aerial photographs may be of assistance in both placer and lode prospecting. An insight into the probable location of channels and paystreaks in placers may be gained through a study of physiography and the application of stream-sedimentation principles. As placer gold tends to concentrate in stream channels in places of slackened water velocity, the prospector should examine with special care such places as the bars on the inner sides of curves and places where streams emerge from rapids into quiet water. Attention to the structure and the types of bedrock may be profitable, as gold often concentrates on the edges of steeply dipping schist, thin-bedded sediments, and other formations that erode into miniature ridges and grooves, thus forming natural riffles in the streambed. Riffles par-

allel to the direction of streamflow are more effective than riffles crossing at a large angle; therefore, portions of channels roughly paralleling the strike of such rocks are most favorable. The pitted, rough surfaces of limestone are more effective in catching gold particles than are the smooth surfaces that erosion produces on most granitic rock, although under favorable conditions potholes may form in granite as well as other rock types, and these potholes may act as effective gold traps.

Oftentimes attention to details in placers may lead the prospector to the discovery of lode deposits. Gold particles in stream gravels commonly may be traced upstream to their source even though the placer itself may be too low in grade to work at a profit. The size and shape of the gold particles give clues to the distance they have traveled. Nuggets found near their point of origin may be comparatively large and quite irregular and angular in shape, whereas particles that have been transported for some distance generally are smaller, more regular, and rounded or flattened.

Geophysical investigations, using magnetic, electric, gravimetric, or seismic methods, are sometimes helpful in locating mineralized zones in bedrock or, when placer prospecting, in determining depth to bedrock or in locating magnetic black sands with which gold may be associated. The prospector should be very careful to distinguish between geophysical prospecting equipment (all of which has been described in published technical papers) and the many and varied kinds of "doodlebugs," which operate on "mysterious" and "secret" principles known only to the operator or to no one. These include many variations on the old-time pendulum-type doodlebug, the forked divining rod or witch stick, and the "electronic" and other more imaginative and modern versions, all of which have been represented by misguided or unscrupulous persons to be infallible in locating, identifying, and evaluating ores. These same gadgets are usually reputed to be equally effective in locating water, oil, buried treasure, lost persons, and just about anything imaginable. This "divining rod myth" is effectively disposed of by Butler (Butler, 1935, p. 71-77) who also discusses a number of useful facts about ore deposits in a paper written especially for prospectors and miners.

SAMPLING

In searching for lode-gold ores the prospector is obliged to depend heavily upon assays to determine whether or not a vein carries gold values or how rich a given ore is. Until a person becomes very familiar with the gold ore in a given mining district his estimate of the value of a specific ore sample can be little more than a guess, and in many gold mines even experienced operators have to rely entirely upon assays to distinguish between ore and waste. Upon finding a possible gold-bearing vein the prospector may be well advised to "high-grade" the deposit and take his preliminary samples from the best looking portions of the ore. Then if the assays show nothing or only traces of gold the deposit may be eliminated from further consideration. If the assays are favorable the vein should be resampled in such a way that the samples will be as truly representative as possible. Details of sampling methods and of evaluating ore deposits, both lode and placer, are described in many books, and a bibliography of literature on sampling has been published by the U.S. Bureau of Mines (Sharwood and von Bernewitz, 1922). Sampling methods, as well as most of the other subjects that would be of interest to the gold prospector, are also described in a very usable handbook for prospectors by von Bernewitz (1943).

Placer sampling is usually accomplished by panning, but rockers or even small sluice boxes may be used. Since placer gold tends to concentrate on or near bedrock, it is necessary in most places for the prospector to dig trenches, pits, or shafts, or to drill to obtain samples for testing. The following description of the technique of panning may be of some assistance to the beginner.

The pan of gravel is held under water, the contents are stirred by hand to break up cemented pieces of gravel and lumps of clay, and the larger stones are picked out. The pan, still under water, is held with both hands in a level position and is given a series of rotary or gyratory motions, largely through wrist action. This causes the heavy particles to settle and the light material to work its way to the top. The pan is tilted, and by raising and lowering it in the water the surface material is washed off. Then by holding the pan in a position tilted away from the prospector, so the contents just barely do not spill, it is alternately gyrated to bring the light material to the surface and washed by raising and lowering the tipped pan in the water. As they come to the surface the larger pieces of barren gravel are picked off by hand. The panning is continued with gradually increased tipping until only the gold and a little heavy sand are left. The residual sand may be separated from the gold by drying and blowing, by removal of magnetite with a magnet, or by adding mercury to collect the gold as amalgam. In experienced hands there is little or no loss of gold.

SIZE OF GOLD PARTICLES

The size of individual gold particles ranges widely. Commonly the gold in lode deposits occurs in particles of submicroscopic size. In placer deposits the finest flour gold may be too tiny for individual particles to be seen without the aid of a magnifier, but they may range upward in size to nuggets weighing several pounds each. The largest nugget known is the Welcome Stranger, weighing 190 pounds, found in 1869 near Ballarat in Australia. The largest nuggets yet found in Washington are from the Swauk district in Kittitas County. A 73-troy-ounce nugget was found in 1900 at the Elliott placer on Williams Creek, and a 77-troy-ounce nugget on a bench of Swauk Creek above the mouth of Baker Creek.

Placer gold particles are classified as follows:

Coarse.—more than 0.06 inch in diameter (about the size of a grain of rice).

Medium.—less than 0.06 inch but more than 0.03 inch in diameter (about half the size of a pinhead).

Fine.—less than 0.03 inch but more than 0.015 inch in diameter (about a quarter of the size of a pinhead).

Very fine.—less than 0.015 inch in diameter.

Fine gold averages 12,000 colors (particles) per ounce, and very fine averages 40,000 colors per ounce. Gold particles that require 300,000 or more colors per ounce are called flour gold, and about 100 particles of this size are required to have a value of 5 cents. Some flour gold is so small that it takes 1,000 colors to be worth 1 cent, and about 14 million colors are needed to weigh 1 ounce. Tiny as they are, each of these individual particles can be seen when placed on a black surface. At $150 per troy ounce gold price, a particle of gold the size of a common pinhead has a value of about 9 cents; a particle the size of a grain of rice has a value of about 85 cents; and a

particle the size of a navy bean has a value of about $15.00. One troy ounce of pure gold has a volume equal to that of a cube a little less than half an inch (0.464 in.) on a side. Table 2 gives the value of several sizes of gold nuggets based on different market prices.

TABLE 2.—Value of gold nuggets at several market prices

Approximate size of nugget	Market price of gold per troy ounce				
	$ 35	$ 70	$ 150	$ 200	$ 250
Pinhead (.0185 gram)	.02	.04	.09	.12	.15
Rice grain (.178 gram)	.20	.40	.85	1.14	1.43
Match head (.267 gram)	.30	.60	1.30	1.70	2.25
Navy bean	3.50	7.00	15.00	20.00	25.00

IDENTIFICATION TESTS

Many times the novice prospector is undecided whether the "yellow stuff" he is looking at is really gold or is something else. The yellow minerals that are most commonly mistaken for gold are pyrite, chalcopyrite, and golden-colored mica flakes. Pyrite, or "fool's gold," is heavy, but not as heavy as gold; it is hard and brittle and crushes to a black powder when hammered, whereas gold is soft (almost as soft as lead) and malleable and can be easily beaten into very thin sheets that are flexible (can be bent a number of times without breaking). Pyrite is soluble in concentrated nitric acid; gold is insoluble. Chalcopyrite, also sometimes mistaken for gold, is similar to pyrite in these properties. Pyrite commonly occurs as cubic crystals, but gold almost always is found in irregular shapes, and in those rare places where it does occur as crystals the crystals are always in intergrown masses.

Tiny golden-colored mica flakes sometimes look deceptively like gold, but the luster of mica is different from that of gold; mica has laminations that can be split with a knife; and mica flakes, like gold, are flexible, but, unlike gold, the flakes are elastic, so that when bent they tend to return to their original shape. Gold is malleable, but mica is not; when mica is hammered it breaks up into numerous tiny flakes. Gold is heavy, but mica is light. Thus, when panned, gold becomes concentrated in the very lowest part of the pan, but mica will be washed out of the pan, although because of its flakiness, it does tend to segregate somewhat from other light minerals. Mica fuses with difficulty; gold, pyrite, and chalcopyrite fuse easily in a blowpipe flame (gold at 1063° C.); and gold when roasted is odorless, but the sulfides, pyrite and chalcopyrite yield sharp-smelling sulfur dioxide fumes.

The gold telluride minerals are comparatively rare and are not easily recognizable. Furthermore, they usually occur as small, sparsely disseminated grains that are difficult to isolate for testing. They vary in color from silver white, yellow, and steel gray to nearly black. Gold in the tellurides may be recognized by its physical properties after the tellurides have been roasted, but it can best be detected by fire assay.

There are no simple, easily performed chemical tests for gold but Savage (1934, p. 97) describes several qualitative tests as well as several wet assay methods. The "purple of Cassius" test, often referred to as the most easily performed test for gold, may be satisfactory as a means of confirming the identification of an unknown metal suspected of being gold, but as a means of detecting gold in an ore it can not ordinarily be relied on.

"Purple of Cassius" Test for Gold

1. Place 1 oz. of finely crushed ore in a glass tumbler or beaker.
2. Add to it 50 cc. aqua regia and stir well.
3. Boil this mixture almost to dryness.
4. Add 20 cc. dilute hydrochloric acid, 30 cc. water; boil and filter.
5. Make filtrate or clear solution basic by adding ammonium hydroxide until it indicates a basic condition on red litmus paper.
6. If a precipitate is present, filter. Treat filtrate or clear unfiltered solution by procedure 7.
7. Add dilute hydrochloric acid, a few drops at a time, until the solution is acidic, then add about 5 cc. stannous chloride solution.
8. If gold is present, a blue or purple precipitate will be thrown down. This is known as the "purple of Cassius." As little as one-quarter ounce per ton in gold can be detected.

Note: If the ore is low grade, it should first be concentrated in a gold pan and then the concentrate should be tested. If the ore is a sulfide, it should be thoroughly roasted before testing.

Spectrographic methods are not very satisfactory for the detection of gold because the gold concentration in many ores is below the limit of spectrographic observation (±0.50 oz/ton).

The standard method for the analysis of gold is the fire assay, and, in view of the modest charge ($6 to $8) made for gold assays, the prospector would be well advised to send his samples to a reputable assayer rather than attempt "home assays." The main steps in a fire assay are: First the specimen is fused in a suitable alkali-flux mixture, containing lead oxide and sodium carbonate and(or) borax. A lead "button" is obtained from this fusion in which is alloyed all the gold and silver that was in the sample. This is then cupeled by heating in a bone-ash container in an oxidizing atmosphere to eliminate the lead by volatilization and by oxidation and absorption into the body of the container. The bead remaining is made up of the precious metals, from which the silver is extracted by "parting" in nitric acid. The residual gold "sponge" may then be melted down and weighed.

The prospector may in some instances wonder whether a given specimen is worth assaying. The identification service offered by the State Division of Geology and Earth Resources may then be of value. The Division examines at no cost to the sender samples of rocks or minerals that occur in Washington and notifies the sender what the material is. Assays or chemical analyses are not made, but mineralogic and petrographic determinations are. If an assay appears warranted, the sender is so advised, so that he may submit a sample of the material to a commercial assayer if he desires.

LOCATING MINING CLAIMS

MINERAL RIGHTS

No license is required to prospect for gold or any other mineral in Washington. The right to mine gold or other minerals on land in Washington may be acquired in one of several ways, depending upon the ownership of the land and its mineral rights. The right is acquired on "open" land simply by making a discovery followed by proper staking and recording, and the mining claim then may be held indefinitely by doing the required $100 worth of assessment work each year. "Open" land is defined and the procedures for obtaining the rights to minerals on land not "open" are described by W. S. Moen (1962) in "Min-

eral Rights and Land Ownership in Washington."

Mining claims, either lode or placer, may be staked without permit or license on the "open" Federal land of the State by any United States citizen or person who in good faith has declared his intention of becoming a citizen. In general, "open" lands include only (1) land of the United States Public Domain (unreserved and unappropriated U.S. public lands) and (2) lands of the National Forests (National Parks are not "open"). The National Forests in Washington are: Olympic, Mount Baker, Snoqualmie, Gifford Pinchot, Wenatchee, Colville, Kaniksu, and Umatilla. Maps of these National Forests may be obtained from the Regional Forester, U.S. Forest Service, P.O. Box 3263, Portland, Oregon, 99201. Records of such Public Domain as remains are kept in the U.S. Bureau of Land Management, West 920 Riverside, Spokane, Washington, 99201, and information about these lands may be obtained there.

Claims may not be staked on land that is not "open." Other procedures, which depend on the ownership of the land, must be followed then if a person desires to prospect or mine on land not belonging to him.

State-owned land.—Application should be made to Department of Natural Resources, Division of Land Management, Olympia, Washington, 98504 for applicable rules and regulations and for a mineral prospecting lease or mining contract on the particular tract, described by legal land description and not to exceed 640 acres. Submerged lands of Puget Sound and of the larger lakes, tidelands of the ocean and sound, and beds of so-called "navigable" streams (many not actually navigable) are either State-owned or (since 1907) have been sold by the State with mineral rights reserved to the State. Information may be obtained from the Commissioner of Public Lands, Department of Natural Resources, if there is doubt as to whether land is State-owned or not.

County-owned land.—Application should be made to the Board of County Commissioners of the county in which the land is situated for details and permit.

State Highway rights-of-way.—Conditions will vary, depending on the status of the land prior to the laying out of the right-of-way. Inquiry may be made of the Director of Highways, Commissioner of Public Lands, or the Division of Geology and Earth Resources.

Indian Reservations.—Application should be made to the Agent in charge of the particular reservation for regulations pertaining to prospecting and leasing.

Privately owned land.—(Including land owned by any individual or any corporation such as Burlington Northern railroad, Weyerhaeuser Timber Co., or other). Application should be made to the owner for permission to trespass, prospect, lease, mine, or purchase. Probably in most instances a private land owner (owner in fee) not only owns the surface rights but also owns the subsurface and all mineral rights to his land. He then may mine or not as he chooses. Anyone else entering the land without the consent of the owner is subject to trespass, he may not stake claims or mine, and he is liable for damages if he persists and injures the land. There are instances, however, where surface rights and mineral rights are separately owned, as described below.

In some land exchanges and in all stock-raising homesteads, all minerals have been reserved to the United States upon issuance of the original patents. In these instances a qualified person may enter the land, prospect for, locate a claim, mine, and remove any of the minerals except those named in the next paragraph. Any person entering such lands to prospect must compensate the owner for any damages caused thereby to crops or improvements.

Ordinarily, the minerals reserved to the United States consist of deposits containing coal, oil, gas, phosphate, sodium, potassium, and oil shale. Lands containing such deposits have not been subject to location since July 17, 1914. Since 1873, coal has been the subject of special laws. Since February 25, 1920, all these minerals may be prospected for under a prospecting permit, and may be leased under certain conditions. Further information about such permits or leases can be obtained from the U.S. Bureau of Land Management, West 920 Riverside, Spokane, Washington, 99201.

Lands containing deposits reserved to the United States are chiefly: (1) lands classified or withdrawn as coal lands and patented thereafter under nonmineral land laws subsequent to March 3, 1909, or (2) lands classified or withdrawn as phosphate, nitrate, potash, oil, gas, and asphaltic minerals, or valuable for such deposits and thereafter patented under the nonmineral land laws (for

example, homesteads), subsequent to July 17, 1914.

Whether or not a given tract of land has minerals reserved to the United States, as mentioned above, may be determined by examining the original patent covering the lands in question—this is a matter of record in the office of the County Auditor of the county where the land is situated. Lands which have been patented with mineral reservations are also recorded with the U.S. Bureau of Land Management at Spokane. The status of all Federal public lands in Washington may be ascertained by correspondence with that office.

In some instances, a previous owner (private individual or a corporation) of a tract of land has reserved to himself the mineral rights when he transferred title to the land. In other words, he may have sold the surface rights and retained ownership of certain or all minerals existing in the land. This has been the case with all State-owned land when the contract of sale was later than 1907, and it is commonly the case with land sold by Burlington Northern. The mineral rights, in such instances, belong to the previous owner of the land, and he has the right of entry for mining purposes, and he may lease his rights or mine if he chooses, but he must compensate the surface owner for damages done to improvements on the land. The only way the surface owner may acquire the mineral rights when they have been reserved by a previous owner is by purchase or lease from the previous owner. Whether or not a previous owner of a given tract of land has reserved the mineral rights when he transferred title to the land may be ascertained by reading the various deeds applicable to the given tract on record in the office of the County Auditor of the county where the land is situated.

Any land owner who may be interested in determining if the mineral rights to his tract were reserved to the United States when patent was issued, or if an owner previous to himself had reserved such rights, may have this information obtained for him by any reliable abstract or title company. The fee for this commonly ranges from a minimum of $10 to about $25 when many transfer instruments must be searched. Of course, he may search the records himself if he should prefer to do so.

Further information on staking mining claims and on other matters having to do with Federal and State mining laws may be obtained from "Mining laws of the State of Washington" by John L. Neff and Robert L. Magnuson, (1974).

No list or map has ever been prepared to show (1) lands "open" for mineral location in Washington, (2) claims that have been staked, or (3) State-owned lands that are available for mineral leasing. Information regarding "open" lands and State-owned lands may be obtained from "Mineral Rights and Land Ownership in Washington" (Moen, 1962). Likewise, no one has published a list of abandoned mining claims. Such a list would be virtually impossible to compile and keep up to date, as well over 125,000 mining claims have been filed in Washington from the earliest record to the end of 1936, and many thousands more have been staked since that time. Records of claim locations and assessment work are not kept by any State or Federal office but are filed with the auditors of the counties in which the claims are located. Information as to the location and current status of previously staked claims can be ascertained only by searching the county records. The auditors also have information as to location and ownership of individual patented claims. Additional information about patented claims may be obtained by examining the original patent survey notes on file in the Department of Natural Resources, Division of Surveys and Maps, Olympia, Washington, 98504, or U.S. Bureau of Land Management, P.O. Box 2965, Portland, Oregon, 97208.

The six full national forests and two fractional parts in Washington cover 9,679,827 acres, which is about 23 percent of the total area of the state. The national forests cover most of the best mineralized areas, thus a large part of the best ground for prospecting is "open" land.

An apparent exception to the general rule that State-owned lands may be leased for mineral ex-

ploration and mining are the tidelands (between extreme low- and ordinary high-tide levels) along the shore and beach of the Pacific Ocean from the mouth of the Columbia River north to Cape Flattery, as these tidelands have been set aside by state laws (Chap. 105 and Chap. 110, session laws of 1901, and Chap. 54, session laws of 1935) as a "public highway." These laws forbid the sale or lease of these lands for any purpose (except that tidelands between the mouth of the Queets River and Cape Flattery may be leased for the extraction of petroleum and gas). Later laws, however, allow the leasing of these lands for gas and oil exploration, but apparently no provision has been made for leasing for other minerals such as gold. The land-ownership and mineral-rights situation along the beach and in the lowlands adjacent is further complicated by (1) the fact that the Olympic National Park includes 47,753 acres in a corridor along theQueets River and a strip ½ mile to 3 miles wide back from the beach and extending from the mouth of the Queets River to Cape Alava, near the mouth of the Ozette River, and (2) the presence along the coast of five Indian Reservations—the Quinault, Hoh, Quillayute, Ozette, and Makah Reservations—on some of which it has been established that the mineral rights on the tidelands belong to the Indians.

STAKING LODE CLAIMS

Possessory title to mineral rights on "open" land is established by staking claims, and this entails (1) making a discovery, (2) posting a location notice, (3) staking boundary lines, and (4) recording a location certificate for each claim. A full-size lode claim is 1,500 feet long and 600 feet wide. There is no legal limit to the number of lode claims an individual may hold.

After mineral has been discovered in place, the locator should immediately post a location notice at the discovery spot, stating (1) date of discovery (date of posting), (2) name of the claim, (3) name of the locator(s), (4) distance in feet claimed in each direction along the course of the vein from the discovery post, (5) width claimed on each side of the vein, (6) general course of the vein, and (7) description of claim by reference to legal land description or to some natural object or permanent monument.

Within 90 days of the discovery date, and before the claim is recorded, the boundary lines of the claim should be marked by cutting brush and blazing trees along the lines. At each of the four corners of the claim (also at each angle of nonrectangular claims) a substantial stake or stone monument must be erected. A tree or stump will do; if a stake is used, it must be at least 4 inches in diameter; and either a stake or monument must be at least 3 feet high above ground. Each corner must be marked with date of location (same date as recorded on discovery notice) and name of claim. Also, it is recommended that the name of locator(s) and designation of corner (such as, NW. cor.) be placed on the corner markers. End lines must not be more than 1,500 feet apart, measured along the vein, and to secure full extralateral rights the end lines should be parallel and should cross the vein. The side lines need not be straight, but should follow the course of the vein and should be not more than 300 feet from the center line of the vein. A discovery excavation is not required on mining claims staked in Washington.

After the other steps have been taken, and within 90 days of the date of discovery, the locator must record a copy of his location notice in the office of the auditor of the county in which the lode is found. This notice should contain the same informa-

tion as is on the location notice on the discovery post.

STAKING PLACER CLAIMS

A placer claim should be in the shape of two or more adjoining 10-acre squares. A claim may be located by one or more persons, but it must be limited in size to 20 acres per locator up to 160 acres for a single placer claim. There is no limit on the number of claims an individual or group may hold. Regardless of the size of a claim (20 acres or 160 acres) only one discovery within it and only $100 annual assessment work is required. On lands covered by a United States survey the placer location should be bounded by lines that conform to the legal survey section lines and section subdivision lines. The claim should be described accordingly (such as, $W\frac{1}{2}NE\frac{1}{4}$ $NW\frac{1}{4}$ sec. 22, T. 20 N. R. 17 E.). On lands not covered by a United States survey the claim boundaries must still follow the same rectangular block system used on surveyed lands, and the description must contain reference to natural landmarks or permanent monuments for identification purposes as in lode claims. Exceptions are made allowing the staking of "gulch claims" of irregular shape in the case of placer locations made in narrow gulches with nonmineral sides.

The procedure for staking placer claims is generally like that for lode claims but differs in detail. Placer claims may be staked on "open" lands by (1) making a discovery (a discovery excavation is not required for placer locations), (2) posting notice, (3) staking lines, (4) recording notice, and (5) doing location development work.

At the point of discovery, immediately after the discovery has been made, a notice of location should be posted, giving the name of the claim, name of locator(s), date of discovery (same as date of posting), and description of the claim by reference to legal land survey section subdivisions (or, where the land is not within an area covered by United States survey, by reference to some natural landmark or permanent monument). Within 30 days of the discovery date the locator must mark the boundaries of the claim on the ground in the same manner as in lode locations—by corner stakes at least 4 inches square and 3 feet high or by monuments 3 feet high and by cutting brush and blazing trees along the side and end lines. Also within 30 days of the discovery date the locator must record a copy of the posted location notice in the office of the auditor of the county in which the claim is situated. Within 60 days after discovery he must do upon the claim development work valued at $10 for "each 20 acres or fractional part thereof." This is location work and not to be confused with assessment work. Within a reasonably short time he must record with the same County Auditor an affidavit showing performance of this location work and the nature and kind of work so done.

PATENTING MINING CLAIMS

The owner of a claim held by possessory right has title only to the minerals and such timber on the claim as he uses in his prospecting and mining operations. He may hold these rights only by annually doing assessment work valued at $100. In Washington, taxes are not usually assessed to the owners of such nonpatented claims. Benefits resulting from a patent are: annual assessment work is no longer required; boundaries are established definitely by survey; and the patented claim owner acquires full title to the claim, including land and timber as well as minerals.

The patentee may sell or dispose of the timber as he pleases, and may use the claim for any lawful purpose, whether mineral or nonmineral; however, as patented claims are real estate they are subject to taxation as such.

After development work to the value of $500 has been done on a claim the owner may apply for patent to the Bureau of Land Management of the Department of the Interior. A circular outlining procedure for obtaining patents to mining claims is available from the U.S. Bureau of Land Management, P.O. Box 2965, Portland, Oregon, 97208. The first step is for the claim owner to employ a licensed United States mineral surveyor. He should then request the U.S. Bureau of Land Management to order the survey to be made. Upon completion of the survey the mineral surveyor's plat and notes must be approved by the Bureau, and then application for patent may be prepared by a qualified attorney and filed with the U.S. Bureau of Land Management.

The recent tendency of the Department of the Interior has been to tighten up on restrictions, and each year fewer and fewer patents are being issued. Two of the things about which the government is strictest are that on each separate claim there must be an adequate discovery and that each claim must be primarily valuable as mineral land. The patent will be denied if the applicant's motive is to acquire land that is valuable primarily for its timber or as a home, resort, or water power sites, as agricultural land, or for other nonmineral use.

The patent costs per claim will vary, depending upon several factors, such as whether only one claim or a group of claims is to be patented. One estimate of the approximate cost for a single lode claim is $2,000 to $4,000, which includes the surveyor's fee; U.S. Bureau of Land Management office expense; attorney's fee; abstract of title; U.S. Land Office entry fee; publication fee; purchase price of the land payable to the government.

MINING METHODS AND TREATMENT

Of the United States' total production in 1972 of lode and placer gold, 0.9 percent was recovered by placer methods, 54.9 percent by amalgamation and cyanidation, and 44.2 percent by the smelting of ores and concentrates (West, J. M., 1974, p. 586). Of the placer gold produced in the United States in 1972, 32 percent was recovered by bucket-line dredges, and the average value of gravels mined by this method was 42.3 cents per cubic yard. Nonfloating washing plants (dry land dredges) accounted for 38 percent of the placer production, operating on gravels averaging $2.29 per cubic yard; dragline dredges, 4 percent; miscellaneous (including underground drifting, gold panning, and small suction dredges), 1 percent, on $3.00 gravel; hydraulicking 25 percent, on 78.3 cent gravel.

A recently published report (West, J. M., 1971), describes equipment and methods useful to prospectors and operators of small placers, and both small-scale and large-scale placer mining methods have been described by Averill (1946). Details of the various mining methods used in both placer and lode-gold mines are given in many textbooks and handbooks, in publications of the American Institute of Mining and Metallurgical Engineers, and in reports of the U.S. Bureau of Mines.

HISTORY OF GOLD IN WASHINGTON

The first discovery of gold in Washington was probably that reported by Stevens (1860), who, in

describing explorations made by Captain McClellan and his party in search of a railroad route through the Cascades in 1853, said, "Here the first traces of gold were discovered, and though not sufficiently abundant to pay for working, it caused considerable excitement in the camp." The locality referred to was in the Yakima Valley, though it is not clear whether it was near the mouth of the Naches River or was on the headwaters of the Yakima River. In the same report Stevens wrote, "It is also worthy of observation that gold was found to exist, in the explorations of 1853, throughout the whole region between the Cascades and the main Columbia to north of the boundary, and paying localities have since been found at several points, particularly on the southern tributary [probably Peshastin Creek] of the Wenatshapan [Wenatchee River]. The gold quartz also is found on the Naches River."

In 1855 there was a small gold rush to the Colville region, and on September 14 of that year the Oregonian newspaper reported prospectors recovering $5 to $8 per day using rockers along the Pend Oreille River. On September 28 and November 23 the Olympia Pioneer and Democrat newspaper reported placer-gold discoveries along the Columbia River from the mouth of the Spokane River to the mouth of the Pend Oreille River and up that river for at least 40 miles. Prospectors were said to be making fairly good recoveries on Sheep Creek just south of the Canadian boundary. The placers in this region appear to have been too small and too low grade to hold the prospectors' interest for long, and their attention was soon directed to other areas.

From the beginning, gold-mining activities were intermittent rather than constant. Periods of activity were followed by periods of stagnation. These cycles were influenced to some extent by economic conditions. In general, gold mining has fared relatively well and prospecting has flourished during economic recessions, and gold mining has been at a disadvantage and has declined during periods of general prosperity and high prices. Of even more influence locally has been the prospectors' urge to move on to possibly more lucrative fields as news was spread of gold strikes in new areas. Thus, though a party that was surveying the international boundary discovered gold on the Similkameen River in Okanogan County in 1859, the men who rushed to the Similkameen stayed only about three months and then flocked northward to the Frazier River and Cariboo district, leaving the Similkameen placers practically deserted. A few months later the surge was reversed and many of the same men returned to the Similkameen, and others spread out in both eastern and western Washington. Hodges reports that these men returning from the north discovered placer gold on Ruby Creek in Whatcom County, on the Sultan River in Snohomish County, and on Peshastin and Swauk Creeks in Chelan and Kittitas Counties in the early 1860's, but Bethune (1891, p. 6-7) sets the dates for discovery of gold in these districts at later dates, as follows: Swauk Creek in 1874, Peshastin Creek in 1877, Ruby Creek in 1878, and Cle Elum River in 1881. Bethune records placer mining on Cassimer Bar at the mouth of the Okanogan River as early as 1860 and increased placer activities along this river in the middle 1880's.

Bars along the Columbia River adjacent to the Colville Indian Reservation were worked intermittently, mainly by Chinese, from 1870 to 1890, and Columbia River bars above Priest Rapids were reported to have been worked prior to 1860. Other bars of the Columbia, Snake, and most of the other rivers in the state were prospected, and some of these yielded moderate amounts of placer gold. Beach placers were discovered along the Pacific Coast and were worked in a small way for many years. During a brief gold ex-

citement in 1894 the beaches were staked for 60 or 70 miles south of Cape Flattery, but productive localities were found to be limited to 20 miles south of Portage Head. By 1900 most of the state's placers had been found and largely worked out.

Nearly all the lode mining districts in the state have some mines that produce gold, at least as a byproduct, and most of these districts had been discovered by 1897, when a historically interesting account of the mines of the Pacific Northwest was published (Bethune, 1891). One of the first discoveries of lode gold in the state was at the base of Mount Chopaka in 1871. In 1878 C. P. Culver discovered lode gold in the Blewett district, where the first stamp mill was built in the then Territory of Washington. Lode gold was discovered at Monte Cristo in Snohomish County in 1889 and at Republic in Ferry County in 1896. Previous to 1898 gold quartz veins were being mined and the ore milled in arrastres near Liberty in the Swauk district of Kittitas County. A few very early discoveries of lode gold were made within the area of the Colville Indian Reservation, but it was not until the Reservation was opened to mineral entry in 1898 that mining began to expand in this region. The Republic district has been the leading lode gold camp in the state, but other important gold-producing areas have been the Railroad Creek, Blewett, Mount Baker, Monte Cristo, Slate Creek, Oroville-Nighthawk, Orient, and Wenatchee districts.

Throughout the years, mining operations at the state's gold mines ceased and currently (January 1975) the Knob Hill mine at Republic in Ferry County is the only operating lode gold mine in Washington. Most mines ceased to operate because it was no longer profitable to mine the gold-bearing veins, the richest parts of which had been mined out. However, the rise in the price of gold over the past several years from $35 per ounce to highs of around $180 per ounce has resulted in renewed interest in the state's gold deposits. Deposits that were too low in grade to operate in the past are currently undergoing examinations.

Although most of the state's gold placer deposits had been worked out by 1900, almost yearly some streams have been worked on a small scale for placer gold. During the depression years of the 1930's, placer mining increased as many unemployed men attempted to earn a living by working the gold-bearing sands and gravels of many streams throughout the state. However, the average daily income of these depression-days gold miners was less than 50 cents. In recent years gold panning has been nothing more than a weekend hobby for many individuals, but because of the high gold prices that prevail today, several placer gold deposits are being operated on a commercial scale.

PRODUCTION

Gold production forms an important part of the total mineral output of the State of Washington. Every year prior to 1916, gold outranked in value all other metals produced, and it has ranked first in many of the years since that date, but in 1956 gold accounted for only 15 percent of the value of metallic production in the state. Annual gold production in Washington from 1866 through 1956 is shown in table 3 and figure 1.

The following data on production, except as otherwise noted, are from the annual volumes of Mineral Resources and its successor, the Minerals Yearbook, published prior to 1924 by the United States Geological Survey and later by the United States Bureau of Mines. Since 1956, gold production figures for individual counties have been withheld to

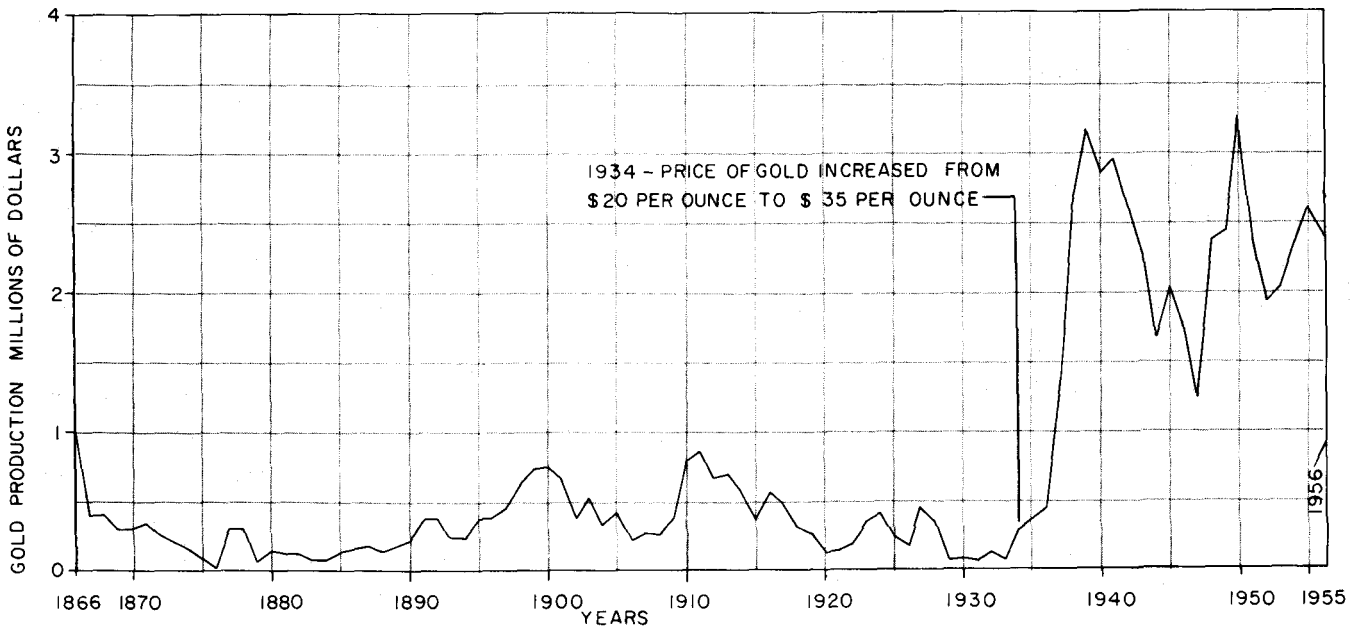


FIGURE 1.—Graph showing total gold production in Washington, 1866-1956.

avoid disclosing individual company confidential data. Total Washington State gold production from 1860 through 1956 was 2,844,204 ounces, valued at $78,306,908, which ranks Washington eleventh among the states as a gold producer. Total United States gold output from the beginning of the record through 1972 has been 318 million ounces, and the Washington share of this amount has been slightly less than 1 percent. The greatest production of gold in Washington in any single year since 1900 was 92,117 ounces, valued at $3,224,095 in 1950. In that year, 97 percent of the state production came from three mines: the Holden, Gold King, and Knob Hill, which ranked in production twelfth, fourteenth, and eighteenth, respectively, among the gold mines of the United States. In the next year, 1951, the Gold King mine was the leading producer in this state, ranking eleventh nationally, followed by the Holden mine (thirteenth) and the Knob Hill mine (sixteenth). Combined production from the Holden and Gold King mines in Chelan County outranked that of all but six other gold districts in the United States in 1951. Prior to 1900 most of the gold produced in the state was from placers, but since that time less than 2 percent of the output has been from placers. Placer production from 1900 through 1956 was $935,042. To illustrate further, placer production for the 10-year period from 1900 through 1909 was $350,541 but for a similar period from 1944 through 1956 was only $16,870.

The Republic district of Ferry County has had the longest consistent record of gold production, and Ferry County has led all counties during 28 of the 50 years from 1903 to 1952, inclusive. Chelan County, formerly a small producer, took the lead in 1938 as a result of the output of the Holden mine and continued to hold it (except for 1947) up through 1956. Stevens County produced the greatest amount of gold during 5 years (1905 through 1908, and 1922), and Whatcom County led for 3 years (1904, 1929, and 1930). Okanogan, Snohomish, and Kittitas Counties have nearly always produced some gold, and in some years important amounts. In total gold production

TABLE 3.—Annual gold production of Washington, 1866-1956

Year	Value	Year	Value	Year	Value
1866 (prior to)	$9,000,000	96	395,490	27	403,380
1866	1,000,000	97	449,664	28	337,167
67	400,000	98	612,118	29	76,898
68	400,000	99	729,388	1930	87,748
69	300,000	1900	732,437	31	60,035
1870	300,000	01	661,240	32	105,057
71	320,107	02	374,471	33	94,319
72	260,000	03	507,885	34	290,149
73	206,341	04	314,463	35	340,886
74	154,535	05	405,078	36	427,609
75	81,932	06	221,648	37	1,270,850
76	26,988	07	259,047	38	2,596,125
77	300,000	08	242,234	39	3,164,700
78	300,000	09	362,051	1940	2,874,760
79	75,000	1910	788,145	41	2,946,160
1880	135,800	11	847,677	42	2,638,860
81	120,000	12	680,964	43	2,283,540
82	120,000	13	696,275	44	1,654.659
83	80,000	14	557,173	45	2,025,100
84	73,952	15	391,419	46	1,790,880
85	126,172	16	577,655	47	1,223,775
86	147,548	17	492,324	48	2,452,625
87	160,503	18	304,658	49	2,519,790
88	145,000	19	252,862	1950	3,224,095
89	193,709	1920	120,860	51	2,359,175
1890	204,000	21	128,486	52	1,917,160
91	371,897	22	186,965	53	2,189,600
92	373,553	23	342,067	54	2,335,900
93	228,394	24	309,617	55	2,602,600
94	232,761	25	230,253	56	2,473,415
95	373,148	26	193,092	Total	$78,346,063

Note: Washington production figures for gold not published after 1956 because individual company confidential data would be disclosed.

for the years 1903 through 1956, Chelan and Ferry Counties are at the top of the list with about $25 million each, followed in order of output by Whatcom Stevens, Okanogan, Snohomish, and Kittitas Counties. Since 1957, almost all gold produced in Washington has come from Ferry County where the Knob Hill mine, which is the state's only major gold mine, produces over $1 million yearly in gold.

Early statistics are not as complete as might be desired, and some early estimates of production appear to have been too high. Total gold and silver production in Washington through 1866 was estimated by J. Ross Browne (1869), United States Commissioner of Mining Statistics, to be $10,000,000. Estimates of early gold production from a few districts follow: $1,500,000 (placer and lode) from the Blewett district from 1870 through 1900, and $200,000 from 1901 through 1910; $500,000 from the Similkameen placers up to 1911; $1,800,000 from the Republic district through 1910; and about $7,000,000 from the Monte Cristo district through 1918.

GOLD PRICES

For almost 40 years, the price of gold was stabilized at $35 per troy ounce, which was the price set by President Roosevelt on January 30, 1934. Prior to 1934, for 300 years, the price of gold had been around $20 per troy ounce. Gold prices were released from their bondage in March 1968, when the government adapted a two-level price system in which one price ($35 per ounce) existed for official monetary transactions, while another existed for private transactions based on open-market demands on day-to-day market fluctuations of the London gold market. After the establishment of a free market for gold in 1968, the open-market price fluctuated between $35 and $45 per ounce until early 1972, when the price rose rapidly (fig. 2). In mid-December, 1974, gold reached an all time high of $197.50 per ounce on the London market. This new high for gold was influenced in part by the announcement (Public Law 93-373) that on December 31, 1974, all statuary restrictions on gold ownership by United States citizens would end, making it legal once again for citizens to own gold—a privilege that had been denied them since 1934. The U.S. Treasury also announced that on January 6, 1975, just 6 days after gold ownership was legalized, 2 million ounces of treasury gold would be sold. The response to this announcement was a drop in the price of gold to $175 per ounce. On January 6, 957,000 ounces of the 2 million ounces offered for sale was sold, but the sale of this gold had very little effect on the market, which remained in the $175 to $180 per ounce range. Because the price of gold is subjected to daily fluctuations influenced by economic situations throughout the world, it is impossible to predict future prices. Prices of gold are published daily on financial pages of newspapers, as well as in industrial trade journals.

Gold is priced and sold by the troy ounce. A troy pound consists of 12 troy ounces, and is equivalent to 0.8229 pound avoirdupois. A bar of gold that weighs 1 pound avoirdupois contains 14.58 troy ounces; a 1 troy ounce bar of gold contains 1.097 ounces avoirdupois. Since most gold nuggets are under 1 troy ounce in size, their weight is expressed in terms of pennyweight and grains. One troy ounce contains 20 pennyweight or 480 grains. Common conversion factors for weighing gold follow:

TABLE 4.—Gold conversion factors

1 ounce troy = 31.1035 grams
1 ounce troy = 1.097 ounces avoirdupois (avdp)
1 ounce troy = 20 pennyweight or 480 grains

(continued on next page)

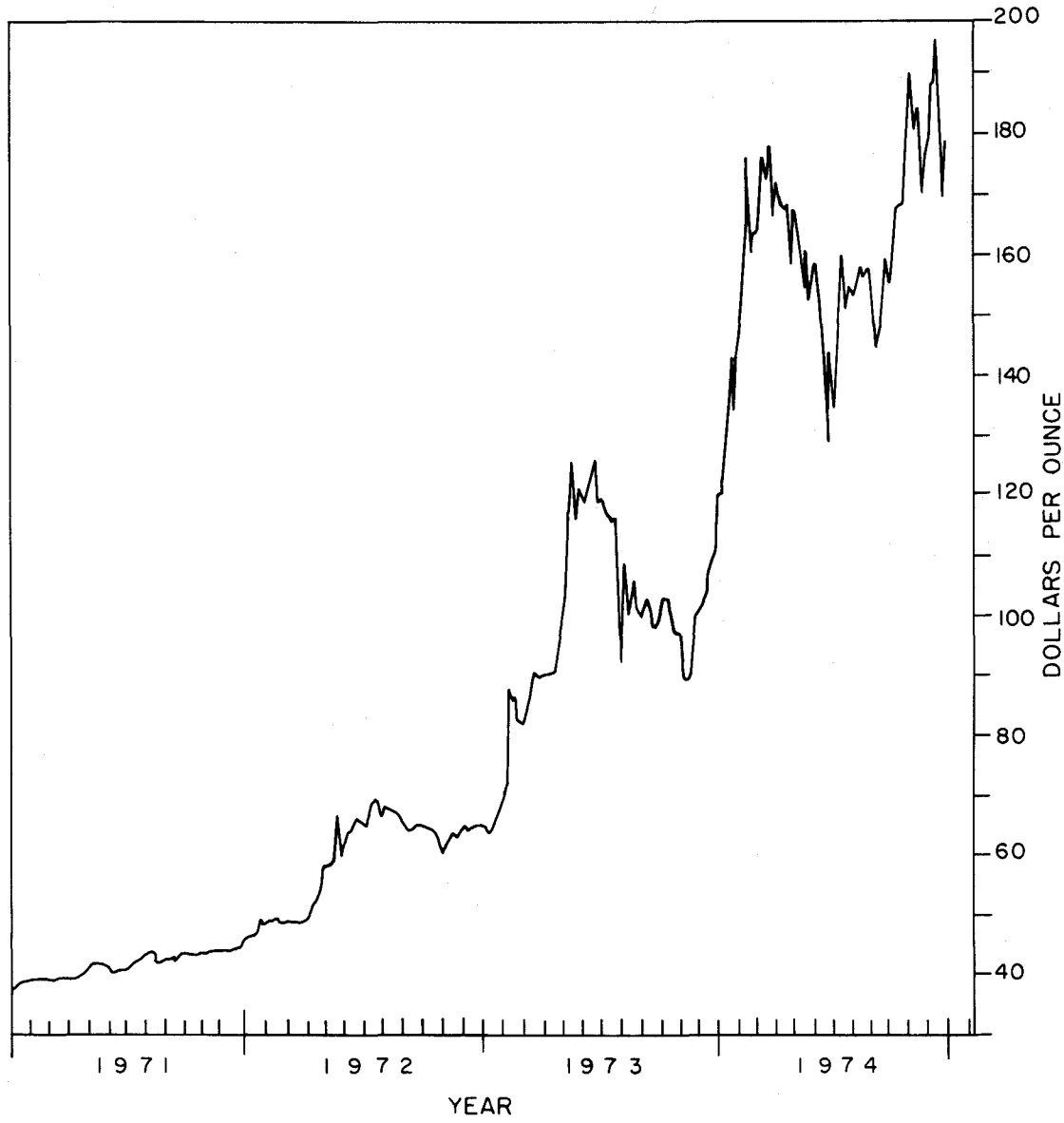


FIGURE 2.—London gold prices, 1971-1974.

TABLE 4—Continued

1 pound troy = 12 ounces troy
1 pound troy = 13.164 ounces avdp
1 ounce avdp = 0.911 ounces troy
1 ounce avdp = 28.349 grams
1 pound avdp = 16 ounces avdp
1 pound avdp = 14.58 ounces troy

"Fineness" with respect to gold is the amount of pure gold in alloys expressed by number of parts per 1,000. Gold with a fineness of 999 contains 99.9 percent gold and 0.1 percent other metals (usually silver). Gold that is 750 fine contains 75 percent gold and would be worth 75 percent of the market price of gold. Another term used to define the purity of gold is the "carat." Pure gold is 24 carat gold. Eighteen carat gold is 18 parts pure gold and 6 parts of other metals. In early-day mining camps, gold

buyers used the "touchstone" to test the fineness of gold. A touchstone is a black, hard stone on which the fineness of an alloy of gold and silver can be tested by comparing its streak with an alloy (touch needle) of known fineness.

SELLING GOLD

Gold, like any other metal, may be bought and sold at any price agreed upon between the buyer and the seller, which is based upon the free market value for refined gold. For many years, United States mints were the principal purchasers of gold, but since 1968 the mints have not purchased gold (by amendment to Gold Regulations, March 17, 1968). On December 31, 1974, for the first time in 40 years, U.S. citizens were once again allowed to purchase and sell gold bullion without a Treasury Department license.

Possible outlets for gold include private buyers, refiners, and some banks. Private buyers appear to be the best outlets for gold nuggets as there is no middleman commission nor delays between the sales and the returns. Also, private buyers will generally pay higher premiums over world market prices of gold for large nuggets that are used for specimens and jewelry. Unrefined gold, such as retort sponge or gold bullion from lode gold mining operations, is usually sent to refiners. Refiners pay for the actual gold content of unrefined gold, but charge for assaying, melting, and refining. It is not advisable to ship small lots because minimum handling charges may exceed the value of the gold. It is always advisable to contact the refiner before shipping any gold because to ship gold without confirmation can result in delays. If your gold is high in silver, request payment for the silver, otherwise the refiner may not pay you for it.

Following is a list of possible purchasers of unrefined gold and retort sponge:

American Smelting & Refining Co., Inc.
Southwestern Ore Purchasing Department
P.O. Box 5747
Tucson, Arizona 85703

Delta Smelting & Refining Co.
1104 Cambie Road
Richmond, B.C. Canada

Englehard Minerals & Chemical Corp.
430 Mountain Avenue
Murray Hill, New Jersey 07974

Handy & Harman
California Branch
P.O. Box 150
El Monte, California 91734

Hoover & Strong, Inc.
119 West Tupper Street
Buffalo, New York 14201

Western Alloy Refinery Company
366 East 58th Street
Los Angeles, California 90011

PLACER DEPOSITS

A placer deposit is "a mass of gravel, sand, or similar material resulting from the crumbling and erosion of solid rock and containing particles or nuggets of gold, tin, platinum, or other valuable minerals that have been derived from rocks or veins." Gold in placer deposits is recovered by panning the gold-bearing material, or by using a rocker or a sluice box. In large-scale mining operations, washing plants and dredges are used. For the purposes of this report, the recovery of placer gold will be limited to panning, rocking, and sluicing.

Because gold has a high specific gravity and is chemically inert, it becomes concentrated in placer deposits, where it commonly is found associated with magnetite, ilmenite, chromite, monazite, rutile,

zircon, garnet, and other heavy minerals. These minerals are the principal constituents of the so-called "black sands." The gold-bearing sands and gravels in placers may be derived from lode gold deposits, but the gold in many placers originated not in lode gold ores but as sparsely disseminated gold in rock too lightly mineralized to be classed as ore. Because of this and the fact that lode deposits from which some placers have been derived have been completely destroyed by erosion, a search for the "mother lode"—the "hard-rock" source of the gold—may be futile in many placer districts. Placer deposits may be of many kinds, as (1) residual deposits from weathering of rocks in place, (2) river gravels in active streams, (3) river gravels in abandoned and often buried channels, (4) eolian deposits, (5) ocean beaches at sea level, and (6) ancient ocean beaches now raised and inland.

Beach placers form through the agency of ocean waves reworking beach sands and gravels and concentrating the heavy minerals. These sands and gravels may represent alluvium brought to the coast by streams, or they may originate from the erosion of the bedrock of the sea cliffs or erosion of unconsolidated glacial or other sediments which overlie the bedrock along the shore. Gold present in minute amounts in the eroded material is released by this process and accumulates with other heavy minerals in the beach sands. Beach placers are frequently found to be enriched when examined directly following storms, when wave action has been especially vigorous.

Stream placers usually are restricted to present-day valleys, but there are numerous examples of bench placers in bars and terraces high above present stream channels and of placers in old valleys not now occupied by streams. Gold in streams usually accumulates at places of slackened stream velocity, as in a broader valley below a narrow gorge, at junctions of tributaries, near the heads of quiet reaches, and on the inside of bends. Furthermore, placer values are almost always concentrated on or near bedrock or on a "false bedrock," which may be a hard clay bed.

Consolidated placers are formed through the same processes that produce ordinary unconsolidated placer gravels and sands, but the consolidated placer deposits originated in pre-Pleistocene time and have subsequently been converted to conglomerates, sandstones, and even quartzites by cementation, compaction, and sometimes recrystallization. The beds comprising these deposits usually are overlain by other sedimentary rocks or by flows of volcanic rocks.

As can be seen in figure 12, placer gold has been found at many localities in Washington. There is no guarantee that gold will be found at any of the localities or deposits. Many deposits have been worked out and other deposits are no longer accessible. This is especially true of the deposits along the Columbia River, most of which are now covered by the waters of several lakes. However, at times of extreme low water, some placer-gold-bearing river bars are exposed and may be panned for gold.

Only the general location of placer gold deposits is shown in figure 12. For a more precise location, as well as general information on the deposits, the reader should consult the section on placer gold occurrences in this report or pages 181 to 193 of Inventory of Washington Minerals, Part II, Metallic Minerals (Huntting, 1956).

WHERE TO PAN

The chances of discovering new placer deposits in Washington are remote, because almost all streams have, in the past, been prospected and mined

TABLE 5.—Placer gold localities

Asotin County
- Snake River bars

Benton County
- Columbia River bars

Chelan County
- Blewett area
- Bridge Creek
- Chiwawa River
- Columbia River bars
- Entiat River
- Lakeside (Lake Chelan)
- Leavenworth
- Negro Creek
- Peshastin Creek
- Railroad Creek
- Wenatchee River

Clallam County
- Cedar Creek
- Ozette Beach
- Sand Point
- Shi Shi Beach
- Yellow Banks

Clark County
- South Fork Lewis River

Douglas County
- Columbia River bars

Ferry County
- Bridge Creek
- Columbia River bars
- Covada district
- Danville area
- Kettle River bars
- Republic
- Sanpoil River

Garfield County
- Snake River

Grant County
- Columbia River bars

Grays Harbor County
- Cow Point
- Damons Point
- Moclips River
- Point Brown

Jefferson County
- Ruby Beach

King County
- Denny Creek
- Money Creek
- Tolt River

Kittitas County
- Cle Elum River
- Columbia River bars
- Liberty
- Manastash Creek
- Naneum Creek
- Swauk Creek
- Teanaway River
- Yakima River

Lincoln County
- Columbia River bars

Okanogan County
- Columbia River bars
- Mary Ann Creek
- Methow River
- Myers Creek
- Nighthawk
- Oroville
- Park City
- Similkameen River
- Squaw Creek
- Twisp
- Wauconda

Pacific County
- Fort Canby

Pend Oreille County
- Pend Oreille River bars
- Russian Creek
- Sullivan Creek

Pierce County
- Silver Creek

Skagit County
- Skagit River

Skamania County
- Camp Creek
- McCoy Creek
- Texas Gulch

Snohomish County
- Darrington area
- Granite Falls
- Sultan River

Stevens County
- Columbia River bars
- Kettle Falls
- Kettle River bars
- Marcus
- Meyers Falls
- Northport district
- Orient

Whatcom County
- Acme vicinity
- Mount Baker
- Ruby Creek
- Silesia Creek
- Slate Creek

Whitman County
- Snake River bars

Yakima County
- American River
- Morse Creek
- Summit district
- Surveyors Creek

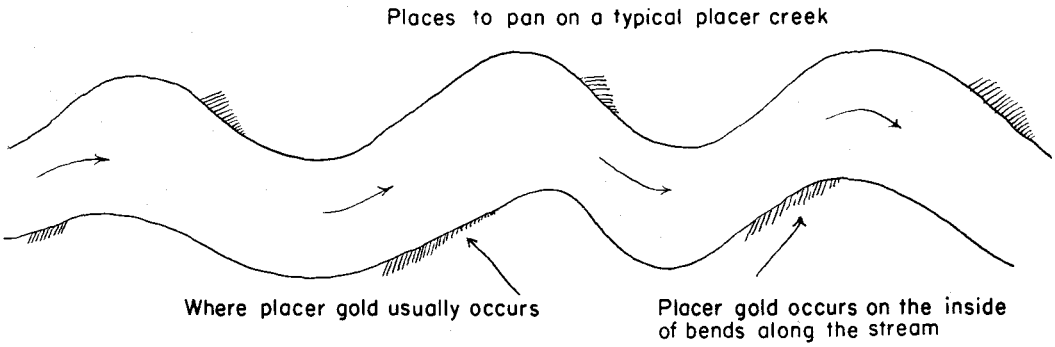


FIGURE 3.—Placer gold deposits along stream channels.

for placer gold. The best chance that an amateur panner has in finding placer gold is to check areas where placer gold has been found in the past (fig. 12) If gold does occur in a stream channel, it usually occurs in that part of the streambed where there has been a sudden decrease in stream velocity. A decrease in velocity lowers the carrying power of the stream, and the heaviest particles, including gold, will be dropped first. Concentrations of gold can be expected where the stream widens, along bends in the channel (fig. 3), or in slack-water areas below rapids. Most coarse gold ends up on or near bedrock, which may be true bedrock or false bedrock (fig. 5). In placer gold districts, most bedrock was worked during the early-day mining operations; however, much bedrock was carelessly or improperly cleaned and some gold was usually left behind. On true bedrock, crevices and protrusions of bedrock act as natural traps for gold. In recent years, significant amounts of placer gold have been recovered by carefully cleaning up the bedrock in placer gold districts.

Another place to look for placer gold is at the base of large boulders in the stream channels. Inasmuch as boulders offer an obstruction to the movement of materials in stream channels, gold and other heavy materials tend to lodge around them. Old tailings, which have been left behind by early-day placer miners, offer another possible source for gold. On several occasions, large nuggets have been found in the tailings. These nuggets were too large to pass through screens that were used to remove the coarse gravels during sluicing operations. In addition to gold that occurs along channels of present-day streams, placer gold has been found in bench placer deposits and buried placer deposits (fig. 4). These deposits represent ancient stream channels, which were abandoned when the stream cut its channel to lower levels. Although some bench and buried placer deposits have yielded significant amounts of gold, most deposits of this type are difficult for the amateur to work. Abundant water is usually not available, or underground mining methods are required.

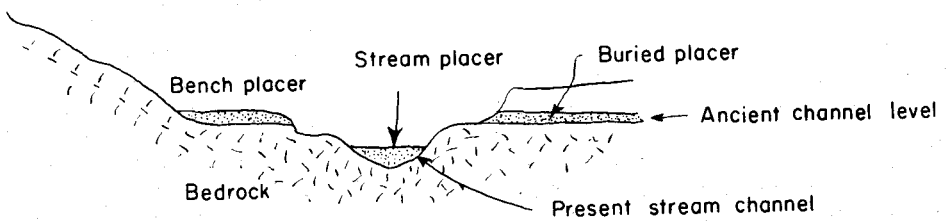


FIGURE 4.—Placer gold on bedrock.

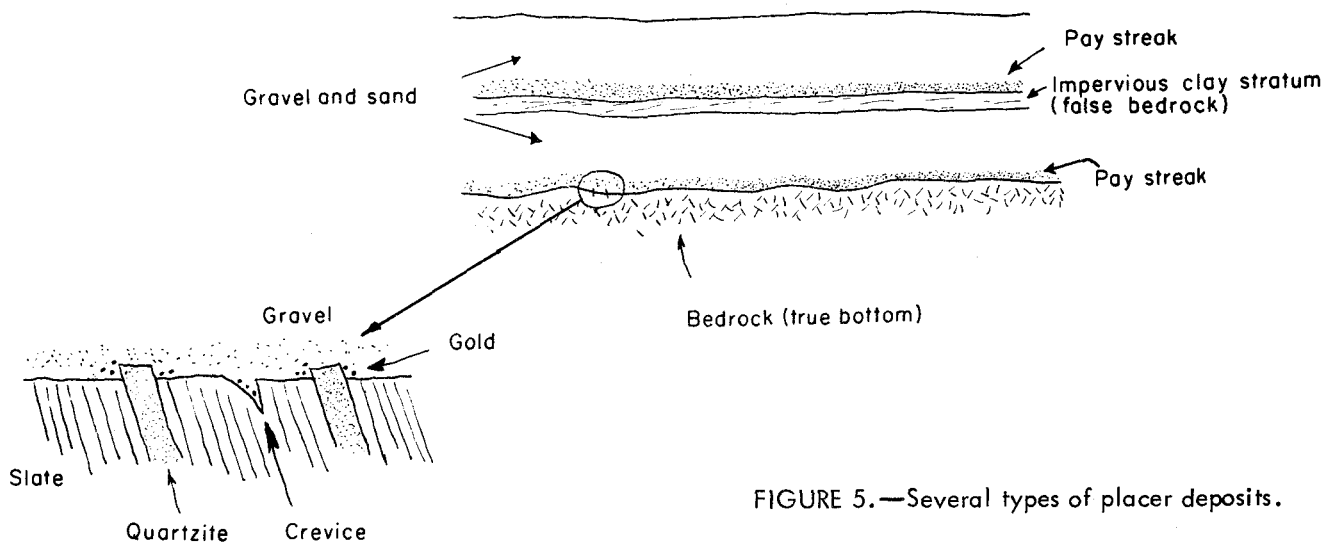


FIGURE 5.—Several types of placer deposits.

Quartzite ribs and crevice serve as natural riffles

Inasmuch as many weekend gold panners will do their panning on river bars, the following discussion by an unknown author concerning pay streaks on river bars should be of interest:

Pay Streaks on River Bars

Most of you who arrive at the river where you are going to work the bars, have a good imagination. You know how to daydream as you have daydreamed about this trip, and what you were going to find. Now that you have arrived at the place you are going to work, keep that imagination working. Do not look at the bar as just a lot of sand and rocks. You know that those rocks were placed there by the action of the water, and if you are on a gold bearing stream, there was gold running at the same time those rocks were deposited.

Gold travels with the heavy rocks, and is deposited in the same places the heavy rocks are. Now is the time to daydream a little, imagine how the water must have run to place those rocks where they are.

In most all of the bars on the rivers, in the gold bearing districts, there are pay streaks, and if you dig a hole straight down you will find one or more of them; some good, some not so good. They will vary from a foot to 5 or more feet apart. When digging your test hole, pan a sample every foot as you go down. You will find the pay streak starts, just above the larger rocks, which are usually on the same level, and ends just below them, sometimes a foot below, but more often 6 inches.

Nearly always, the bottom of the pay streak can also be found two other ways, one is that the rocks are white and also that there is not so much fine gravel or dirt between the rocks and the digging is much harder for that reason.

You will find as you reach the pay streak that the digging gets harder, but as soon as you come to the bottom of it and below the white rocks, the gravel is not cemented as hard. Now use your imagination again; the white rocks that you find at the bottom of your pay streak were at one time the top of the bar. The sun bleached them white, and the ground around them was hardened by the action of the sun and water.

Along came the next heavy flow of water and flowed over the top of the bar. The gold, concentrates, and large rocks were traveling on the bottom of that flow, and the top of the bar that had been hardened acted as a false bedrock and more or less of the gold and concentrates were deposited as the rocks sticking up acted as natural riffles.

As the flow of water lost its force, it started depositing lighter material and that lighter material is the overburden above the pay streaks. How long the flow of water was strong enough to carry this lighter material and not strong enough to carry the gold and concentrates determines how far above the pay streak the new top of the bar is formed, and also how much overburden there will be on top of the pay streak.

Sometimes the flow of water is so heavy that it takes a large part of the bar along with it and deposits other pay streaks farther down the bar or on a bar farther down the river. That is how those pay streaks are formed, and if you know how they are formed, you should know how to find them.

Always test the ground right at the edge of the water that is running; do this on the inside of the arc that the bends make, half way down the bend and from there on down. That is where the gold that is moving with the natural flow of water will be found concentrated.

Always make two or three tests of a good looking spot, and be sure all the material in that one pan comes from the same spot. One pan of dirt might be from a spot that has a large rock in front of it, which you cannot see; you could get a very good pan right there and the ground for distance around there might not have enough values to make the ground worth working. You must not expect to find the gold evenly deposited, a whirl or an eddy may concentrate most of the gold that came by it, and there will not be any gold for some distance below that place.

If the river has cut into the bar on the inside of the bend and left the edge exposed, you can sometimes see where the pay streak is without doing any digging for it, and again you can sometimes start right at that point to work back into the bar or up along the edge of it.

There are many times that the river will cut out a bar when the first heavy flow comes; then it will make a good deposit where it starts to build in a new bar, as the best deposits are made during the heavier flow of water. Then, due to an obstruction of some kind or due to a lighter flow of water, it will build that bar right back to where it was in the first place. You therefore cannot go by existing conditions wholly; you must use your imagination.

If you find a place on the bar where there is a deposit of washed sand, even though it is nowhere near the river, it is a good place to prospect. There was some kind of an obstruction that caused an eddy to wash that sand into one place and that same obstruction could have caused a deposit of gold somewhere near it.

When you do find a place on the bar that has good values, study the ground conditions good before starting to work. Figure how you can work it the easiest and at the same time keep from covering up any ground with tailings or rocks that could later prove good workable ground. Beginner prospectors will invariably cover up ground that they will later want to work.

Unless you just want to work for fun or exercise, don't do your prospecting close to highways or any place you can drive to; you can almost gamble there has been a lot of prospectors there before you. You will find that the farther you get away from the roads and the harder it is to get to a place the more chances there is that you will find something worthwhile.

If you are prospecting the little bars in the gulleys, don't let the growth that is there at present fool you. Where there is now a bend, the creek may have originally come straight across that bend; some obstruction or a slip may have changed the course, and the good deposit will lie where the growth now is.

"Flood gold" deposits are another source of gold for the amateur gold panner. Flood gold is finely divided gold that travels long distances during flood conditions and ends up on "skim bars" in stream channels. Skim bars (fig. 6) occur where streams sweep

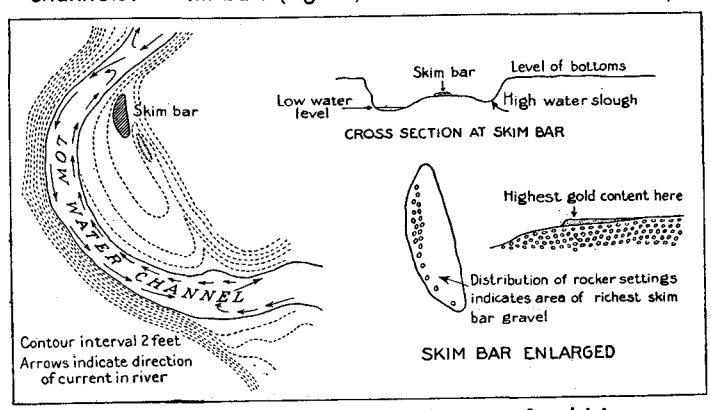


FIGURE 6.—Skim bar and distribution of gold in skim-bar gravels. From Hill, 1916, p. 280.

around curves. During flood stages these bars are under water, and as the flood waters recede, finely divided gold is deposited on the skim bars. This gold is so small that it make take up to 40,000 flakes to make an ounce.

The amateur gold panner is likely to make many mistakes on his first time out. Some common mistakes are as follows:

1. Do not pan on ground that has been staked by others. If the ground belongs to others, ask permission to pan.
2. Avoid streams adjacent to highways and well-traveled roads because these areas

have been panned many times in the past.

3. Pan at that time of the year when the water level in the stream is lower and the bedrock channel is exposed.
4. Avoid shallow-gradient streams because the current of these streams is usually too weak to transport gold.
5. Avoid potholes in bedrock because the gold that ends up in these holes has usually been ground to a very fine powder and carried away by the stream.
6. Do not pan in swift water because much of the fine gold in your pan will be washed away.
7. Avoid sand bars because the gold is usually so small that it is difficult to save.

HOW TO PAN GOLD

Gold panning is the least expensive, but the hardest way to wash gold from sand and gravel. The gold pan's principal function is to locate gold-bearing sand and gravel, or to clean up concentrates from placer mining operations. An experienced panner can handle around 100 pans (16-inch-diameter pan) in 10 hours, which is about 6 tenths of a cubic yard. Because of the small amount of material that can be handled in a day, only the richest material is panned.

The technique of panning gold is not difficult, but requires practice. Standard gold pans are 10, 12, and 16 inches in diameter; the 12-inch pan is probably the most widely used. Frying pans and other flat pans have been used as gold pans, but are less effective. In panning sand and gravel for gold, these steps should be followed (Savage, 1934, p. 35-36):

1. Fill the pan nearly full of the gravel or crushed rock from which large stones have been screened.
2. Place the pan under water and be sure that all the material gets wet. This may be done by mixing the contents of the pan with the hands.
3. Quickly rotate the pan from side to side without tipping it, either under water or while it is full of water. This action gives the gold a chance to settle to the bottom and the larger rocks to come to the top.
4. Now, while continuing the motion from side to side, tip the pan to the front. This will cause the lighter material and the larger pieces which have come to the top in procedure 3 to go to the front of the pan.
5. With the thumb of either hand, scrape a portion of the lighter material and the larger pieces over the brim of the pan.
6. Continue the motion as described in procedure 4, allowing water to wash some of the lighter material over the brim. It will be necessary to add water to the pan.
7. Now continue procedures 3, 4, 5, and 6 until the amount of material has been reduced to a quantity that will cover only a small portion of the bottom of the pan. This is the concentrate.
8. To feather the concentrates so as to separate the gold from the lighter material, pour out water until only enough is barely present to cover the concentrates.
9. Start this water swirling around the lower part of the pan so as to wash over the concentrates. The lighter material will be washed farther than the heavier particles, so that the gold will finally be left as a "tail" at the end of the concentrate and may be collected.

The film of grease that is put on new gold pans to prevent rusting must be removed before use. The pan may be cleaned by scrubbing it with fine silt from a streambed, or by using a commercial cleansing powder, such as Ajax or Old Dutch cleanser. The grease on a new gold pan can also be removed by passing the pan over a gas or other suitable flame until the metal turns blue. Bluing a pan makes it easier to see the fine flakes of gold in the pan.

The use of a perforated pan often speeds up the process of panning. In this operation a pan, the same size as the one used for panning, is perforated with $\frac{1}{4}$-inch holes and placed inside of the regular pan. The perforated pan acts as a sieve and allows only the minus $\frac{1}{4}$-inch material to pass into the regular pan. The plus $\frac{1}{4}$-inch material is discarded and the material that passed into the regular pan is panned in the usual way.

The final separation of the gold from the concentrate is done in a number of ways. Tweezers or the point of a knife can be used to pick up the larger pieces, whereas the small flakes or colors can be picked up by pressing down on them with a dry finger tip or with the end of a wooden match. The gold is removed by placing the finger tip over the vial of water and washing it off with a splash of water, or by dipping the end of the match in the water. A small pointed water-color brush can also be used to pick up small flakes of gold. The brush is most efficient when its tip is moistened and pressed against a dry flake of gold.

A small globule of clean mercury will also pick up gold, providing the gold is untarnished and free of oil. After the gold has been picked up by the mercury, the mercury can be dissolved in nitric acid, leaving only the gold. However, it should be pointed out that mercury penetrates the surface of the gold and causes the gold to become brittle and silvery in color. In some cases, heating the gold to a dull-red color will drive off the remaining mercury. When dissolving mercury in acid or exposing it to heat, be certain to work in a well-ventilated area. Mercury fumes are poisonous and should not be breathed.

The lighter particles of a concentrate may be blown away from the gold; however, this technique requires a special skill. After the concentrate is dried, and the magnetite has been removed with a magnet, the remaining material is placed on a stiff piece of paper or a piece of tin. While holding the paper or tin level, blow lightly across the concentrate while tapping the paper or tin. With practice, a clean separation of the gold and the lighter sands can be made.

BLACK SAND

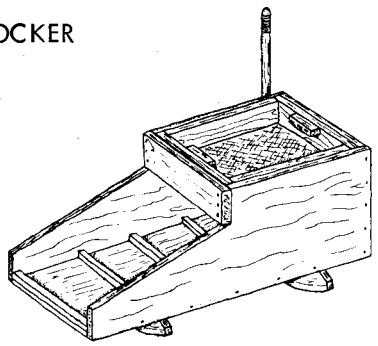
Placer gold may be accompanied by black sand, but not all black sand contains placer gold. Black sand is usually made up of several dark-colored minerals, such as magnetite, chromite, ilmenite, garnet, cassiterite, and other heavy, dark minerals. However, in some deposits the black sand may consist only of grains of magnetite or chromite.

Although black sand may at times hinder the recovery of placer gold by clogging the riffles of the rocker or sluice box, some black sand is desirable because it allows you to determine the efficiency of your placer-mining operation. Generally speaking, if you recovered black sand, you should have also recovered any gold that was present.

When using a rocker or a short sluice box, it is time to clean up when black sand starts going over the second and third riffles. When panning, if you have trouble sloughing the black sand from your

gold pan and preventing small flakes of gold from going with it, you are better off to let the fine gold go than to spend the extra time trying to separate it. It takes nearly as much time to carefully pan a single pan, as it does to pan two pans rapidly. You will not lose the coarser gold by working fast, but only the very small flakes that make up a small part of the gold you recover. If you wish, you may save the black sand, and recover the fine gold at a later time.

THE ROCKER



The rocker is commonly used in small-scale placer work and for testing placer grounds. Using a rocker, a person can handle about twice as much material per day as he could by panning. Rockers are usually hand made and hand operated; however, some rockers are operated by small gas engines. Rockers are usually set up on the banks of streams where gold-bearing material and water is available. One man can operate a rocker but it is more efficient when operated by two men. One man fills the hopper with gravel, and dumps it when the gravel is washed. The other man bails water into the hopper and does the rocking. Water, sand, silt, and gold pass through holes in the hopper and fall upon a canvas apron where most gold is caught. From the apron the screened material passes over riffles where more gold is caught. Material remaining in the tray is examined for nuggets that are too large to pass through the holes in the tray and is then discarded. If the material that is being washed contains much gold or black sand, the canvas apron and riffles should be cleaned frequently, otherwise gold will escape over the clogged apron or riffles. The concentrate from the apron and riffles is usually washed in a tub of water and later panned. Figure 7 shows plans for a wooden rocker.

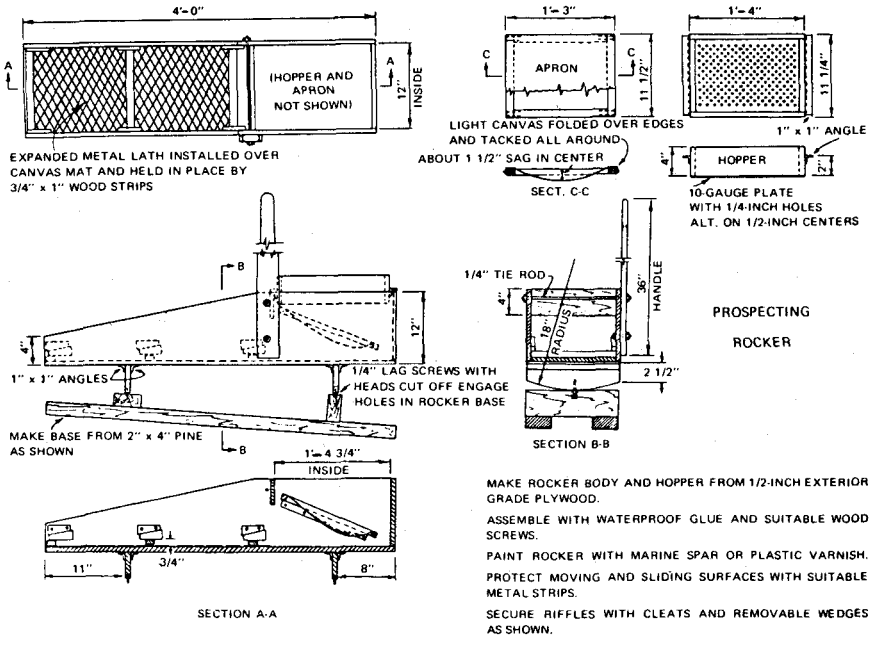
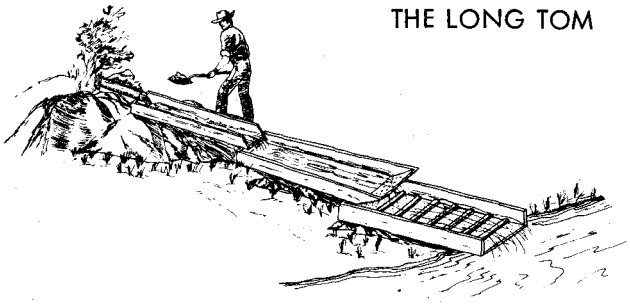


FIGURE 7.—Prospecting rocker suitable for general use. With this rocker, one working under normal conditions can wash the equivalent of eight 80-pound samples per day. This includes the time needed for clean ups, panning, and logging sample data. From Wells, 1969, p. 78.



THE LONG TOM

The long tom is a trough for washing gold-bearing material. It has a greater capacity than a rocker and does not require rocking; however, it is not as portable as a rocker. A tom consists of three parts: (1) a receiving hopper, (2) an open washing box with a perforated or screened end, and (3) a short sluice box with riffles (fig. 8). The three boxes are set on slopes ranging from 1 to 1½ inches per foot. Material to be washed is fed into the receiving hopper along with a good supply of water. The sand, fine gravel, and gold passes through the screen in the middle box and the coarse gravel is forked out. Gold, black sand, and any other heavy minerals are caught by the riffles in the lowest box. The riffle concentrates are removed when they pack up behind the riffles and allow no place for gold to lodge. When time permits, the concentrates are further concentrated by panning them in a gold pan. The long tom is most efficient when operated by four men. Two men shovel material into the hopper, one man forks out the gravel, while the last man shovels tailings away from the end of the tom. As much as 10 cubic yards of unconsolidated gravel can be washed by four men in 10 hours.

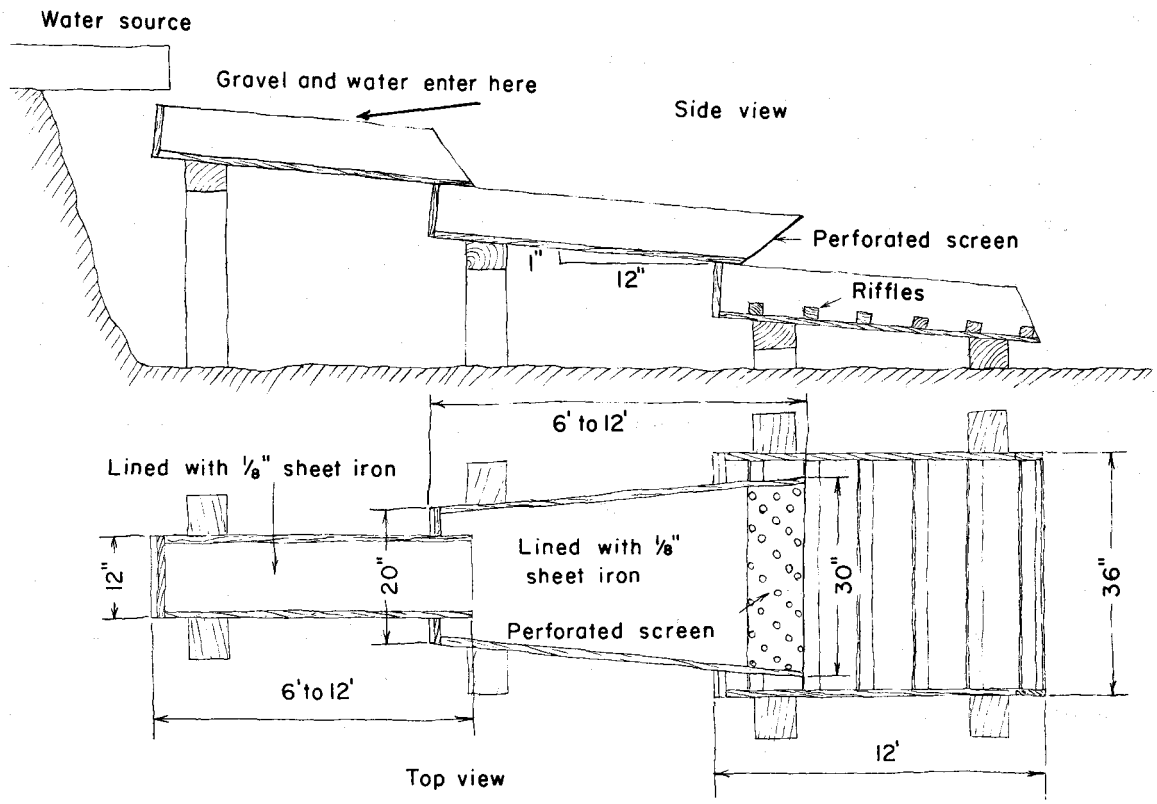
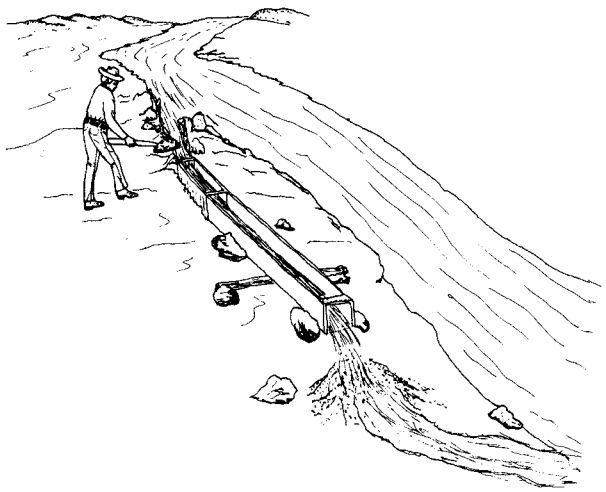


FIGURE 8.—The long tom. From West, 1971, p. 26.

THE SLUICE BOX



A sluice box is an inclined trough containing riffles in the bottom that provide a lodging place for gold and other heavy minerals. The material to be concentrated is carried through the sluice by water; thus it is important that abundant water is available for sluicing operations. Sluice boxes range from 6 inches to 6 feet in width, and from 4 to several hundred feet in length. For ease in handling, long sluices are usually made up in 12-foot sections. A common sluice box is around 12 inches wide, 12 inches high, and 12 feet long (fig. 9). However, for ease in handling, a prospecting sluice box may be 8 inches wide, 6 inches high, and as little as 4 feet long. The riffles in the bottom of the boxes are commonly made of $\frac{1}{2}$- to 2-inch-square wood strips that are placed 1 to several inches apart. Riffles might also consist of poles, expanded metal, mats, and burlap, or anything that will create an eddying action in the water and trap gold while allowing waste material to pass through the boxes. Hungarian and pole riffles are shown in figure 10.

Sluice boxes are set on grades that allow the sand and gravel to move and at the same time permit gold to settle in the boxes. The grade will depend upon the character of the gravel, character of the gold, kind of riffles, and the amount of available water. Common grades for sluice boxes range from $\frac{1}{2}$ to 1 inch per foot. The capacity of a sluice depends upon its size and the amount of water available. Two men shoveling by hand can handle 10 to 15 cubic yards of unconsolidated sand and gravel in a 10-hour shift.

Water for sluicing operations is usually directed to the head sluice box by means of a ditch. In some operations, water is pumped to the box. In general, 7 to 13 times as much water as gravel will be required to move unconsolidated sand and gravel through a sluice box.

Length of sluices depend mainly upon the character of the gold. Coarse gold settles quickly and is easily held in the riffles, while fine and porous gold is carried long distances by the current. Long sluices aid in the breakdown of clayey and cemented gravels and also give the fine gold a chance to settle. Long sluices are also used to carry the waste material away from the working area. In general, sluices should be long enough to break up the sand and gravel and free the gold, which in some cases may require several hundred feet of sluices. Crude operations often use only 3 to 6 boxes (30 to 72 feet); however, no attempt is made to save the very fine gold.

After the sluice boxes are set up at the proper grade and sufficient water is flowing through the sluice, all material that will run through the sluice is shoveled into the head box. Boulders are usually stacked outside the working area. Some operators place a sloped screen or bars (a "grizzly") across the box where the gravel enters, which permits the coarse material to roll off to one side. The openings in the screen or bars is commonly $\frac{1}{4}$ to 1 inch; $\frac{1}{2}$-inch openings are probably the average size. Feeding the sluice continues until the riffles are filled with concentrate, then the process of "cleaning up" commences. Clear water is usually run through the boxes

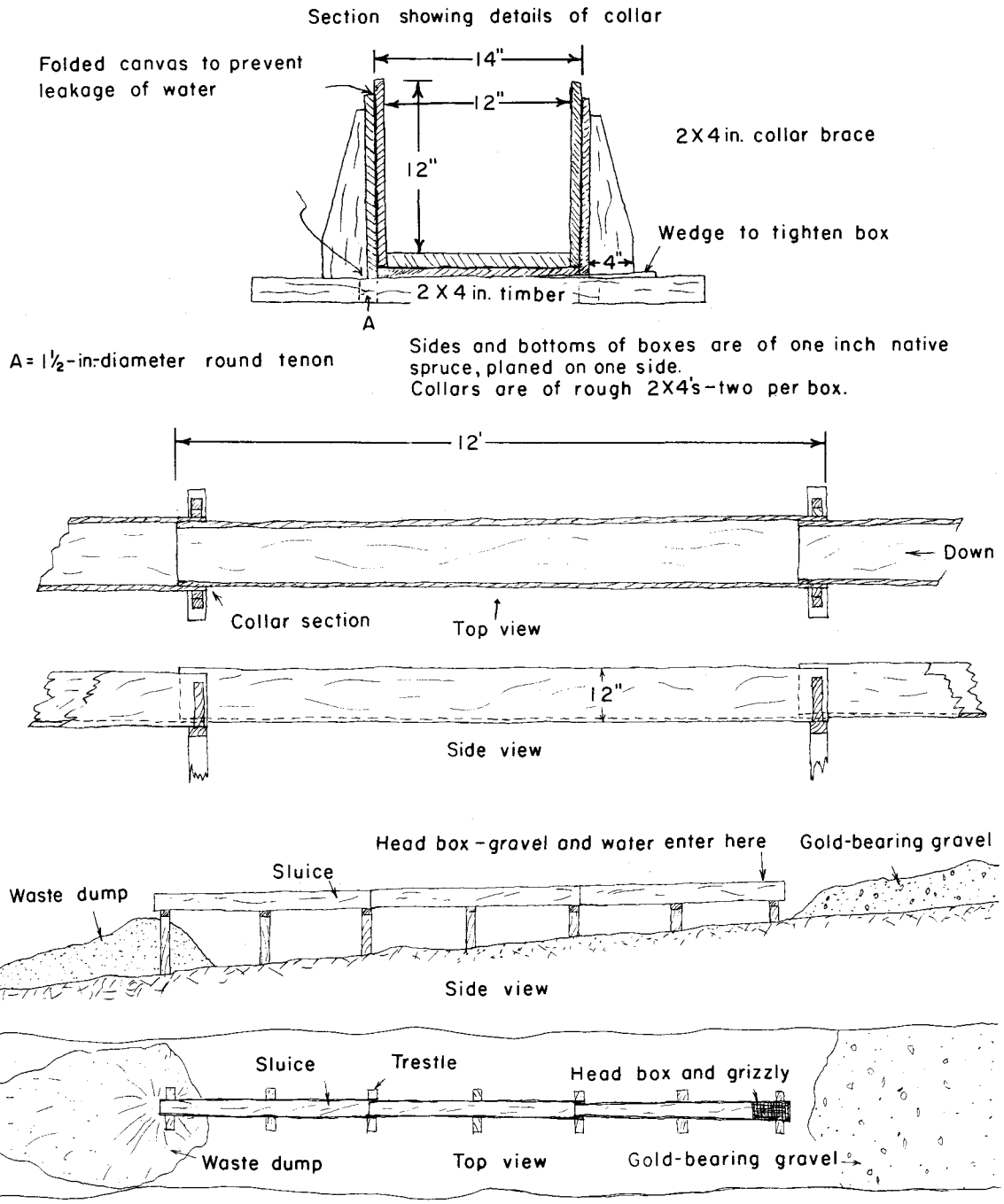


FIGURE 9.—The sluice box. From Masson, 1953.

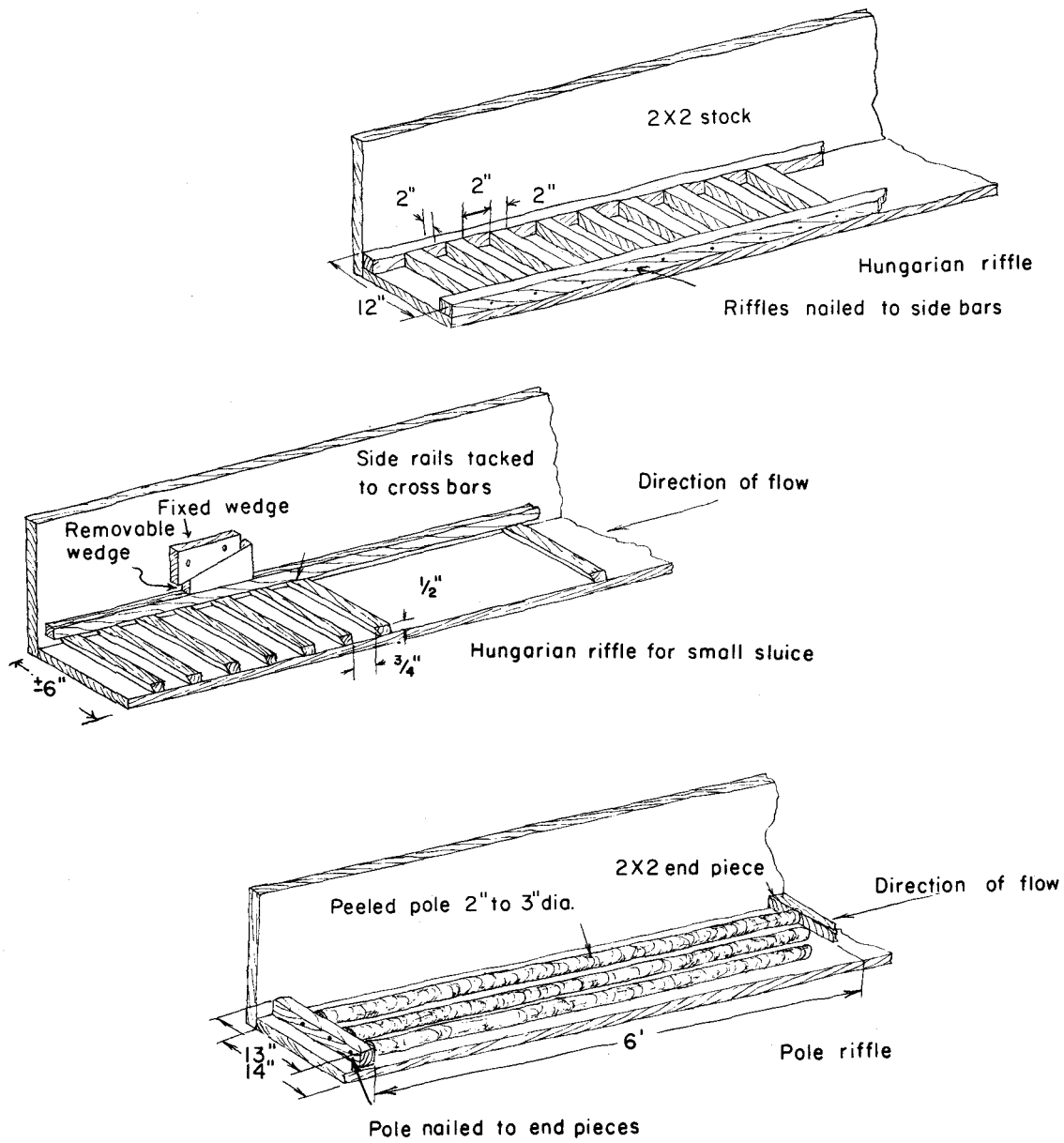


FIGURE 10.—Common riffles for sluice boxes. From Wells, 1969, p. 75.

until the tops of the riffles are clear of gravel. The riffles are lifted from the boxes, beginning with the first box, allowing the concentrate to remain on the bottom of the box. After the riffles have been removed, a light flow of water, just sufficient to move the concentrate, is allowed to flow into the sluice. As the concentrate works downstream, gold and other heavy minerals remain behind. This material is carefully collected, and further concentrated in a pan or rocker. Any fabric or matting that is used on the bottom of the boxes under the riffles is carefully removed and washed in a tub of clear water.

The clean up of sluices varies and depends on the amount of concentrate. The upper boxes may be cleaned up daily or weekly, whereas the lower boxes may require only a monthly clean up. Because of the danger of theft, in rich placer grounds clean ups of the upper boxes should be made daily because most of the coarse gold will be found here.

PORTABLE SUCTION DREDGES

In recent years portable suction dredges have been widely used in recovering placer gold from the bottom of stream channels. The suction dredge consists of a portable sluice box with an attached suction hose that is capable of sucking up sand and gravel. The basic components of a suction dredge consists of (1) a suction hose, (2) a suction nozzle, (3) a gasoline-driven jet pump, (4) a hopper or baffle, (5) a sluice box, and (6) a flotation assembly (fig. 11).

In the operation of the dredge, water is pumped under pressure by the jetting pump into the suction nozzle where a vacuum is created that sucks up sand and gravel. The sand and gravel enters a hopper or baffle where the larger gravel is screened out while the finer material passes through a sluice

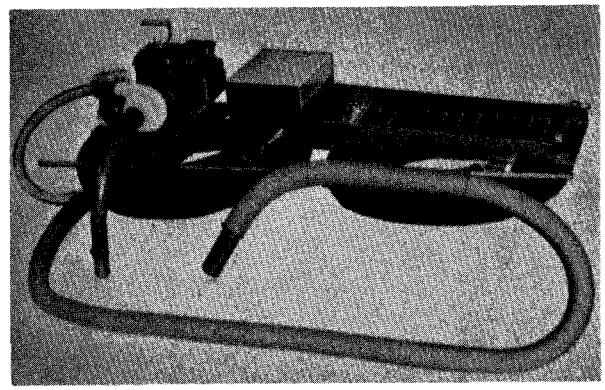


FIGURE 11.—Typical suction dredge. From Keene Engineering, Northridge, California.

box where gold and heavy minerals settle out behind riffles. Matting is usually present beneath the riffles and aids in collecting any fine gold that is present. Most suction dredges are designed to operate for several hours without cleaning.

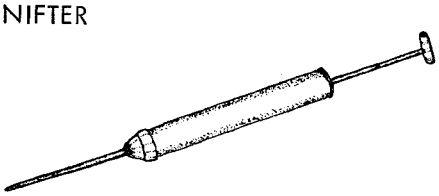
Small suction dredges having 2-inch-diameter suction hoses, and weighing only around 30 pounds, can handle up to 3 cubic yards of loose-pack sand and gravel per hour. A 150-pound suction dredge with a 5-inch-diameter suction hose can handle as much as 18 cubic yards of material per hour.

Inasmuch as most suction dredge mining operations take place in water, the operators of these dredges usually wear skin diving equipment consisting of a wet suit, weights, face mask, and an air supply. In place of the portable air tanks commonly used in skin diving, air is supplied to the underwater man on a suction dredge crew through an airline that is connected to an air compressor on shore, or one that is part of the portable dredge. Many suction dredges have air compressors that are powered by the same gasoline engine that runs the jetting pump.

Although a portable suction dredge is a very efficient piece of placer gold mining equipment, it is costly when compared to the simple sluice box. However, the suction dredge can work placer ground

that cannot be worked by conventional placering methods. Currently (1975), portable suction dredges range in price from a low of $195 for a 1½-inch-size suction hose to as much as $2,000 for an 8-inch dredge.

THE SNIFTER



A snifter is a poor man's suction dredge and may consist of nothing more than a turkey baster, a metal tube with a rubber bulb at one end, or an old grease gun with a flexible nozzle. The snout of a snifter is poked into a crevice, and any concentrate that has collected in the crevice is sucked out and later panned for gold. In shallow waters, only a swim suit, diving mask, and a snorkel may be needed to work crevices. However, in deep waters, skin diving suits and portable air tanks are required.

STREAM POLLUTION

Certain federal and state agencies have established rules and regulations for the protection of water purity and fish life in streams. Any mining operation that would seriously disturb a stream would be objectionable and would require permits from the Department of Ecology and the Department of Fisheries. Gold panning and small-scale operations that use rockers or small sluice boxes do not require permits. However, if large-scale sluicing is planned, or if you decide to use a suction dredge and pump up material from the streambed, a permit will be required. The required permits may be obtained from:

Washington Department of Fisheries
Stream Improvement and Hydraulics
5803 Capitol Blvd.
Olympia, WA 98501 Ph. (206) 753-2984

Washington Department of Ecology
7272 Clearwater Lane
Olympia, WA 98504 Ph. (206) 753-2353

OCCURRENCES

GENERAL STATEMENT

The following lists of lode and placer gold occurrences are extracted and condensed from similar but more complete lists in Division of Mines and Geology Bulletin 37, Inventory of Washington minerals, Part 2, Metallic minerals. The original lists in Bulletin 37 are as complete as it is possible to make them—including every occurrence known to the Division. Those complete inventories include many properties where gold is present in trace or only very minor amounts along with other metals which are the principal constituents of the ore. Most occurrences where gold is of secondary or minor value are not included in the following pages, and anyone wanting the complete list may refer to Bulletin 37, Part 2. Although most of the following occurrences have either been in production in the past or are considered to merit further prospecting, a few of the occurrences shown do not fall in either of these categories, but are included for some special reason—(1) to illustrate the geographic distribution of gold deposits in the state, (2) because of special interest in gold in certain areas even though probabilities of profitable operations in those areas are very slight, or (3) because of special interest or considerable publicity given a few individual deposits of little or no probable value.

The properties are arranged by counties and are listed within the counties alphabetically by name. The numbers following the names correspond to the numbers designating those same properties on the maps. It will be noted that several numbers are missing on the maps, as well as on the finding lists. This has been done intentionally in order to condense the list of gold properties. The properties that have been deleted represent deposits that have been worked out, or deposits that have little if any value. However, gold properties that have been deleted from this publication are still listed in Bulletin 37, Part 2.

To facilitate tracing a numbered symbol on a map to the description of the property represented by the symbol, a finding list (numerically arranged) relating number to property name is included with each map. The scale of the maps is such that they can be regarded as index maps only. Locations of the properties are given as precisely as possible in the text, but, because of the small map scale, the detail is not as great as it would be on larger scale maps. In order to indicate the locations of all the occurrences in some areas it is necessary to allow a single symbol to represent several closely spaced properties.

The property descriptions from which these lists are condensed were compiled from a wide variety of sources, of varying degrees of reliability. Thus, the critical reader probably may find inaccuracies and may recognize that some properties are inadequately described. Little information is available on most of the placer deposits, reflecting the comparatively minor value of the state's placers.

For the reader's convenience the occurrences are described under a standardized set of 8 headings: Loc (location), Elev (elevation), Ore min (ore minerals), Gangue, Deposit, Dev (development), Assays, and Prod (production). Legal land descriptions are abbreviated; thus, sec. 3, (40-25E) indicates section 3, Township 40 North, Range 25 East, Willamette Meridian. Unless otherwise noted, assay values and production figures are based on gold prices at $35 per troy ounce.

ABBREVIATIONS

Ag—silver
As—arsenic
Au—gold
av.—average
Bi—bismuth
conc.—concentrate
Cr—chromium
Cu—copper
cu.—cubic
Dev—development
dist.—district
Elev—elevation
est.—estimated
Fe—iron
fr.—fraction
gm.—gram, grams
Hg—mercury
Loc—location
Ni—nickel
O—oxygen
Pb—lead
Prod—production
Prop—property
Pt—platinum
R.—range
Sb—antimony
Se—selenium
T.—township
tr.—trace
U—uranium
vol.—volume
W—tungsten
Zn—zinc

PLACER GOLD OCCURRENCES

ASOTIN COUNTY

Clarkston Placer (154)

Loc: Snake River near Clarkston. Ore min: Gold, magnetite, ilmenite, zircon. Assays: River sand concentrated by panning gave $24.99 per ton in gold ($20 gold), 572 lb. magnetite, 530 lb. ilmenite, and 30 lb. zircon per ton.

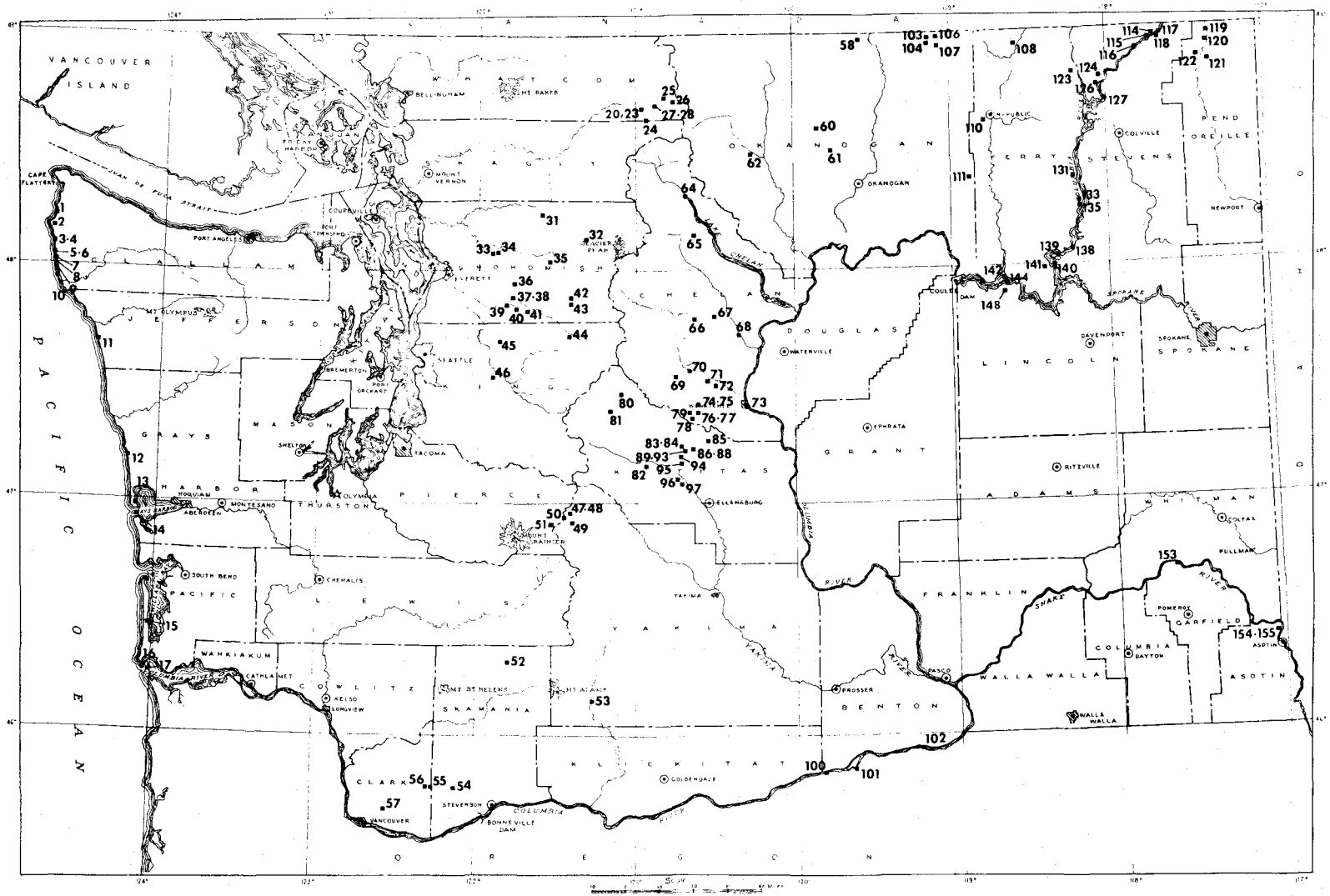


FIGURE 12.—Placer gold occurrences in Washington.

1. Shi Shi Beach
2. Ozette Beach
3. Little Wink
4. Morgan
5. Morrow
6. Yellow Banks
7. Main and Bartnes
8. Johnson Point
9. Cedar Creek
10. Sunset Creek
11. Ruby Beach
12. Moclips River
13. Oyhut
14. Point Brown
15. Ocean Park
16. Fort Canby
17. Sand Island
20. Combination
21. Lazy Tar Heel
22. Nip and Tuck
23. Alice Mae
24. Woodrich
25. Farrar
26. Slate Creek
27. Johnnie S.
28. Old Discovery
31. Darrington
32. Deer Creek
33. Granite Falls
34. Peterson
35. Alpha and Beta
36. Sultan Canyon
37. Aristo
38. Horseshoe Bend
39. Sultan River
40. Sultan
41. Gold Bar
42. Bench
43. Phoenix
44. Money Creek
45. Tolt River
46. Raging River
47. Elizabeth
48. Gold Links
49. Gold Hill
50. Ogren
51. Silver Creek
52. McCoy Creek
53. Surveyors Creek
54. Texas Gulch
55. Lewis River
56. McMunn
57. Brush Prairie
58. Similkameen
60. Meadows
61. Ballard
62. Methow River
64. Stehekin River
65. Railroad Creek
66. Deep Creek
67. Mad River
68. Entiat River
69. Icicle Creek
70. Leavenworth
71. Wenatchee River
72. Wednesday
73. Wenatchee
74. Ingalls Creek
75. Ruby Creek
76. Bloom
77. Solita
78. Shaser Creek
79. Nigger (Negro) Creek
80. Fortune Creek
81. Big Salmon La Sac
82. Cle Elum
83. Bear Cat
84. Baker Creek
85. Naneum Creek
86. Boulder Creek
87. Nugget
88. Old Bigney
89. Becker
90. Bryant Bar
91. Dennett
92. Swauk Mining & Dredging
93. Williams Creek
94. Gold Bar
95. Swauk Creek
96. Yakima River
97. Perry
100. Artesian Coulee
101. Gone Busted
102. Berrian Island
103. Cuba Line
104. Walker
106. Deadman Creek
107. Mary Ann Creek
108. Goosmus Creek
110. Alva Stout
111. Crounse
114. Reed and Roberts
115. Nigger Creek Bar
116. Northport Bar
117. Nigger Bar
118. Evans
119. Schierding
120. Harvey Bar
121. Sullivan Creek
122. Schultz
123. Kettle River
124. China Bend
126. Bossburg Bar
127. Valbush Bar
131. Daisy
133. Johnson
135. Turtle Rapids
138. Rogers Bar
139. Wilmont Bar
141. Ninemile
142. Covington Bar
144. Hellgate Bar
148. Keller Ferry
153. Indian Bar
154. Clarkston
155. Snake River

Snake River Placer (155)

Loc: Snake River, Asotin County. Ore min: Gold, zircon, ilmenite, magnetite. Assays: Natural sand 12 cents to $1.64 per ton gold, tr. to 2 lb. per ton zircon, 12 to 18 lb. per ton ilmenite, 20 to 34 lb. per ton magnetite.

BENTON COUNTY

Artesian Coulee Placer (100)

Loc: Sec. 6, (4-24E), 4 miles east of Alderdale. Deposit: Gravel in a deserted channel of the Columbia River covering several square miles. Assays: 50 cents to $2.00 per cu. yd.

Berrian Island (Goody) Placer (102)

Loc: Sec. 1, (5-28E) and sec. 6, (5-29E), on north bank of Columbia River (1950). Ore: Flour gold. Deposit: Screened material from the J. G. Shotwell aggregate plant was run through sluice boxes and a low-grade conc. recovered. Assays: 2 to 6 mills per ton. Prod: Plant operated 6 weeks and conc. shipped to Tacoma smelter in 1949.

Blalock Island Placer

Loc: On Blalock Island, in Columbia River, near Patterson. Prop: State leases. Prod: Small amount in 1954 and unknown amount in previous years.

Gone Busted Placer (101)

Loc: On Blalock Island, in Columbia River, near Patterson. Prod: Dry-land washing plant operated 1938-1940.

CHELAN COUNTY

Bloom Placer (76)

Loc: Sec. 1, (22-17E), on Peshastin Creek, 1 mile above Negro Creek, Blewett district. Elev: 2,200 ft. Assays: About 25 cents per yd. Prod: About $100 by 1897.

Deep Creek Placer (66)

Loc: Sec. 19, (27-18E), at the mouth of Deep Creek. Assays: About 26 cents per yd. Prod: Unknown amount.

Entiat River Placers (68)

Loc: Along Entiat River.

Icicle Creek Placers (69)

Loc: Along Icicle Creek. Prod: Reportedly considerable.

Ingalls Creek Placer (74)

Loc: Sec. 25, (23-17E), on Peshastin Creek, at the mouth of Ingalls Creek.

Leavenworth Placer (70)

Loc: Secs. 10 and 11, (24-17E), near Leavenworth.

Mad River Placer (67)

Loc: On Mad River.

Nigger (Negro) Creek Placers (79)

Loc: Secs. 2 and 3, (22-17E), from mouth of Negro Creek upstream for 2 miles. Assays: 10 cents to $1.20 per yd. Prod: $1,100 prior to 1897.

Peshastin Creek Placers

Loc: On upper reaches of Peshastin Creek. Deposit: Placer gold found in best concentration on bedrock below gravels. Assays: Gold is of high purity.

Railroad Creek Placer (65)

Loc: Secs. 16 and 17, (31-18E), on Railroad Creek.

Ruby Creek Placer (75)

Loc: Sec. 36, (23-17E), at mouth of Ruby Creek.

Shaser Creek Placer (78)

Loc: SE¼ sec. 14, (22-17E), near mouth of Shaser Creek. Assays: Gold is of high purity.

Solita Placer (77)

Loc: On Peshastin Creek. Prod: Unknown amount in 1931.

Stehekin River Placers (64)

Loc: Along Stehekin River.

Wednesday Placer (72)

Loc: On Wenatchee River near Dryden. Prod: Unknown amount in 1931.

Wenatchee Placer (73)

Loc: Sec. 3, (22-20E), at Wenatchee.

Wenatchee River Placer (71)

Loc: Sec. 22, (24-18E), on Wenatchee River 1½ miles below Peshastin.

CLALLAM COUNTY

Cedar Creek (Starbuck) Placer (9)

Loc: Near mouth of Cedar Creek in east ½ sec. 18, (29-15W). Ore min: Gold, platinum, ilmenite, magnetite, chromite, zircon. Deposit: Gold and platinum occur in a beach placer in a 2- to 15-inch sand layer on the surface of a wave-cut bench in clay. The sand layer is said to be 400 feet long and 100 feet wide at low tide. Assays: Said to yield from 2 to 5 pennyweights of Au and Pt per cu. yd. Ratio of Pt to Au ranges from 1:5 to 1:15. Prod: Reported $5,000 in gold and 5 oz. of crude platinum prior to 1917.

Johnson Point Placer (8)

Loc: NW¼ sec. 5, (28-15W), at Johnson Point (Cape Johnson). Deposit: Beach placers and gold in Pleistocene deposits of the bench adjacent. Assays: Some pans of sand ran as high as 60 cents Au, and some panners recovered $2 to $10 per day. Prod: 1908.

Little Wink (Japanese, Sand Point) Placer (3)

Loc: Center S½SW¼ sec. 1, (30-16W), at mouth of Little Wink Creek. Deposit: Reworked Pleistocene gravels in a beach placer.

Main and Bartnes Placer (7)

Loc: NW¼NW¼ sec. 19, (30-15W), near small stream. Deposit: Sand and gravel cemented by clay and iron oxide. Some boulders a foot in diameter. Dev: Irregular pit 30 feet long, 15 feet wide, and 6 feet deep.

Morgan (Big Wink Creek) Placer (4)

Loc: NW¼NW¼NE¼ sec. 12, (30-16W), on beach 125 feet northwest of mouth of Big Wink Creek. Deposit: Reworked Pleistocene gravels at high-tide level. Boulders as much as 2 feet in diameter; those 1 foot in diameter are common. Dev: Pit 30 feet long, 15 feet wide, and 6 feet deep.

Morrow Placer (5)

Loc: SW¼SW¼ sec. 18, (30-15W), at high-tide level. Deposit: Beach placer in which there is a 2-foot layer of gravel reworked by wave action from Pleistocene gravel. Dev: An area 50 by 25 feet has been worked. Assays: Spotty fine gold content average $4.00 per yd. Prod: Worked from 1932 to 1940. Best year's cleanup was $1,678.

Ozette Beach Placer (2)

Loc: Sec. 12, (31-16W), on the beach 2 miles north of mouth of Ozette River. Deposit: Beach deposit of gold and platinum concentrated along surface of a wave-cut terrace in sandstone. Prod: Small amount in early 1900's.

Shi Shi Beach (Lovelace) Placer (1)

Loc: Beach between Portage Head and Point

of Arches in secs. 18, 19, and 30, (32-15W). Ore min: Magnetite, ilmenite, free gold, platinum, iridosmine, zircon. Deposit: Beach deposit in which a thin layer of fine heavy sand rests on a wave-cut terrace in sandstone overlain by 1 to 3 feet of gravel and sand. Gold and platinum are found in the thin layer and in cracks in the bedrock. Assays: A conc. showed 1,120 pounds ilmenite, 96 pounds zircon, $558.09 gold ($20 gold), $20.45 platinum per ton. Prod: $15,000 in gold prior to 1904 from this and the Ozette placer.

Sunset Creek Placer (10)

Loc: Sec. 19, (29-15W)

Yellow Banks Placer (6)

Loc: 2 miles south of Sand Point in SW¼ sec. 18, (30-15W). Ore min: Gold, platinum, ilmenite, magnetite. Deposit: Beach deposit of gold and platinum concentrated on surface of a wave-cut terrace in Pleistocene drift. Prod: Small amount in early 1900 and in 1939.

CLARK COUNTY

Brush Prairie Placer (57)

Loc: On Brush Prairie. Ore min: Gold, magnetite, ilmenite. Deposit: Placer "black sands." Assays: A sample of conc. showed 1,176 pounds magnetite, 328 pounds ilmenite, $57.05 gold per ton (1905).

Lewis River Placer (55)

Loc: 5 miles east of Moulton on the Lewis River, 1 mile above McMunn placer. Deposit: Placer gravel in river bed. Dev: Pit 75 by 100 feet and 30 feet deep. Improv: $30,000 hydraulic mining outfit (1912). Assays: 1 oz. Au recovered from 1 ton of black sand. Prod: 1 oz. of gold.

McMunn Placer (56)

Loc: On east fork Lewis River about 4 miles east of Moulton. Approximately sec. 21, (4-4E). Ore min: Gold, platinum, magnetite, hematite, limonite. Deposit: Gold and platinum occur in a thin veneer of gravel on bedrock and in cracks in the bedrock. Gold but not platinum found also in higher terrace gravels. Assays: Panning tests indicate the pay gravel to contain 0.126 gm. Pt, 1.14 gm. Au. Prod: McMunn reports $150 in gold and 1½ oz. platinum.

FERRY COUNTY

Alva Stout Placer (110)

Loc: NW¼ sec. 2, (36-32E), Republic dist.

Covington Bar Placer (142)

Loc: Sec. 9, (28-33E), on north side of Columbia River. Assays: 19 test holes showed no values of importance except in a small area of less than 1 acre, where 5 holes tested gave an average of 30 cents per cu. yd.

Daisy Placer (131)

Loc: On west bank of Columbia River, 2 miles above Daisy. Approximately in sec. 1, (33-37E). Deposit: Terraces 20 to 30 feet above river level contain a 6-inch paystreak at a depth of 1 foot. Assays: Samples of the paystreak ran 2 cents or 3 cents per cu. yd. ($20 gold).

Goosmus Creek Placer (108)

Loc: On Big Goosmus Creek, Danville area. Deposit: Placer deposit containing many boulders, along narrow creek bottom.

Hellgate Bar Placer (144)

Loc: Lot 5, sec. 13, (28-33E), north side of Columbia River. Deposit: A high bar had gravel 2½ to 3 feet thick showing values of 21.8 cents per cu. yd. A lower bar had 7 or 8 acres of

gravel 2 to 3 feet thick average 27 cents per cu. yd. A low bench 2 miles long and 300 feet to ½ mile wide contains an iron-stained gold-bearing layer about 6 inches thick, 100 to 600 yards wide, and 2 miles long. Assays: The 6-inch paystreak averages 1 to 5 cents per cu. yd. ($20 gold). Prod: Small amount in early 1900's.

Johnson Placer (133)

Loc: On bank of Columbia River in NE¼ sec. 8, (32-37E). Deposit: Paystreak consists of 1 to 3 feet of medium- to fine-textured gravel beneath 4 to 8 feet of sand. Dev: Pit 2,000 cu. yd. in size. Assays: Average of 5 cents per yd. ($20 gold) from the pit. Prod: $100 reported.

Kettle River Placers (123)

Loc: Along Kettle River.

Ninemile Placer (141)

Loc: On Columbia River near mouth of Ninemile Creek, probably in sec. 16, (29-35E). Ore min: Flake gold worth 0.02 cent per flake and much flour gold. Deposit: 2 terraces, one 30 feet and the other 100 feet above Columbia River. Paystreaks as much as 1 to 3 feet thick in the terraces. Dev: Old Chinese workings extend 3/4 mile along the river and 200 feet back from the river. Assays: Paystreak averages a little more than 40 cents per yd. ($20 gold).

Rogers Bar Placer (138)

Loc: Sec. 23, (30-36E), on west bank of Columbia River, 2 miles below the town of Hunters. Prop: Bar is about 3½ miles long. Ore: Gold, platinum. Deposit: 3 bars, 30, 75, and 100 feet above the river, include 1,500 acres of land. The best pay gravel is found in bars exposed only at low water. Assays: Tests indicate paystreaks in the lower bar to run 1 to 50 cents per yd. in gold. Prod: 4 operators were working in 1934.

Turtle Rapids Placer (135)

Loc: On the Columbia River 2 miles above Blue Bar, near Turtle Rapids, near Covada. Deposit: Terrace 60 feet above high water extending along the river for several miles contains a paystreak a few inches thick. Assays: Panning tests indicate the paystreak to run 30 cents per cu. yd. ($20 gold).

Wilmont Bar Placer (139)

Loc: Lot 6, sec. 4, (29-36E), on north bank of Columbia River, opposite Gerome post office. Ore min: Monazite, magnetite, ilmenite, zircon, free gold. Deposit: 2 terraces, one 20 and the other 100 feet above Columbia River. In lower terrace gold occurs in surficial 1 to 5 feet of material. Assays: Pounds per ton: magnetite, 1,308; ilmenite, 150; monazite, 30; zircon, 60; gold, $1.65 per ton. Panning tests indicate a value of 10 to 14 cents gold per cu. yd. in lower bar and a fraction of a cent per cu. yd. in the upper bar. Prod: 1934.

GRAYS HARBOR COUNTY

Cow Point Placer

Loc: On ocean beach, at Cow Point. Deposit: Ocean beach placer. Assays: A large sample showed 0.02 oz. Au per ton.

Moclips River Placer (12)

Loc: Sec. 8, (20-12W).

Oyhut Placer (13)

Loc: On ocean beach at Oyhut. Deposit: Beach placer. Assays: 72 cents Au per ton.

Point Brown Placer (14)

Loc: Secs. 15 and 23, (17-12W).

JEFFERSON COUNTY

Ruby Beach Placer (11)

(continued on next page)

Loc: E½NE¼ sec. 31, (26-13W), on tombolo between Abbey Island and Ruby Beach. Deposit: Very fine grained gold in beach sand.

KING COUNTY

Money Creek Placer (44)
Loc: Secs. 20 and 29, (26-11E).

Raging River Placers (46)
Loc: Along Raging River.

Snoqualmie River Placers
Loc: Along Snoqualmie River

Tolt River Placer (45)
Loc: SE¼ sec. 29, (26-8E), on Tolt River. Deposit: Fine placer gold said to occur in top 18 inches of gravel in the river bars in this vicinity.

KITTITAS COUNTY

Baker Creek Placers (84)
Loc: Along Baker Creek above its junction. with Swauk Creek. Deposit: Placers. One nugget found on a bench of Swauk Creek above the mouth of Baker Creek had a value of $1,004.

Bear Cat Placer (83)
Loc: Sec. 33, (21-17E), Swauk dist.

Becker Placer (89)
Loc: Sec. 10, (20-17E), Swauk dist.

Big Salmon La Sac Placer (81)
Loc: W½ sec. 16, (22-14E) on Cle Elum River at Big Salmon La Sac.

Boulder Creek Placer (86)
Loc: At junction of Boulder and Williams Creeks, sec. 1, (20-17E). Deposit: Stream gravels. Pay dirt found at or closely above bedrock. Assays: 50 cents to $40 per yd. Prod: Considerable. (1936).

Bryant Bar (Deer Gulch) Placer (90)
Loc: Sec. 10, (20-17E), Swauk dist. Ore min: Coarse free gold. Deposit: Cemented gravel on a bench. Bedrock is flat. Dev. 325 feet of drifts. Assays: Av. 35 cents per yd., max. 90 cents per yd. Prod: 1939.

Cle Elum Placer (82)
Loc: On Cle Elum River near town of Cle Elum. Prod: Reportedly considerable.

Cle Elum River Placer
Loc: Along Cle Elum River from near headwaters to a place about halfway to its mouth.

Dennett Placer (91)
Loc: SE¼ sec. 10, (20-17E), Swauk dist.

Fortune Creek Placer (80)
Loc: SE¼ sec. 14, (23-14E) on Cle Elum River near mouth of Fortune Creek.

Gold Bar Placer (94)
Loc: Sec. 15, (20-17E), Swauk dist.

Naneum Creek Placer (85)
Loc: Secs. 25 and 26, (21-18E).

Nugget Placer (87)
Loc: Secs. 1 and 2, (20-17E) and sec. 6, (20-18E).

Old Bigney Placer (88)
Loc: SW¼ sec. 1, (20-17E), near Liberty. More than $200,000 prior to 1903. Produced 1908, 1915, 1916, 1923.

Perry Placer (97)
Loc: On Yakima River about 2 miles below mouth of Swauk Creek. Probably in sec. 28, (19-17E). Assays: 36 cents per yd. Prod: Small

amount in 1934.

Swauk Creek Placers (95)

Loc: Along Swauk Creek between the mouths of Baker and First Creeks. Deposit: Gravel from a few feet to 70 or 80 feet in thickness. Pay gravels are found on and near bedrock. Assays: Gravel varies from a few cents to $40 per yd. Prod: Considerable.

Swauk Mining & Dredging Placer (92)

Loc: Secs. 3 and 10, (20-17E). Assays: Tests prior to 1923 showed 32 cents per yd. Prod: 1933.

Williams Creek Placers (93)

Loc: Along Williams Creek near Liberty and at its junction with Swauk Creek. Deposit: Good pay gravel is found within 3 or 4 feet of bedrock and 70 or 80 feet below present stream level. Prod: Considerable.

Yakima River Placer (96)

Loc: Secs. 20 and 21, (19-17E).

LINCOLN COUNTY

Keller Ferry (Angle) Placer (148)

Loc: E½ sec. 8, (28-33E), opposite the mouth of Sanpoil River. Prod: 1932. 186.8 oz. Au from 11,628 cu. yd. of gravel in 1933-1934.

OKANOGAN COUNTY

Ballard Placer (61)

Loc: 1 mile below Conconully, on Salmon River. Deposit: Bench about 1 mile square. Assays: 0.1 cent to 10 cents per pan at $20 gold.

Crounse (Strawberry Creek) Placer (111)

Loc: On Strawberry Creek in S½ sec. 35, (34-31E). Access: 1½ miles north of Park City by road. Ore min: Gold, magnetite, ilmenite. Deposit: Flats from 20 to 200 feet wide along the stream are underlain by a shallow layer of coarse gravel. Dev: Small pits. Assays: 2 pans of gravel from the layer next to bedrock yielded 1 cent in Au and 1 oz. or more of black sand. Prod: Reportedly $100 worth of gold at $20 gold.

Cuba Line Placer (103)

Loc: Sec. 1, (40-29E), Myers Creek dist.

Deadman Creek Placer (106)

Loc: On Deadman Creek, Myers Creek dist. Deposit: Placers in creek bed and in bars as much as 250 feet above the creek.

Mary Ann Creek Placer (107)

Loc: Secs. 13 and 24, (40-29E) on Mary Ann Creek. Deposit: Gold occurs from grass roots downward to bedrock. 7-inch clay seam 4 feet above bedrock acts as false bedrock, and values are richer above the clay than elsewhere. Prod: $40,000 in 1880's.

Meadows Placer (60)

Loc: 8 miles above Conconully, on north fork of Salmon River. Deposit: Bar placer. Assays: 10 to 15 cents per yd. at $20 gold.

Methow River Placers (62)

Loc: Along Methow River.

Murray Placer

Loc: Sec. 11, (30-28E), Kartar area.

Similkameen Placers (58)

Loc: Along the Similkameen River between Oroville and Nighthawk. Deposit: Gold found as flake gold, shot gold, and nuggets in the river bars and lower terraces. Prod: Reportedly $500,000 in the few years following 1859. Intermittent to 1955.

Walker Placer (104)
Loc: Secs. 13 and 14, (40-29E), Myers Creek district.

PACIFIC COUNTY

Fort Canby Placer (16)
Loc: Mouth of Columbia River near Fort Canby. Deposit: Sand. Assays: 822 lb. magnetite, 240 lb. ilmenite, 81 cents gold per ton at $20 gold.

Ocean Park Placer (15)
Loc: Ocean beach at Ocean Park. Deposit: Sand. Assays: 22 pounds magnetite, 4 pounds ilmenite, 87 cents gold per ton at $20 gold.

Sand Island Placer (17)
Loc: Island at mouth of Columbia River, just south of Ilwaco. Deposit: Sand. Assays: 160 pounds magnetite, 68 pounds ilmenite, 2 pounds zircon, $1.51 gold per ton at $20 gold.

PEND OREILLE COUNTY

Harvey Bar Placer (120)
Loc: On Pend Oreille River in north center section 26, (40-43E). Deposit: Placer gravel on pockety dolomite bedrock.

Schierding Placer (119)
Loc: SE¼ sec. 10, (40-43E). On east side Pend Oreille River just below mouth of Z Canyon gorge. Prop: 120 acres of patented land. Deposit: Well-rounded river gravel, generally less than 6 inches in diameter, but come boulders up to 18 inches. Assays: Small colors of flat gold with well-rounded edges. One nugget of 2 pennyweight.

Schultz Placer (122)
Loc: Near SE. cor. sec. 19, (39-43E), in draw near Schultz's cabin. Deposit: Surface gravels. Assays: Reportedly 50 cents to $1.50 per yd. Prod: Reportedly produced about 1900.

Sullivan (O'Sullivan) Creek Placer (121)
Loc: On Sullivan Creek east of Metaline Falls. Assays: Nuggets valued at $20 each have been found. Prod: Reportedly several hundred thousand dollars.

PIERCE COUNTY

Ogren Placer (50)
Loc: Sec. 12, (17-10E), Summit dist.

Silver Creek Placer (51)
Loc: NE¼ sec. 25, (17-10E), on headwaters of Silver Creek. Deposit: Placer deposit from which considerable coarse gold has reputedly been recovered. Assays: Recoveries over a 10-year period average $1.25 per yd. at $20 gold.

SKAMANIA COUNTY

McCoy Creek Placer (52)
Loc: E½ sec. 15, (10-8E).

Texas Gulch Placer (54)
Loc: E½ sec. 25, (4-5E).

SNOHOMISH COUNTY

Alpha and Beta Placers (35)
Loc: SW. cor. sec. 32, SE. cor. sec. 31, (30-10E), and E½ sec. 6, (29-10E). Prop: 2 patented claims. Deposit: Sand and gravel in flat area below steep slopes at head of Williamson Creek.

Aristo Placer (37)
Loc: Sec. 17, (28-8E), on Sultan River just below the mouth of Sultan River Canyon. Prod:

Small amount produced by primitive methods and small hydraulic unit.

Bench Placer (42)

Loc: Sec. 19, (28-11E), 800 feet from junction of Silver Creek with north fork of Skykomish River. Assays: 80 cents to $1.00 per yd.

Darrington Placer (31)

Loc: NW¼ sec. 23, (32-9E), near town of Darrington on the west side of Sauk River.

Deer Creek Placer (32)

Loc: On Deer Creek near Darrington.

Gold Bar Placer (41)

Loc: Secs. 6, 7, and 8, (27-9E), on Skykomish River.

Granite Falls Placer (33)

Loc: NW¼ sec. 8, (30-7E), on north side of the south fork of Stilaguamish River about 1 mile NE. of Granite Falls.

Horseshoe Bend Placer (38)

Loc: Sec. 8, (28-8E), on Sultan River 5 miles north of the town of Sultan. Prop: 157 acres of patented ground. Ore: Coarse gold. Assays: Average values 25 to 40 cents per yd at $20 gold. Prod: Several thousand dollars.

Peterson Placer (34)

Loc: Near center sec. 9, (30-7E), on Stilaguamish River. Deposit: Gold-bearing gravels.

Phoenix Placer (43)

Loc: NW¼ sec. 29, (28-11E), on Howard Creek.

Shirley Placer

Loc: On the north fork of Skykomish River near Galena.

Stillaguamish River Placers

Loc: Along Stillaguamish River. Assays: Said to have been some rich placer deposits.

Sultan Placer (40)

Loc: NW¼ sec. 5, (27-8E), on Skykomish River, south of the town of Sultan. Prod: $200 up to 1934, $1,408 during 1934.

Sultan Canyon (McCloud) Placer (36)

Loc: SE¼SE¼ sec. 32, (29-8E) and NE¼ sec. 5, (28-8E).

Sultan River Placer (39)

Loc: On Sultan River at west edge of town of Sultan, probably in sec. 31, (28-8E).

Sultan River Placers

Loc: Along Sultan River from its source to its mouth. Ore: Gold. Assays: Average yield said to be 40 to 85 cents per yd. at $20 gold.

STEVENS COUNTY

Bossburg Bar Placer (126)

Loc: Sec. 25, (38-37E), on west bank of Columbia River. Deposit: Large bench or high bar which had 30,000 cu. yd. of gravel average 25 cents per yd.

China Bend Placer (124)

Loc: Lots 3 and 4, sec. 7, (38-38E), on SE. bank of Columbia River. Assays: 8 samples showed 8.7 to 32.5 cents per cu. yd.

Evans Placer (118)

Loc: Northport to international boundary. Assays: Said to range from 10 cents to $35.00 per yd. Prod: Produced prior to 1941.

Nigger Bar Placer (117)

Loc: Secs. 14 and 21, (40-41E), 2 miles south of Canadian boundary, on west side of Columbia River. Deposit: Bar 300 feet wide and more than 1 mile long is covered by a 2-foot overburden of sand and large boulders. Assays: A 125-foot strip 1,000 feet long had 2½ feet of

gravel averaging 26 cents per cu. yd.

Nigger Creek Bar (Dead Man's Eddy) Placer (115)

Loc: Sec. 28, (40-40E), at mouth of Negro Creek on west bank of Columbia River. Deposit: Large low bar, with no large boulders. Assays: Average 27.9 cents per cu. yd. Prod: 1933-1934.

Northport Bar Placer (116)

Loc: Sec. 36, (40-39E), on west bank of Columbia River, opposite Northport. Assays: 7 test pits showed an average of 2 feet of gravel which ran 20.1 cents per cu. yd.

Reed and Roberts Placer (114)

Loc: Sec. 20, (40-40E), about 1 mile west of Columbia River. Deposit: High bench. Prod: $17,500 reported from less than 2 acres of gravel 3 feet deep in 1934.

Valbush Bar Placer (127)

Loc: Sec. 16, (37-38E), on east side of Columbia River between Marcus and Bossburg. Owner: State. Ore: Gold. Assays: 25,000 cu. yd. produced in 1934 yielded an average of 21.4 cents per yd. Another operator on the same bar recovered $3,486.00 from 16,000 cu. yd. in 1934. Prod: 1934, 1939, 1940.

WHATCOM COUNTY

Alice Mae Placer (23)

Loc: Secs. 11 and 12, (37-14E), on Ruby Creek.

Combination Placer (20)

Loc: Sec. 2, (37-17E), Slate Creek dist. Prop: 1 patented claim.

Farrar Placer (25)

Loc: SW$\frac{1}{4}$ sec. 32, (38-17E) on Slate Creek between Lime and Darlington Creeks. Prod: Several hundred dollars per year up to 1948.

Johnnie S. Placer (27)

Loc: SE$\frac{1}{4}$ sec. 12, (37-14E), at mouth of Granite Creek, Slate Creek dist.

Lazy Tar Heel Placer (21)

Loc: Secs. 10, 11, and 12, (37-14E), Ruby Creek dist.

Nip and Tuck (Tanya) Placer (22)

Loc: Sec. 11, (37-14E), Slate Creek dist.

Old Discovery Placer (28)

Loc: SE$\frac{1}{4}$ sec. 9, (37-16E) on Ruby Creek about 2 miles above its confluence with Granite Creek. Deposit: Placer gold is found in old stream channels well above present stream level. Prod: Several thousand dollars in "old days."

Slate Creek Placer (26)

Loc: Sec. 3 (37-17E), Slate Creek dist.

Woodrich Placer (24)

Loc: Secs. 9 and 10, (37-16E), 2 miles up Canyon Creek from Beebe's cabin on Granite Creek. Deposit: An old gravel bar, 300 feet long and 5 to 20 feet thick, from which at least 2 nuggets valued at $30 to $40 each were taken.

WHITMAN COUNTY

Indian Bar Placer (153)

Loc: Sec. 15, (14-41E), near Penawawa.

YAKIMA COUNTY

Elizabeth Placer (47)

Loc: Secs. 4 and 5, (17-11E), Summit dist.

Gold Hill Placer (49)

Loc: Sec. 35, (17-11E), Morse Creek area.

Gold Links Placer (48)

Loc: Secs. 4 and 5, (17-11E), Summit dist.

Morse Creek Placer

Loc: Near head of Morse Creek, Summit dist. Deposit: An $80 nugget was found, and $1 nuggets were not uncommon when gold was $20 per ounce.

Surveyors Creek Placer (53)

Loc: Sec. 14, (8-12E), on Klickitat River.

LODE GOLD

In hydrothermal deposits, gold occurs in recoverable quantities in most ores of silver, copper, bismuth, and antimony, and in many ores of lead and zinc, as well as in many deposits where gold is the only value. These deposits range from deep-seated, high-temperature ores to epithermal ores, and they may be found in rocks of many types, but most commonly gold-bearing ores are in quartz veins closely associated with granitic or volcanic rocks of acidic to intermediate composition. Because gold is chemically inert, it is sometimes found to be concentrated as free-milling ore in the oxidized zones of sulfide bodies through leaching and partial removal of the sulfides. Many mines have operated successfully on such free-milling ore, but as the workings went to greater depths and reached the base (sulfide) ore, the operations became unprofitable, largely because of increased cost for metallurgical treatment of the base ore. Lode gold ore mined in Washington in 1950 averaged 0.485 ounce of gold and 1.509 ounces of silver per ton, as compared with averages of 0.277 ounce of gold and 0.273 ounce of silver per ton for the United States as a whole.

The lode gold deposits shown on figure 13 are deposits where gold occurs in quartz or other rocks in place. In general, a lode, ledge, or vein is a tabular deposit of valuable mineral between definite boundaries. Gold may occur as distinct grains or flakes of the native metal in the vein material. Gold, such as this that is uncombined with other substances, is called "free gold." Unfortunately, most gold is invisible and occurs in a very finely divided state or is combined with other metals. Extraction of this gold requires elaborate milling and smelting processes, which are beyond the means of the average prospector. However, should a prospector discover a valuable deposit of gold that he cannot develop, he can always seek the assistance of gold mining companies. Most major gold mining companies are seeking new deposits; however, the deposits would have to be large, containing around 10 to 20 million tons of ore that assays not less than 0.10 ounce per ton in gold. Such deposits would usually be mined by open-pit mining operations. Small gold mining companies are interested in smaller deposits that could be mined underground. These deposits would have to contain at least 500,000 tons of ore that assays at least 0.5 ounce per ton in gold.

Pocket gold hunting can prove profitable for the miner or prospector with limited funds. A "pocket hunter" is a miner or prospector who searches for small, rich gold deposits that occur on or near the surface. Extremely rich gold ore can simply be crushed in a mortar and concentrated by panning. Free gold in quartz can also be recovered by grinding the ore to sand-size particles (20 to 40 mesh), and running the material through a sluice box or over amalgamation plates or corduroy blankets. The use

of mineral jigs, concentrating tables, and flotation cells will increase the amount of gold recovered, as well as allow lower-grade gold ores to be treated. Methods of recovering gold from ore may be found in books such as "Handbook of Mineral Dressing" (von Bernewitz, 1943), and "Handbook for Prospecting and Operators of Small Mines" (Taggart, 1945). Flowsheets for small gold mines, as well as for the world's largest gold mines, have also been published by The Denver Equipment Company, P.O. Box 5268, Denver, Colorado, 80217.

It is beyond the scope of this report to discuss underground mining methods and the development of small lode mines. The Montana Bureau of Mines (Sahinen, 1964) and the Idaho Bureau of Mines (Staley, 1961) have both published several excellent books on these subjects.

LODE GOLD OCCURRENCES

BENTON COUNTY

Prosser (165)

Loc: SW¼ sec. 33, (9-25E). Ore min: Pyrite. Deposit: Mineralized zone along contact of basalt with interbasalt sediments. Dev: Shaft 50 feet deep and open cut 100 feet long. Assays: 26 cents to $1.60 Au and about the same values in Ag. One assay showed $13.00 Au (1934).

CHELAN COUNTY

Alta Vista (Pole Pick No. 2) (127)

Loc: SW¼ sec. 2, (22-17E), on south side of Culver Gulch. Elev: 3,700 feet. Prop: 1 patented claim: Pole Pick No. 2. Ore min: Arsenopyrite, pyrite. Gangue: Quartz, calcite, talc. Deposit: 4-foot quartz-calcite vein in peridotite. The vein is heavily impregnated with ore minerals. Dev: Total of about 1,190 feet of crosscuts and drifts. Assays: Ranged from 0.04 oz. to 1.6 oz. Au. Main vein ranged from $8 to $200 Au at $20 gold. Prod: Amount not known.

Black and White (Diamond Dick) (128)

Loc: SW¼ sec. 12, (22-17E), on east side of Peshastin Creek several hundred yards south of Blewett. Ore min: Free gold, pyrite, chalcopyrite, arsenopyrite. Gangue: Quartz, calcite. Deposit: Small ore-bearing stringers of quartz and calcite in a shear zone in serpentine. Dev: A shaft and 3 adits with raises and stopes, totaling at least 850 feet of workings. Assays: Reported $8 Au at $20 gold, 80 cents Ag. Prod: Small amount in 1934 and 1939.

Black Jack (Blewett, La Rica) (129)

Loc: SW¼ sec. 1, (22-17E), Blewett dist. Elev: 2,340 feet. Ore min: Free gold, native mercury, arsenopyrite, pyrite. Deposit: Quartz vein cutting serpentine. Dev: 1,300-foot adit, a shorter adit, several winzes and raises. Assays: 3,000 tons of ore av. $10 Au at $20 gold. Prod: 3,000 tons of ore about 1900, $4,000 in 1940.

Blinn (151)

Loc: NE¼ sec. 3, (22-17E). Prop: 5 patented claims: Shafer, Olympia, Pole Pick No. 3, Seattle, Vancouver. Ore min: Pyrite, chalcopyrite. Gangue: Quartz, calcite. Deposit: A 1- to 5-foot quartz-calcite vein cuts serpentine and greenstone. Dev: 1 long adit and

1,000 feet of shorter ones. Prod: In 1880 ore was milled in a 2-stamp Harrington mill. Produced 1936, 1937.

Blue Bell (I. X. L.) (131)

Loc: SW¼ sec. 1, (22-17E). Ore min: Pyrite, free gold. Gangue: Quartz, calcite. Deposit: No well-defined veins. Seams in serpentine are filled with vein and ore minerals. Dev. 450 feet of adits. Prod: Some small pockets yielded high values.

Bobtail (Wye) (132)

Loc: SW¼ sec. 2, (22-17E), in Culver Gulch, Blewett dist. Elev: 3,100 feet. Deposit: Lenticular quartz vein in serpentine. Small ore body of medium grade. Dev: Two short adits, one 50 feet long. Prod: Has produced.

Butte (116)

Loc: Secs. 25 and 26, (27-22E), Chelan Butte dist. Prod: Amount not known.

Cook-Galbraith (121)

Loc: T. 25 N., R. 20 E., about 3 miles up Entiat River from its mouth. Near top of ridge north of Entiat River. Elev: 2,160 feet. Prop: 80 acres deeded land. Ore min: Free gold. Gangue: Quartz. Deposit: A 7- to 18-inch quartz vein in granodiorite. Dev: Open cuts. Assays: 2 assays gave values of $23.80 and $68.60 per ton.

Culver (133)

Loc: SW¼ sec. 2, (22-17E), Blewett dist. Elev: 3,250 to 4,100 feet. Ore min: Free gold, arsenopyrite, pyrite. Gangue: Quartz, calcite, talc. Deposit: Ore occurs as lenses in a quartz-calcite vein enclosed in serpentine. Dev: 14 adits aggregating more than 4,500 feet of length, and numerous raises and stopes. Assays: $5 to $500 Au at $20 gold. Prod: About $300,000 by 1902.

Eureka (Golden Cherry, Golden Chariot) (134)

Loc: SW¼ sec. 1, (22-17E). Elev: 2,400 feet. Deposit: A 12- to 18-inch vein in serpentine. Dev: 970 feet of underground work. Assays: Much of the ore assays as high as $30 Au at $20 gold. Prod: Amount not known.

Fraction (135)

Loc: SW¼ sec. 1, (22-17E), Blewett dist. Amount not known.

Gold Knob (153)

Loc: Secs. 16 and 21, (22-20E), Wenatchee dist. Access: Road. Owner: State. Deposit: Gold- and silver-bearing quartz stockwork in Swauk sandstone. Dev: Several diamond drill holes, approximately 800 feet of crosscutting through silicified zones, an approximate 90-foot winze. Assays: Up to 1952 all assays far below ore grade.

Golden Eagle (Lucky King) (136)

Loc: SE¼ sec. 2, (22-17E). Ore min: Pyrite, free gold. Gangue: Quartz, calcite, talc. Deposit: A 1- to 3-foot vein composed of quartz, calcite, and talc is impregnated with pyrite. Dev: Upper crosscut and drift total 175 feet. There is a raise to the surface. A lower crosscut totals 650 feet. Assays: 2 assays across the vein from upper adit near the raise gave $3.75 and $4.10 per ton at $20 gold. Prod: $2,000 reported.

Golden King (Wenatchee, Squillchuck, Gold King) (154)

Loc: Near center sec. 22, (22-20E). Elev: 1,000 feet. Prop: 3 patented claims: Golden King, MacBeth, Stanley. Ore min: Pyrite.

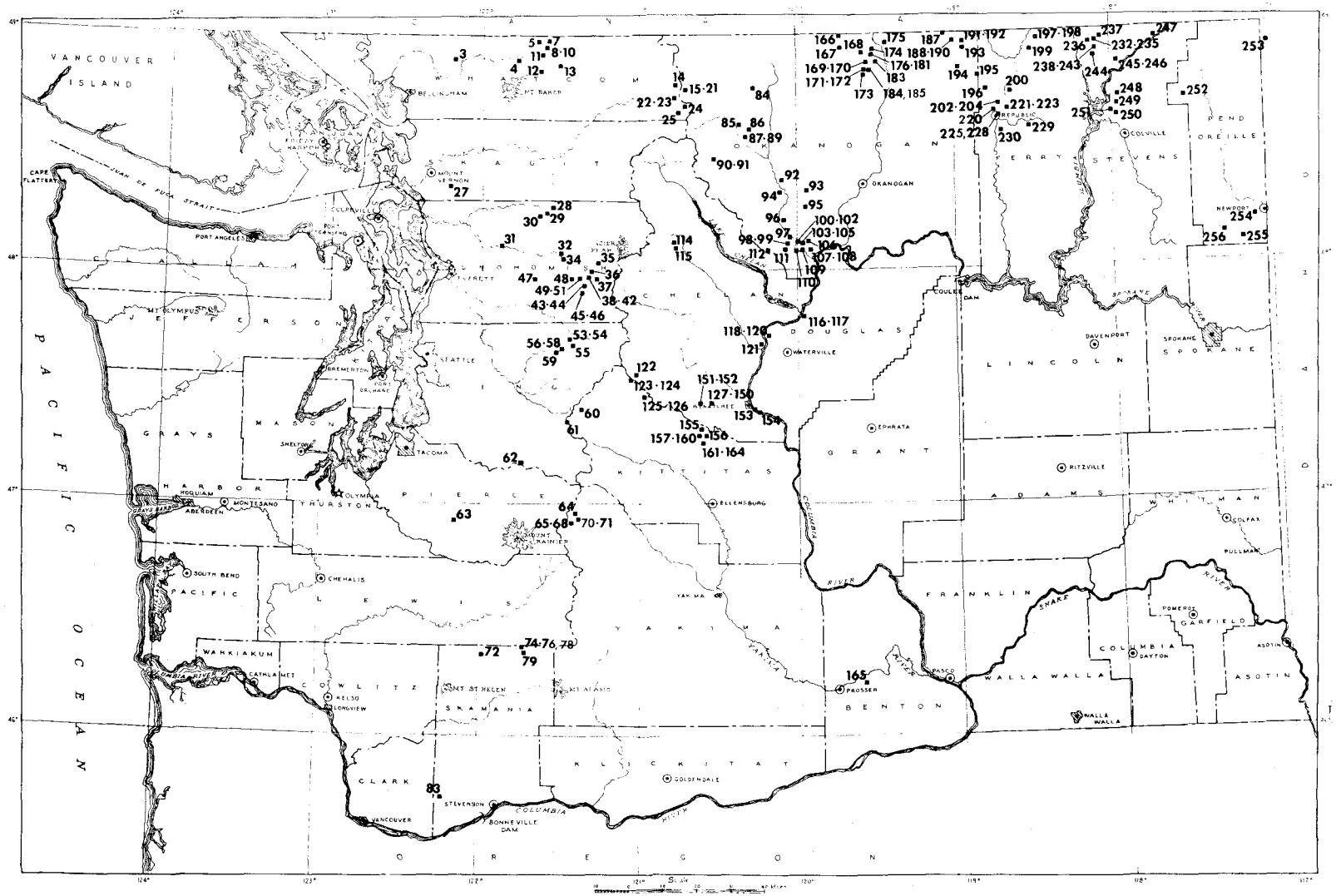


FIGURE 13.—Lode gold occurrences in Washington.

3. Nooksack
4. Great Excelsior
5. Gargett
7. Boundary Red Mountain
8. Evergreen
9. Lone Jack
10. Saginaw
11. Goat Mountain
12. Verona
13. Ruth Mountain Pyrite
14. Anacortes
15. Allen Basin
16. Beck and Short Grub
17. Indiana
18. Goat
19. Mammoth
20. New Light
21. Golden Arrow
23. North American
24. Whistler
25. Azurite
27. Mount Vernon
28. Blue Bird
29. Queen Anne
30. Sunrise
31. Wayside
32. Copper Independent
34. "45"
35. Glory of the Mountain
36. Rainy
37. Monte Cristo
38. Caplin-Holbrooke
39. Good Hope
40. Justice
41. Peabody
42. Sidney
43. Ben Butler
44. Jasperson
45. Index Gold Mines, Inc.
46. Last Chance
47. Great Northern
48. Calumet
49. Edison
50. Mineral Center
51. Undaunted
53. Damon and Pythias
54. Apex
55. Coney Basin
56. Beaverdale
57. Lucky Strike
58. Monte Carlo
59. Lennox
60. Carmack
61. San Jose
62. White River
63. Seigmund Ranch
64. Silver Creek Gold & Lead
65. Blue Grouse and Sure Thing
66. Campbell
67. Silver Creek
68. Washington Cascade
70. Fife
71. Gold Hill
72. Golconda
74. Bruhn
75. Camp Creek
76. Johnson
78. Primary Gold
79. Brown and Livingston
83. Silver Star
84. Mountain Beaver
85. Mazama Queen
86. Imperial
87. American Flag
88. Gold Key
89. Mazama Pride
90. Iron Cap and Snow Cap
91. Mid Range
92. Spokane
93. Red Shirt
94. Alder
95. Minnie
96. Silver Ledge
97. Independence
98. Gold Coin
99. St. Anthony
100. Grubstake
101. Holden-Campbell
102. Okanogan
103. Hunter
104. Hidden Treasure
105. Highland
106. Methow
107. Friday
108. Roosevelt
109. Last Chance
110. Paymaster
111. Chelan
112. Hidden Treasure
114. Red Cap
115. Red Hill
116. Butte
117. Kingman and Pershall
118. Pangborn
119. Sunshine
120. Rex
121. Cook-Galbraith
122. Aurora
123. Silver Bull
124. Silver Creek
125. Ida Elmore
126. Maud O.
127. Alta Vista
128. Black and White
129. Black Jack
131. Blue Bell
132. Bobtail
133. Culver
134. Eureka
135. Fraction
136. Golden Eagle
137. Hummingbird
139. North Star
140. Olden
141. Olympia
142. Peshastin
143. Phipps
144. Phoenix
145. Pole Pick
146. Prospect
147. Sandell
148. Tip Top
149. Wilder
150. Lucky Queen
151. Blinn
152. Ontario
153. Gold Knob
154. Golden King
155. Golden Fleece
156. Wall Street
157. Cascade Chief
158. Cougar
159. Flodine
160. Liberty
161. Ewell
162. Clarence Jordin
163. Mountain Daisy
164. Ollie Jordin
165. Prosser
166. Golden Zone
167. Gold Crown
168. Chloride Queen
169. Pinnacle
170. Leadville
171. Gold Crown
172. Summit
173. Palmer Mountain Tunnel
174. Bullfrog
175. Okanogan Free Gold
177. Bellevue
178. Hiawatha
180. Spokane
181. Triune
183. Rainbow
184. Black Bear
185. War Eagle
187. Poland China
188. Butcher Boy
189. Gray Eagle
190. Reco
191. Caribou
192. Gold Axe
193. Crystal Butte
194. Whitestone
195. Bodie
196. Silver Bell
197. Morning Star
198. Surprise
199. Panama
200. Valley
202. Tom Thumb
204. South Penn
206. Ben Hur
207. Black Tail
208. El Caliph
209. Ida May
210. Iron Mask
211. Knob Hill
212. Little Cove
213. Lone Pine
214. Morning Glory
215. Mountain Lion
216. Pearl
217. San Poil
218. Seattle
219. Surprise
220. Trade Dollar
221. Insurgent
222. Last Chance
223. Quilp
225. Butte and Boston
226. Flag Hill
227. Princess Maude
228. Republic
229. California
230. Golden Harvest
232. White Elephant
233. F. H. and C.
234. Swamp King
235. Beecher
236. Eureka
237. Easter Sunday
238. Titanic
239. First Thought
240. First Thought Extension
241. Michigan
242. Trophy
243. Second Thought
244. Gem
245. Homestake
246. Antelope
247. St. Crispin
248. Gold Bar
249. Gold Ledge
250. Gold Reef
251. Sunday
252. Rocky Creek
253. Deemer
254. Gilbert
255. Sunrise
256. Hansen

Gangue: Quartz, calcite, siderite. Deposit: Quartz gash veins in a 200- to 800-foot wide silicified zone, in sandstone of the Swauk formation. Dev: A quarry, 2 main adits, and a level from a 500-foot inclined shaft total about 2 miles of workings. Assays: 1950 shipments average 0.74 oz. Au, 0.66 oz. Ag. 1949-1953 shipments average 0.506 oz. Au, 0.59 oz. Ag. Highest monthly average shipments ran 1.27 oz. Au. Total production from 1949 to 1967 averaged 0.396 oz. Au and 0.607 oz. Ag. Prod: 1949-1967 1,036,572 tons valued at $14,962,305 in gold and silver.

Hidden Treasure (112)

Loc: NW¼SW¼ sec. 17, (30-21E). Gangue: Talc, chlorite. Deposit: Hydrothermally altered rock along contact of granitic rock with hornblendite. Dev: 20-foot shaft. Assays: Surface samples assay $5 Au, Ag at $20 gold.

Hummingbird (137)

Loc: SE¼ sec. 2, (22-17E), Blewett dist. Elev: 2,900 feet. Ore min: Free gold, arsenopyrite, pyrite, chalcopyrite. Gangue: Quartz, calcite, talc. Deposit: Quartz-calcite vein cutting serpentine. Dev: 650-foot crosscut and drift with stopes. Prod: Amount not known.

Kingman and Pershall (117)

Loc: On Chelan Butte. Ore min: Free gold. Deposit: 4-foot vein. Assays: One assay as high as $2,000 per ton at $20 gold. Prod: $15,000 reported in the 1890's.

Lucky Queen (150)

Loc: SW¼ sec. 1, (22-17E). Ore min: Free gold, chromite. Gangue: Talc, calcite, quartz. Deposit: Shear zone in serpentine from a stringer to 3 feet in width. One small segregation of chromite encountered. Dev: 545-foot adit, 412-foot adit. Prod: About $1,000 by 1901.

North Star (139)

Loc: SE¼ sec. 2, (22-17E). Ore min: Pyrite, arsenopyrite. Gangue: Quartz, calcite. Deposit: A 1- to 8-foot fissure vein cutting serpentine. Dev: 125-foot adit with stopes and raises, and 2 other adits totaling 320 feet of length. Assays: Assays at various intervals across the vein average $1 to $15 per ton at $20 gold. Average of 1,000 tons shipped was $20 per ton. Prod: 1,000 tons ore prior to 1907. Produced 1915.

Olden (Eastern Star) (140)

Loc: SE¼ sec. 2, (22-17E), Blewett dist. Deposit: 2 veins varying in width from 1 to 6 feet. Dev: 350 feet of underground work. Assays: 500 tons average about $5 Au at $20 gold. Prod: 500 tons of ore by 1902.

Olympia (141)

Loc: NW¼ sec. 2, (22-17E), Blewett dist. Ore min: Pyrite, arsenopyrite, chalcopyrite. Gangue: Quartz, calcite. Deposit: Small quartz lenses in a sheer zone in serpentine. Dev: 910 feet of crosscut and drifts.

Ontario (152)

Loc: Sec. 4, (22-17E). Ore min: Sulfides. Deposit: A wide mineralized zone in serpentine. Dev: 2 short adits and a shaft. Assays: $7 to $8 Au at $20 gold, 3 percent Ni, 3½ percent Cu.

Pangborn (118)

Loc: SW¼ sec. 25, (26-20E), Entiat dist. Owner: State. Ore min: Free gold. Deposit: Several quartz veins from 3 inches to 3 feet wide cut decomposed gneiss. Dev: 180-foot adit, 60-foot shaft, 40-foot shaft, numerous open cuts and short adits. Assays: Ore that was milled ran about ½ oz. Au. Prod: Amount not known.

Peshastin (Blewett, La Rica) (142)

Loc: SE¼ sec. 2, (22-17E). Elev: 2,400 to 2,480 feet. Prop: 8 claims. Ore min: Free gold, arsenopyrite, chalcopyrite, pyrite, galena, stibnite. Gangue: Quartz, calcite. Deposit: Lenticular lenses filling a shear zone in serpentine. Some lenses were 100 feet long and as much as 8 feet thick. Dev: 3 adits, the Meteor with 700 feet of drifts, the Peshastin with 1,300 feet of drifts and crosscuts, and the Draw with 480 feet of workings. Many stopes in the adits. Assays: 22 tons shipped in 1940 returned 0.81 oz. Au, 0.13 oz. Ag, 0.09 percent Cu. Prod: About $60,000 by 1902, 22 tons in 1940.

Phipps (143)

Loc: SW¼ sec. 2, (22-17E), Blewett dist. Ore min: Free gold, chalcopyrite, arsenopyrite, pyrite. Deposit: Quartz vein varying from a thin seam to 5 feet in width cuts serpentine. Dev: Several hundred feet of crosscuts, drifts, and stopes. Prod: Amount not known.

Phoenix (144)

Loc: Sec. 2, (22-17E), Blewett dist. Gangue: Quartz. Dev: 3 drifts with stopes. Assays: Average $20 Au on a large tonnage at $20 gold. Prod: 1,000 tons of ore prior to 1897.

Pole Pick (145)

Loc: SW¼ sec. 2, (22-17E). Ore min: Free gold, pyrite. Gangue: Quartz. Deposit: Main vein is 1 to 4 feet wide. 2 subsidiary veins also occur. All 3 are in serpentine. Dev: 2 crosscuts with raises, drifts, and stopes total about 2,000 feet of length. Assays: Ore extracted before 1901 is said to average $10 to $132 Au. Ore mined 1942-1947 averaged 35.82 Au. Prod: Est. production by 1901 was 8,000 tons of ore valued at $70,000. 1937, 1941, 1942 (291 tons), 1946 (90 tons), 1947 (81 tons), 1948 (19 tons), 1949 (20 tons), 1950-1951.

Prospect (146)

Loc: SW¼ sec. 2, (22-17E), Blewett dist. Gangue: Quartz, calcite, talc. Deposit: Oxidized vein in serpentine. Dev: Small openings on all of the claims. Prod: Ore was treated in an arrastre in the late 1890's.

Red Cap (114)

Loc: Sec. 9, (30-16E), Chiwawa dist. Prop: 20 claims. Ore min: Chalcopyrite, pyrite, arsenopyrite. Dev: 52-foot crosscut. Assays: $3.50 to $72 Au at $20 gold.

Red Hill (115)

Loc: Sec. 15, (30-16E), Chiwawa dist. Prop: 10 claims. Ore min: Copper and iron sulfides, arsenopyrite. Dev: 2 short adits. Assays: $2.50 to $29 Au, Ag at $20 gold.

Rex (Rogers) (120)

Loc: N½ sec. 36, (26-20E). Owner: State. Ore min: Pyrite. Deposit: 2 oxidized quartz veins 3 to 12 inches wide in decomposed gneiss. Dev: 3 adits totaling about 500 feet of length. Improv: A 2-stamp mill (1938). Assays: Most of the ore milled averaged about 1 oz. Au. Prod: More than $170,000 by 1930. Small amounts in 1933, 1934, and 1940.

Sandell (147)

Loc: SE¼ sec. 2, (22-17E), Blewett dist. Elev: 2,660 feet. Ore min: Free gold, arsenopyrite, pyrite. Gangue: Quartz, calcite, talc. Deposit: Quartz-calcite vein cutting serpentine. 1 ore shoot mined averaged 2 to 6 feet thick. Dev: 300 feet of crosscut and a large amount of drifting on the vein. Prod: Amount not known.

Sunshine (119)

Loc: Sec. 36, (26-20E), Entiat dist. Owner:

State. Ore min: Free gold. Dev: 100-foot shaft, 730-foot adit. Assays: $14.96 to $306 Au.

Tip Top (148)

Loc: SE¼ sec. 1, (22-17E), Blewett dist. Prop: 1 claim. Ore min: Free gold. Gangue: Quartz. Deposit: Vein averaged 2½ feet in width cuts serpentine and brecciated rock of the Hawkins formation. Dev: 500 feet to 600 feet of adit. Ore treated in an arrastre in 1901. Assays: Oxidized ore near surface averaged $40 per ton; deeper ore averaged $25 per ton at $20 gold. Prod: About $10,000 by 1901, small amount in 1940.

Wilder (Ivanhoe, White Elephant) (149)

Loc: SW¼ sec. 2, (22-17E), Blewett dist. Deposit: A 2- to 6-foot vein. Dev: Several crosscuts and drifts total about 500 feet of length. Assays: Tr. to $72 Au at $20 gold with a very little Ag and Cu. Average assay is $4.50 per ton. Prod: Est. 150 tons of ore prior to 1911. 1915, 1917, 1937.

CLARK COUNTY

Silver Star (83)

Loc: Secs. 14, 15, 22, and 23, (3-4E). Elev: 1,500 feet. Ore min: Chalcopyrite, pyrite, siderite, sphalerite, galena, magnetite. Gangue: Quartz and altered country rock. Deposit: Mineralized extrusive rock. About 2 tons of ore on the dump. Dev: 125-foot adit, 227-foot adit. Assays: Assays show 0.08 to 0.24 oz. Au, 0.50 to 2.8 oz. Ag, 2.32 percent Cu, 3.6 percent to 12.8 percent Zn, and 0.34 percent to 0.4 percent Pb. A 3.8-foot channel sample showed 0.9 percent Zn, 0.3 percent Cu, 0.9 oz. Ag.

FERRY COUNTY

Ben Hur (206)

Loc: Center of line between secs. 34 and 27, (37-32E) Elev: 2,800 feet. Prop: 1 patented claim: Ben Hur. Ore min: Pyrite. Gangue: Quartz, calcite. Deposit: 4-foot quartz vein in propylitic latite porphyry. Composed of fine-grained banded quartz and 10 percent to 30 percent calcite. Vein said to extend the length of the claim. Dev: 300-foot shaft, winze, and drifts on 3 levels. Assays: Smelter assays of ore shipped show $15 Au, 4.5 oz. Ag. In 1910, $6 to $10 per ton at $20 gold. Prod: $65,000 up to 1910, 1909-1915, 1918, 1933, 1949, 1950.

Black Tail (Hope) (207)

Loc: Near E¼ cor. sec. 34, (37-32E). Prop: 1 patented claim: Black Tail. Deposit: Several quartz veins 2 to 6 feet wide in quartz latite porphyry and propylitic andesite. Dev: Crosscut adit 300 feet long, drifts, and 600-foot inclined shaft. Workings total about 2,000 feet. Assays: 300 tons produced prior to 1902 ranged from $13 to $20 per ton at $20 gold. Prod: 1909-1910, 1912-1920, 300 tons prior to 1902.

Butte and Boston (Boston and Butte) (225)

Loc: SW¼ sec. 12, (36-32E), Republic dist. Prop: 1 patented claim: Butte and Boston. Deposit: 2½- to 5-foot quartz vein cuts andesite porphyry. Same vein as on Princess Maude property. Dev: 265-foot shaft, 75-foot shaft, 285-foot adit, 35-foot adit, and 400 feet of drifts (1902). Assays: Av. $16 per ton, $14 of which is in gold at $20 gold.

California (Apollo) (229)

Loc: SW¼SW¼ sec. 20, (36-34E), Republic dist. Elev: 4,200 feet. Ore min: Galena, chalcopyrite, sphalerite, malachite, azurite. Deposit: Quartz vein along fracture zone in greenstone and argillite. Dev: 525-foot shaft, 80-foot adit. Assays: $60 Au, Ag. Prod: 1901-1939.

El Caliph (208)

Loc: SW¼ sec. 34, (37-32E), Republic dist. Prop: 1 patented claim: El Caliph. Ore min: Free gold, pyrite. Gangue: Quartz, calcite. Deposit: ½- to 18-inch vein cutting quartz latite and shales. Vein displaced by minor faults. Dev: Adit and shaft totaling 450 feet (1902). Assays: 85 tons of ore produced prior to 1902 yielded $9,000. Prod: Est. $15,000 to $20,000 to end of 1936.

Flag Hill (226)

Loc: Secs. 1 and 2, (36-32E). Gangue: Quartz, calcite. Deposit: Said to be a 5-foot vein with an est. length of 1,500 feet. Dev: 1,500 feet of adit, three 50-foot shafts, and a 100-foot shaft. Total length of workings about 4,000 feet. Assays: Typical assay said to be 0.21 oz. Au, 0.61 oz. Ag. Prod: Said to be 400 tons prior to 1940. 1941.

Golden Harvest (230)

Loc: Sec. 36, (36-32E). Prop: 7 patented claims. Deposit: Said to be a 2½-foot vein with an est. length of 150 feet. Dev: 1,600-foot adit and several shafts. Assays: Typical assay said to be 0.21 oz. Au, 2.0 oz. Ag. Prod: 800 tons in 1937-1938.

Ida May (209)

Loc: SW¼ sec. 34, (37-32E), Republic dist. Prop: 1 patented claim: Ida May. Deposit: Small vein. Dev: 50-foot adit. Prod: 1914.

Insurgent (221)

Loc: Near west line NW¼ sec. 35, (37-32E). Prop: 1 fractional claim. Ore min: Pyrite, gold. Gangue: Quartz. Deposit: Vein believed to be an offshoot of the Lone Pine vein cuts propylitic andesite. Ore shoot 30 feet long and 2½ feet wide now stoped out. Dev: Opened by adits on Lone Pine claim.

Iron Mask (210)

Loc: Sec. 32, (37-32E). Prop: 1 patented claim. Deposit: Said to be an 8-foot vein with an est. length of 400 feet. Dev: 49-foot adit and other workings total 150 feet. Assays: Typical assay said to be 0.12 oz. Au, 0.12 oz. Ag.

Knob Hill (211)

Loc: W½SE¼ sec. 27, (37-32E). Elev: 2,700 feet. Prop: 13 patented claims, including Knob Hill, Mud Lake, Alpine, Lone Hand, Rebate, Mountain Lion. Owner: Knob Hill Mines, Inc., San Francisco, Calif. Ore min: Free gold, tellurides, pyrite, arsenopyrite, stibnite, realgar, marcasite, tetrahedrite, polybasite, pyrargyrite, argentite. Gangue: Quartz, chalcedony, adularia, sericite, calcite, barite, graphite. Deposit: 4 parallel veins and a cross vein with mining widths of 5 to 15 feet. Dev: Inclined 1,200-foot shaft with 9 levels at 110-feet vertical intervals. Abandoned open pits. Improv: 400-ton flotation-cyanidation mill, camp and office buildings. Assays: 7,192 tons of ore averaged 1.5 oz. Au, 4.5 oz. Ag. Prod: More than $10,000,000 by end of 1951. Produced 1937 to present.

Last Chance (222)

Loc: W½NW¼ sec. 35, (37-32E). Prop: 1 claim: Last Chance. Ore min: Free gold, tetrahedrite, pyrite. Gangue: Quartz, calcite. Deposit: Vein in andesite flow breccia average 8 feet in width. Vein filling consists of chalcedonic banded quartz, calcite, and fragments of country rock. Ore is largely removed above the 500-foot level. Dev: 2-compartment vertical shaft 690 feet deep, from which 1,200 feet of drifts and crosscuts have been driven. Also extensive stoping. Assays: 24,000 tons of ore averaged about $13 per ton at $20 gold. Ratio

of precious metals averaged 7.85 oz Ag to 1 oz. Au. Prod: $3,000,000 by the end of 1923.

Little Cove (212)

Loc: NE¼ sec. 34, (37-32E), Republic dist. Prop: 1 patented claim. Gangue: Chalcedonic quartz, calcite. Prod: 2 carloads valued at $1,450 prior to 1934. Produced 1934, 1939-1940.

Lone Pine (213)

Loc: E½NE¼ sec. 34, (37-32E). Prop: 1 patented claim: Lone Pine. Gangue: Quartz, calcite. Deposit: 5 veins in propylitic andesite are from 2 to 14 feet wide and consist of chalcedonic quartz traversed by narrow black crenulated ribbons. Most of the ore above the 500-foot level stoped out. Dev: More than 2,500 linear feet of underground workings, principally on 2 adits and a shaft. Assays: Ore averaged $10 to $15 per ton ($20 gold). Prod: $137,000 to 1910, 1935.

Morning Glory (Old Gold) (214)

Loc: S½SW¼ sec. 34, (37-32E). Elev: 3,000 feet. Prop: 1 patented claim and a fraction. Ore min: Gold, pyrite, tellurides. Gangue: Quartz, calcite. Deposit: Vein of drusy banded quartz from a few inches to 2 or 3 feet wide in quartz latite porphyry. Several rich pay shoots have been mined. Dev: Adit and air shaft with drifts said to aggregate 1,700 feet. Assays: Ore shipped carried values up to $400 Au at $20 gold. Tellurium is reported. Prod: $100,000 to 1936, 1937-1939.

Morning Star (Lucile Dreyfus, Faithful Surprise, Mineral Hill, Virginia) (197)

Loc: SW¼ sec. 16, (40-34E). Elev: 2,300 feet. Prop: 10 claims, 9 of which are patented: Mondamin, Tycoon, Minnehaha, Morning Star, Copper Bullion, Old Virginia, Alabama, Alabama Fraction, Copper Lady. Ore min: Free gold, pyrite, scheelite, chalcopyrite, pyrrhotite. Deposit: Quartz vein cutting serpentine is said to average 2 feet in width. Dev: 3,000-foot haulage adit, 2 shafts of 220 and 325 feet. Total workings 12,000 feet. Assays: Average 0.66 oz. Au, 1 oz. Ag, 2 percent Cu. Prod: $15,000 to 1910, $27,000 in 1917, about $15,000 in 1935. Produced 1936-1939, 790 tons 1940-1943.

Mountain Lion (215)

Loc: W½ sec. 27, (37-32E). Elev: 3,000 feet. Prop: 1 patented claim: Mountain Lion. Ore min: Gold, pyrite. Deposit: 3 parallel veins of banded quartz in andesite flow breccia. Productive vein is 10 to 12 feet wide. Dev: 1,260-foot adit and 700-foot vertical shaft. Open pit mining methods began in 1941. Assays: Smelter assays of ore in 1904 and 1905 show $5 Au at $20 gold, 2 oz. Ag. Prod: $200,000 to 1910, 1936-1938. Production after 1938 is included with Knob Hill mine.

Panama (199)

Loc: Near N. ¼ cor. sec. 6 (39-34E), Curlew area. Assays: 22 samples showed nil to 4.6 percent Cu, 0.25 to 7.12 oz. Au, 1.22 to 89.7 oz. Ag. The average was 1.71 percent Cu, 0.98 oz. Au at $20 gold, 24.80 oz. Ag.

Pearl (216)

Loc: Near center NE¼ sec. 34, (37-32E). Prop: 1 patented claim. Gangue: Quartz. Deposit: 12-foot vein (Surprise) continues through the claim its entire length of 1,500 feet. Wall rock is propylitic quartz latite porphyry. Assays: Said to assay $4.60 per ton at $20 gold. Prod: 1909-1922.

Princess Maude (Southern Republic) (227)

(continued on next page)

Loc: Near center sec. 12, (36-32E). Prop: 1 patented claim. Ore min: Pyrite. Gangue: Quartz, calcite, laumontite. Deposit: 2- to 4-foot vein in propylitic andesite. Vein consists of vitreous white quartz showing lines of crustification parallel to the walls. Dev: 70-foot incline and 200-foot adit from which a 200-foot and a 300-foot drift have been driven. Assays: Ore shipped said to average $25 per ton at $20 gold. Prod: Has produced.

Quilp (Imperator, Eureka) (223)

Loc: Near west line SW¼ sec. 35, (37-32E). Elev: 2,800 feet. Prop: 1 patented claim: Quilp, originally located as the San Poil. Ore min: Gold, pyrite, chalcopyrite, native silver. Deposit: Vein of chalcedonic banded quartz 7 to 8 feet wide cuts propylitic andesite. Dev: 400-foot shaft with several drifts and stopes. Winze sunk from 400-foot to 500-foot level. Assays: 20,000 tons of ore in 1906 had average assay of 0.4 oz. Au, 5 oz. Ag. Average assay on shipments in 1909 was 0.5 oz. Au, 4 oz. Ag. Prod: Total $720,938.70 to end of 1920; 1936; 22,402 tons 1937; 9,828 tons 1938; 1939-1940.

Republic (Blaine Republic) (228)

Loc: NE¼ sec. 12, (36-32E). Elev: 3,300 to 3,900 feet. Prop: 13 patented claims. Ore min: Pyrite, free gold. Gangue: Quartz, calcite. Deposit: Vein as much as 8 or 10 feet wide, but average 2 or 3 feet. Vein is composed principally of chalcedonic quartz. Concentrically crustified. Crustifications marked by dark crenulated bands. Dev: About 2 miles of adits, drifts, winzes, raises, and crosscuts. Assays: Some handpicked ore assays $100, but most average 0.14 oz. Au, 0.56 oz. Ag. Prod: Estimated at $1,400,000 to 1910; 2,757 tons of ore to smelter 1937; shipped 1933-1946.

San Poil (217)

Loc: SW¼NE¼ sec. 34, (37-32E), Republic dist. Prop: 1 patented claim. Deposit: Latite porphyry cut by a quartz-calcite vein thought to be the southward extension of the Ben Hur vein. Vein is cut by several faults. Ore in lenses up to 8 feet thick. Dev: 2,500 feet of adits which expose the vein for 1,000 feet. Assays: Some of the ore shipped averaged 0.7 oz. Au, 4 oz. Ag. Prod: 1909-1921, 1931, 1935. 200 tons prior to 1902.

Seattle (218)

Loc: W½NW¼ sec. 34, (37-32E), Republic dist. Prop: 1 patented claim: Seattle. Dev: 60-foot shaft. Prod: 1938-1939.

South Penn (204)

Loc: Sec. 22, (37-32E), Republic dist. Ore: Gold, silver. Gangue: Quartz. Assays: 1945 production of 172 tons yielded $2,168. Prod: 1941-1949.

Surprise (219)

Loc: E½NE¼SE¼ sec. 34, (37-32E). Prop: 1 patented claim: Surprise. Ore min: Gold, pyrite. Gangue: Quartz. Deposit: 4- to 8-foot vein in propylitic quartz latite. Vein consists of banded quartz and included fragments of country rock. Dev: 1,100 feet of drifts and crosscuts (1909). 700-foot inclined shaft. Assays: 2,400 tons averaged $21.65 per ton at $20 gold. Prod: Over $1,000,000. 1910-1923, 1934, 1938, 1947-1950.

Surprise (198)

Loc: Near north line NW¼ sec. 16, (40-34E). Ore min: Free gold. Deposit: 2-foot quartz

vein in serpentine with some black slate and diorite. Coarse yellow gold in the quartz. Dev: Adit more than 300 feet long. Assays: Ore shipped averaged $17 per ton. Prod: Has produced.

Tom Thumb (202)

Loc: S½SE¼ sec. 15, (37-32E). Elev: 3,200 feet. Prop: 6 patented claims. Deposit: Quartz spread widely through shale. Lodes not well defined. One 8-foot vein in andesite. Dev: Said to be about 1,600 feet of underground development, including a 375-foot shaft. Assays: Ore said to range from $10 to $15 per ton at $20 gold, though some shipments yielded $23 per ton. 8 or 9 oz. Ag per oz. Au. Prod: 1908-1910, 1915, 1916, 1934, 1938.

Trade Dollar (220)

Loc: E½SW¼ sec. 27, (37-32E). Prop: 1 patented claim: Grade Dollar. Deposit: Quartz vein from 20 inches to 13 feet wide. Dev: 300-foot shaft with short drifts on 2 levels. Assays: 1,000 tons of ore averaged $17 per ton at $20 gold with 10 to 12 oz. Ag per ton. Prod: About $25,000 by 1934.

Valley (Golden Valley, Lame Foot) (200)

Loc: Sec. 6, (37-33E). Prop: 3 patented claims: Valley, Valley No. 1, Valley No. 2. Ore min: Aurous selenide, pyrite, tetrahedrite. Gangue: Quartz, calcite. Deposit: Vein estimated to average 7 feet wide and 1,200 feet in length in andesite. Dev: 400-foot incline and other workings on 3 levels total 2,500 feet. Assays: Typical assay shows 0.28 oz. Au, 1.0 oz. Ag. Analysis shows 0.0027 percent to 0.0061 percent Se. Prod: 1,994 tons prior to 1941, 5,800 tons 1942, 1,302 tons 1943, 1950.

KING COUNTY

Apex (54)

Loc: SW¼ sec. 34, (26-10E), Miller River dist. Elev: 3,150 feet. Ore min: Arsenopyrite, pyrite, chalcopyrite, galena, arsenolite. Deposit: Quartz vein 2 to 6 feet wide fills a continuous fissure in granodiorite. High-grade ore occurs in narrow streaks in the vein. Dev: Adits on 5 levels total 2,500 lineal feet. Assays: High-grade ore $20 to $80 Au. Low-grade $5 to $7 Au. 237 tons averaged $41.07 per ton, the values chiefly in Au. Ore and conc. shipped in 1920 averaged 21 percent to 26 percent As, 18 to 20 oz. Ag, 1½ to 2½ oz. Au, 4½ percent to 6 percent Pb. Prod: 300 tons valued at $80,000 prior to 1901. Produced 1905, 1908, 1910, 1912, 1913, 1916-1920, 1926, 1928, 1936-1943. $300,000 total.

Beaverdale (56)

Loc: Secs. 8 and 9, (25-10E). Elev: 3,000 to 3,720 feet. Prop: 6 patented claims. Ore min: Pyrite, arsenopyrite. Gangue: Quartz, gouge. Deposit: Altered and brecciated granodiorite along narrow zone of faulting in which are seams of quartz and sulfides up to 20 inches thick. Dev: 3 adits; one at 3,370 feet is caved at portal, another at 3,610 feet is 55 feet long, and the other at 3,720 feet follows vein for 140 feet. Assays: Said to run as high as $161 Au.

Carmack (60)

Loc: Secs. 7 and 8, (22-11E). Prop: 6 patented claims. Deposit: 3 veins 12, 2½, and 1 feet wide. Dev: 375 feet of tunnel and shafts. Assays: 1 oz. to 1½ oz. Au. Prod: 20 tons shipped prior to 1901.

Coney Basin (55)

Loc: Sec. 13, (25-10E) and sec. 19, (25-11E). Elev: 2,100 to 5,800 feet. Ore min: Chalcopyrite, galena, sphalerite, pyrite, tetrahedrite. Gangue: Quartz. Deposit: Small persistent quartz veinlets along joint planes in granodiorite. Also 1 silicified mineralized zone 4 feet wide. Dev: 1,650-foot adit, another shorter adit, and some open cuts total about 3,000 feet. Assays: Average of 22 samples gave 0.38 oz. Au, 11.97 oz. Ag. 3 other assays showed 0.24 percent to 1.30 percent Cu, 2.6 percent to 6.9 percent Pb, 2.9 percent to 9.1 percent Zn. 8 tons shipped to smelter in 1941 had 0.86 oz. Au, 19.71 oz. Ag, 0.82 percent Cu, 6.0 percent Pb, 6.0 percent Zn, 1.52 percent As, 0.26 percent Sb. Prod: 40 tons in 1895, produced in 1934, 1937-1939, 1941.

Damon and Pythias (53)

Loc: Sec. 33, (26-10E). Elev: 3,000 feet. Ore min: Arsenopyrite, pyrite, chalcopyrite, galena. Gangue: Quartz. Deposit: 2 veins, one of which is said to average 3 feet in width over distance of more than 900 feet in granodiorite. Dev: 3,000 feet of crosscut and drifts expose the veins for about 1,500 feet of length and from 800 to 1,400 feet of depth. Assays: 23 tons shipped said to run 0.87 oz. Au, 9 oz. Ag, 4 percent Pb. Mine-run ore said to carry 7.86 percent As, 0.245 oz. Au, 2.2 oz. Ag. Prod: 23-ton shipment reported prior to 1940.

Lennox (59)

Loc: Secs. 7 and 18, (25-10E) and sec. 13, (25-9E), Buena Vista dist. Elev: 1,830 to 2,870 feet. Ore min: Sphalerite, chalcopyrite, pyrite, arsenopyrite, galena. Gangue: Quartz, calcite. Deposit: Shear zones in granodiorite are persistent to depths and lengths of several hundred feet, but mineralization is irregular. Dev: 5 adits and 2 open cuts. Lower crosscut 670 feet long. 3 diamond drill holes totaling 1,240 feet, 120-foot drift, 20-foot drift. Assays: A 1-ton lot of picked ore (1938): 1.14 oz. Au, 10.42 oz. Ag, 1.5 percent Cu, 1.2 percent Pb, 8.3 percent Zn, 6.18 percent As, 0.67 percent Sb. 8 samples assayed in 1947 ranged from $7.51 to $63.91 Au, Ag, Pb, Zn, Cu.

Lucky Strike (57)

Loc: Secs. 9 and 10, (25-10E), Buena Vista dist. Elev: 3,000 to 4,000 feet. Ore min: Pyrite, arsenopyrite, chalcopyrite. Gangue: Quartz. Deposit: Said to be an 8-foot ledge traceable for 500 feet. Two parallel faults about 6 feet apart in granodiorite containing quartz-sulfide seams as much as 12 inchs thick. Dev: 30-foot shaft. Assays: Reportedly assays $20 to $30 Au, Ag, Cu.

Monte Carlo (58)

Loc: NW$\frac{1}{4}$ sec. 4, (25-10E). Elev: 3,440 feet. Ore min: Pyrite, malachite, arsenopyrite, molybdenite. Gangue: Quartz, tourmaline. Deposit: Quartz vein along a shear zone in granite varies from 1 inch to 20 inches wide. Dev: 340-foot drift and a crosscut. 2 other adits reported. Assays: Said to assay $25 to $55 Au, Ag.

San Jose (61)

Loc: SE$\frac{1}{4}$ sec. 27, (22-10E), Cedar River dist. Assays: 10 tons shipped in 1894 averaged $12 per ton in gold.

White River (62)

Loc: Approximately sec. 6, (19-8E), on south side of Quartz Mountain. Deposit: Silici-

fied and altered volcanic rocks associated with the alunite deposits. Dev: 2 adits, one 300 feet long. Assays: Said to range from 54 cents to $1.40 Au at $20 gold.

KITTITAS COUNTY

Aurora (Lynch, Paramount) (122)

Loc: Secs. 26 and 27, (24-14E). Prop: 16 patented claims. Ore min: Free gold, arsenopyrite. Deposit: 4-foot quartz vein. Dev: 2,000-foot haulage adit and 2 shafts each more than 200 feet deep. Assays: Ore said to assay 1 oz. Au, 14 oz. Ag, 6 percent Cu, 28 percent As, probably on a picked sample. Prod: Has produced.

Cascade Chief (Morrison, First of August, Gladstone) (157)

Loc: SE¼SW¼ sec. 26, (21-17E). Elev: 3,400 feet. Ore min: Free gold. Deposit: 3 shear zones in sandstone average 4 feet in width and carry stringers of mineralized quartz. Dev: Crosscut and some old workings total several hundred feet of workings. Assays: Channel sample across the vein assayed $7.24 Au at $20 gold. Ore mined in 1911 averaged $33.26 per ton. Prod: 1911, 1938, 1939.

Clarence Jordin (162)

Loc: Sec. 2, (20-17E), Swauk dist. Ore min: Free gold. Gangue: Quartz, calcite. Prod: $35,000 reported. Produced from Ace of Diamonds claim in 1952.

Cougar (158)

Loc: Sec. 36, (21-17E), Swauk dist. Elev: 3,500 feet. Ore min: Free gold. Deposit: Quartz vein in a decomposed basaltic dike. Prod: Test shipment in 1938.

Ewell (Flag Mountain) (161)

Loc: N½ sec. 1, (20-17E), Liberty area.

Flodine (159)

Loc: Sec. 25, (21-17E) and sec. 30, (21-18E). Ore min: Free gold, pyrite. Gangue: Quartz. Deposit: Fissured zone. Dev: 260-foot shaft, 288-foot adit, 140-foot crosscut with 159-foot drift. Assays: $6.00 to $17.20 Au at $20 gold. Prod: Several thousand dollars from oxidized zone prior to 1928.

Golden Fleece (Mercer, T-Bone) (155)

Loc: NE¼SW¼ sec. 13, (21-17E), Swauk dist. Ore min: Pyrite, free gold. Gangue: Quartz, calcite. Deposit: Mineralized shear zone about 4 inches wide cuts carbonaceous shales. Dev: 100-foot adit and open cut. Assays: Tr. to 0.34 oz. Au. Prod: $30,000 reported.

Ida Elmore (125)

Loc: S½ sec. 24 and NE¼ sec. 25, (23-14E), Cle Elum dist. Prop: 2 patented claims: Ida Elmore, Apex. Deposit: Quartz vein about 12 to 18 inches wide in serpentine. Dev: 235 feet of crosscut and about 100 feet of drift, also some open cuts. Assays: Averaged 3/4 to 1 oz. Au.

Liberty (160)

Loc: NW¼NE¼ sec. 25, (21-17E) and sec. 19, (21-18E). Ore min: Pyrite. Deposit: Shear zone about 4 feet wide in carbonaceous shale contains discontinuous mineralized stringers of quartz and calcite. Dev: 1,200-foot adit with a 145-foot drift, and another 200-foot adit. Assays: Test run on 33 tons of ore returned 10 oz. Au, or 0.3 oz. per ton. Prod: 1935-1936.

Maud O. (126)

Loc: NW¼ sec. 25, (23-14E), Cle Elum dist. Ore min: Pyrite, arsenopyrite. Deposit: Min-

eralized quartz vein in a zone of crushed greenstone into which serpentine has been intruded. Vein irregular. Prod: 1930.

Mountain Daisy (163)

Loc: Sec. 1, (20-17E) and sec. 6, (20-18E), Swauk dist.

Ollie Jordin (164)

Loc: Sec. 2, (20-17E), 3/4 miles up Williams Creek from Liberty, Swauk dist. Ore min: Free gold. Deposit: Silicified zone 4 feet wide in Swauk sandstone contains small quartz-calcite stringers in which "wire" gold occurs. Dev: 170-foot adit. Assays: Gold occurs in rich pockets, hence assays are erratic. Ore averaged $40 per ton at $20 gold on 500 tons mined. Prod: About $20,000 in gold during 2 years prior to 1934.

Silver Bull (123)

Loc: Contiguous to Fish Lake in Stevenson Gulch, Cle Elum dist. Ore min: Pyrite. Deposit: 5-foot vein of white quartz carrying pyrite and free-milling ore. Dev: 4 adits 40, 70, 90, and 130 feet long. Assays: $100 Au, Ag at $20 gold.

Silver Creek (124)

Loc: Sec. 12, (23-14E), Fish Lake area. Deposit: Quartz vein 15 to 20 feet wide reported, but average values are too low to mine whole width, although some assays show good values in gold and silver. Dev: 5 adits, 1 shaft. Assays: A 5-ton shipment gave $12 per ton. Prod: 1937, 1939.

Wall Street (156)

Loc: Sec. 30, (21-18E). Gangue: Quartz. Deposit: Silicified fracture zones in sandstone. Dev: 900-foot adit connected by a raise with a 306-foot adit 260 feet above the lower adit. A 54-foot winze in the upper adit. Assays: $5.60 to $10.50 Au at $20 gold. Prod: $50,000 reported prior to 1935. 1938.

OKANOGAN COUNTY

Alder (94)

Loc: Secs. 25, 26, 35, and 36, (33-21E). Elev: 3,000 to 3,800 feet. Prop: 3 patented claims. Ore min: Chalcopyrite, pyrite, sphalerite, native copper, pyrrhotite. Deposit: Silicified zone 15 to 75 feet wide in sheared argillite. Dev: 3 adits total several hundred feet. Large open pit. Improv: 300-ton flotation mill (1952). Assays: 6,831 tons shipped in 1939 averaged 0.55 oz. Au, about 0.50 oz. Ag, 0.16 percent to 0.55 percent Cu. Prod: 1937; 1939, 13,000 tons of ore; 1940, 9,000 tons of ore; 1941; 1942, about 4,000 tons; 1950; 1951.

American Flag (Oriental and Central) (87)

Loc: SE$\frac{1}{4}$ sec. 30, (36-20E). Elev: 2,600 to 3,000 feet. Prop: 2 patented claims. Ore min: Pyrite, arsenopyrite, chalcopyrite, sphalerite. Gangue: Quartz, calcite. Deposit: 2 mineralized fault zones 2 to 40 inches wide in diorite contain small quartz stringers and sulfides. Dev: 2 adits and a sublevel together with a raise and winze total about 1,400 feet. Assays: 0.16 to 3.08 oz. Au across widths of 2 inches to 2 feet. Prod: A few hundred tons produced before 1910, and small production in 1940.

Bellevue (177)

Loc: NW$\frac{1}{4}$ sec. 4, (39-26E), Wannacut Lake dist. Ore min: Arsenopyrite, pyrite, chalcopyrite, pyrargyrite, stephanite, a little native silver, free gold, and possibly gold-silver telluride. Deposit: Quartz vein from 10 inches to 3 feet wide enclosed in slate. Vein average

15 inches wide. Dev: Small shaft and several open cuts. Assays: A test shipment of 1,000 pounds returned $75 Au, Ag, at $20 gold, more than half of which was Au. Prod: Several tons.

Black Bear (184)

Loc: NE¼ sec. 36, (39-25E), on Palmer Mountain. Elev: 2,500 feet. Ore min: Free gold, pyrite. Deposit: A 4-foot quartz vein along contact of chlorite schist and serpentine. Vein carries a 3-foot paystreak. Dev: 2,500 feet of underground workings. Assays: Av. $18 Au, Ag, Cu at $20 gold. Prod: $150,000 prior to 1902; 77 tons in 1947.

Bodie (Northern Gold) (195)

Loc: SW¼ sec. 3, (38-31E) and sec. 34, (39-31E). Elev: 3,000 feet. Prop: 5 patented claims. Ore min: Free gold, pyrite. Deposit: Finely disseminated ore in quartz-calcite vein. Vein much altered and leached near surface, and is similar to those in Republic dist. Veins are in tuff and andesite. One vein averaged 4 feet wide. Dev: Several thousand feet of workings on 4 levels. Assays: 302 tons produced 1940-1944 returned $9,770 or $32.35 per ton. Ore said to average about $10.00 Au. Prod: 1906, 1907, 1909-1911, 1914, 1915, 1934-1944. 66,032 tons 1935-1944.

Bullfrog (174)

Loc: SW. part sec. 33, (40-26E), Palmer Mountain dist. Ore min: Pyrite, black metallic sulfide mineral. Deposit: Reportedly a 7-foot quartz vein in quartzite and sericitic schist traceable for 3,000 feet. Dev: Adit, 160-foot shaft, 140-foot shaft. Assays: 10-ton test yielded $17 per ton, of which $12 was in gold at $20 gold and $5 in silver (1902). Prod: 4,600 pounds shipped.

Butcher Boy (188)

Loc: SW¼NW¼ sec. 21, (40-30E), Myers Creek dist. Prop: 2 patented claims. Ore min: Pyrite, pyrrhotite, sphalerite, galena. Gangue: Quartz, calcite. Deposit: Quartz vein in argillite from 1 inch to 6 feet wide. Argillite has been intruded by granite. Dev: 326-foot adit, shaft, stope. Assays: Vein in adit said to assay $7 to $17 Au, at $20 gold, 70 cents Ag. Some ore said to carry as much as 7 oz. Au. Prod: 11 carloads of ore 1907.

Caribou (191)

Loc: SE¼ sec. 14, (40-30E), Myers Creek dist. Prod: 8 carloads of ore in 1916.

Chelan (Pennington) (111)

Loc: Near NE. cor. sec. 17, (30-22E). Elev: 3,000 feet. Ore min: Scheelite, pyrite, free gold. Deposit: Several mineralized quartz veins from 6 to 24 inches wide along shear zones in diorite. Dev: Caved adit on No. 7 vein and 40-foot adit on No. 4 vein, also some open cuts. Assays: Gold values of $21 and $161 are reported. Scheelite content less than ¼ percent.

Chloride Queen (168)

Loc: SE¼NE¼ sec. 36, (40-25E), Nighthawk dist. Ore min: Pyrite, free gold. Deposit: A 1- to 4-foot iron-stained quartz vein in argillite is sparsely mineralized with pyrite and reportedly free gold. Dev: 50-foot inclined shaft and a drift. Prod: 1936, 1937.

Crystal Butte (Mother Lode) (193)

Loc: Center W½ sec. 35, (40-30E), Myers Creek dist. Prop: 5 patented claims. Ore min. Galena, chalcopyrite, sphalerite, pyrite, arsenopyrite. Deposit: A mineralized quartz vein av. 1 foot in width occurs along the contact of

limestone and argillite. Dev: Inclined shaft, adit, open cuts, some old caved workings. Assays: A carload and a truckload shipped in 1937 netted $40 per ton in gold and silver.

Friday (Tom Hal) (107)

Loc: SW¼ sec. 20, (30-23E), Squaw Creek dist. Ore min: Pyrite, chalcopyrite, arsenopyrite, bornite, malachite. Deposit: 1-foot quartz vein in gneissic diorite. Dev: 110-foot crosscut, 100-foot winze, 240-feet of drift (1902). Assays: 10 tons selected ore yielded $70 per ton prior to 1902, at $20 gold. Other assays showed 0.56 oz. Au, 1.3 oz. Ag. Prod: $5,000 prior to 1897, 1 carload in 1940.

Gold Axe (192)

Loc: SW¼ sec. 24, (40-30E), Myers Creek dist. Prod: 16 or 17 carloads (1914-1915).

Gold Coin (98)

Loc: E½ sec. 5, (30-22E), Squaw Creek dist. Prop: 2 patented claims: The Billy, Gold Coin No. 1. Prod: 1934, 1941.

Gold Crown (171)

Loc: Sec. 31, (39-26E), Palmer Mountain dist. Gangue: Quartz. Deposit: 10-foot vein. Assays: Dump sample showed $105 Au. Prod: Amount not known.

Gold Crown (167)

Loc: SW¼ sec. 32, (40-25E), Chopaka area. Prop: 3 claims. Ore min: Pyrite, chalcopyrite. Gangue: Quartz. Deposit: Veins a few inches to 4 feet thick in granite. Dev: 60-foot shaft and shallow pits. Assays: Av. 2 oz. Au, 4 oz. Ag, 4 percent Cu reported.

Gold Key (88)

Loc: Near NW. cor. sec. 30, (36-20E). Elev: 2,500 feet. Ore min: Pyrite, arsenopyrite, and some chalcopyrite. Deposit: Quartz stringer in diorite mineralized to some extent. Dev: 110-foot adit with a 15-foot winze. Assays: 37 tons shipped av. 0.7 oz. Au. Prod: 37 tons of ore shipped in 1931.

Golden Zone (166)

Loc: Near SE. cor. sec. 7, (40-25E), Nighthawk dist. Elev: 1,500 feet. Prop: 5 patented claims. Ore min: Pyrite, chalcopyrite, free gold, argentiferous galena, occasionally sphalerite and arsenopyrite. Gangue: Quartz. Deposit: Vein up to 4 feet thick in granite a short distance from its contact with metamorphic rocks. Dev: 5,000 feet of adits and drifts. Assays: Up to $10 Pb, $25 Au, 4 oz. Ag. Prod: Prior to 1911, 1939.

Gray Eagle (189)

Loc: Sec. 16, (40-30E), Myers Creek dist. Ore min: Pyrite, free gold. Deposit: Small quartz veinlets filling fractures in altered granitic rock. Prod: $8,000 in 1916. 1936-1939.

Grubstake (100)

Loc: NE¼SW¼ sec. 10, (30-22E), Squaw Creek dist. Ore min: Pyrite. Deposit: Quartz vein in gneissic granitic rock. Dev: Adit, caved (1938).

Hiawatha (Josie) (178)

Loc: Near center N½ sec. 10, (39-26E), Wannacut Lake dist. Elev: 3,200 feet. Prop: 3 patented claims. Ore min: Auriferous galena, chalcopyrite, pyrite, sphalerite. Deposit: 4 quartz veins in argillite. The Hiawatha vein has been most developed. It averaged 3 feet in width and is traceable for 2,500 feet. Mineralization sparse. Dev: Two 80-foot adits 80 feet apart and connected by drift near the face. Assays: Av. of 22 assays was $26 Au, 1 oz. Ag.

One sample showed 9.5 percent Pb, 0.32 oz. Au, 61.7 oz. Ag. Prod: 1938.

Hidden Treasure (Sunshine, Triangle) (104)

Loc: SE¼ sec. 11, (30-22E), Squaw Creek dist. Ore min: Chalcopyrite, galena, sphalerite, pyrite, malachite. Gangue: Quartz, calcite. Deposit: 2- to 4-foot vein in gneiss. Dev: 200-foot adit, 260-foot adit, 50-foot winze, 80-foot drift. Assays: 90 tons shipped prior to 1902 returned $67 per ton. Prod: 90 tons prior to 1902. Produced 1939-1942.

Highland (Highland Light) (105)

Loc: E½ sec. 11 and W½ sec. 12, (30-22E), Squaw Creek dist. Ore min: Pyrite, chalcopyrite, scheelite, sphalerite. Deposit: Several quartz veins; one, the Sailor Boy, has an av. width of 6 feet and is exposed for length of 3,000 feet. Dev: Several old adits and shafts totaling 2,000 feet. Assays: 2 to 5 oz. Au, 1 percent to 9 percent Zn, and very small percentage of W. Prod: $13,000 from 1938 to 1941 in gold and zinc.

Holden-Campbell (101)

Loc: Mainly secs. 10 and 11, (30-22E). Also along south edge of secs. 2, 3, and 4, and N½ sec. 14. Elev: 3,000 feet. Prop: 29 claims. Ore min: Pyrite, chalcopyrite, molybdenite, scheelite. Deposit: Quartz veins in gneissoid diorite, among them the Hunter, the Okanogan, the Doris Barbara, the Bay Horse, the Ace of Diamonds, and the Esther veins. Dev: More than 1,100 feet of underground workings and several surface cuts. Assays: Estimated ¼ percent scheelite. Prod: Considerable gold ore.

Hunter (103)

Loc: NW¼ sec. 11, (30-22E), Squaw Creek dist. Ore min: Chalcopyrite, pyrite, scheelite. Deposit: Quartz vein a few inches to 5 feet wide adjacent to basalt dike in diorite. Dev: 660-foot adit, 135-foot adit, and a caved adit. Also some open cuts. Assays: Av. reported in 1902 as $32 Au, Ag, Cu. Also 0.4 percent to 0.6 percent WO_3. Prod: Small amount in 1940.

Imperial (Crown Point) (86)

Loc: NW¼ sec. 16, (36-20E). Elev: 3,700 feet. Ore min: Chalcopyrite, arsenopyrite, pyrite, pyrrhotite. Deposit: A silicified zone 20 to 25 feet wide in quartzite is cut by a 1- to 3-foot mineralized quartz vein. Dev: Inaccessible shaft 130 to 150 feet deep, 25-foot drift at collar of shaft, 400-foot crosscut, 50-foot shaft, 150-foot drift, 2 other crosscuts, and a 10-foot shaft. Assays: 1 ore shoot 100 feet long shows from 0.16 to 0.95 oz. Au. Cu is estimated at 3 percent to 4 percent.

Independence (97)

Loc: SW¼ sec. 29, (31-22E). Elev: 2,550 feet. Ore min: Pyrite, chalcopyrite, molybdenite. Deposit: 3-foot quartz vein in gneissic diorite. Dev: Inclined shaft, 380-foot adit. Assays: $5 to $10 per ton at $20 gold. Prod: 1940, 1942.

Iron Cap and Snow Cap (90)

Loc: Sec. 34, (35-18E), on cliffs south of North Lake and in the small basin ¼ mile west of the lake. Elev: 6,500 feet. Ore min: Pyrite, arsenopyrite, pyrrhotite, chalcopyrite, sphalerite. Deposit: Quartz veins in diorite near its contact with greenstone. The Iron Cap vein is about 10 feet wide and extends from North Lake to the top of the sheer cliffs south of the lake, a vertical distance of 500 feet. Dev: Adits. Assays: 3 shipments to the Tacoma smelter av. 1.27 oz. Au, 1.81 oz. Ag, 0.24 percent Cu.

Prod: 3 shipments to the Tacoma smelter in 1940.

Last Chance (109)

Loc: Sec. 24, (30-22E), Squaw Creek dist. Assays: 3 carloads av. $39 per ton (1897). Prod: 3 carloads ore prior to 1897.

Leadville (John Judge, Denver City, Grandview) (170)

Loc: Near SW. cor. sec. 19, (39-26E), Elev: 2,500 to 3,000 feet. Prop: 13 patented claims, including: Leadville, Denver City. Ore min: Galena, pyrite, chalcopyrite, free gold. Gangue: Quartz, calcite. Deposit: Veins of quartz 6 inch to 3 feet wide along the contact of argillite and gabbro. Leadville vein traceable for 200 feet in lower adit. Denver City vein is traceable for 1,000 feet on the surface. Mineralization is sparse. Dev: 2,500 feet of adits and shafts. Prod: 1937 (15 tons), 1938, 1939.

Mazama Pride (Hotchkiss) (89)

Loc: N½ sec. 30, (36-20E). Elev: 2,000 to 2,800 feet. Ore min: Pyrite, arsenopyrite, chalcopyrite. Deposit: 2 or 3 quartz veins 1 to 3 feet thick in diorite. Dev: 525-foot crosscut, 80-foot drift, 30-foot drift, 15-foot shaft, several open cuts. Assays: 37 tons shipped reportedly assayed 0.7 oz. Au. Other assays show 1.08 oz. Au, 1.50 oz. Ag. Prod: About 37 tons in 1931 and reportedly another shipment in 1939.

Mazama Queen (Continental) (85)

Loc: SE¼ sec. 14, (36-19E). Elev: 2,600 feet. Ore min: Pyrite, sphalerite, chalcopyrite, galena. Deposit: An 8- to 10-inch quartz-calcite vein in altered andesite. Dev: 1,000-foot adit. Assays: Ore said to range from $10 to $47 per ton. 4 samples showed 0.32 to 0.44 oz. Au, 1.74 to 4.30 oz. Ag, 8.5 percent to 10.0 percent Zn. Prod: Test shipments in 1938 and 1939.

Methow (London, New London) (106)

Loc: E½ secs. 12 and 13, (30-22E) and W½ secs. 7 and 18, (30-23E), Squaw Creek dist. Ore min: Pyrite, chalcopyrite, scheelite. Deposit: Mineralized quartz veins from 3 inches to 15 feet wide; among them the New London, Homestake, Mineralite, Roosevelt, Tungstic, Milwaukee. Dev: More than 2,200 feet of underground workings, of which more than half are west of the river, also numerous trenches and open cuts. Assays: Av. 0.44 oz. Au, 0.8 oz. Ag, 1 percent Cu, and a small amount of W. Prod: $40,000 in gold in 1940-1941.

Mid Range (91)

Loc: Sec. 34, (35-18E), at head of North Creek. Elev: 6,000 to 7,760 feet. Access: About 5 miles by trail north of Gilbert, terminus of the Twisp River road. Ore min: Pyrite, arsenopyrite, pyrrhotite, chalcopyrite, sphalerite. Deposit: 2 mineralized quartz veins in diorite. Dev: Several adits and open cuts. Assays: Ore shipped in 1940 av. 1.27 oz. Au, 1.81 oz Ag, 0.24 percent Cu. Prod: 10 tons shipped to Tacoma smelter in 1939 and 22 tons in 1940.

Minnie (95)

Loc: NW¼ sec. 23, (32-22E), Twisp dist. Elev: 2,400 feet. Ore min: Pyrite, sphalerite, chalcopyrite, scheelite, marcasite. Gangue: Quartz, gypsum, native sulphur. Deposit: Leached and honeycombed quartz vein averaged 3 feet wide in metamorphic rocks. Dev: 160-foot adit on which is 55-foot winze, 25-foot drift, and 30-foot stope; also several open cuts.

Improv: House (1951). Assays: Carload of ore shipped in Nov. 1945: 0.46 oz. Au, 7.75 oz. Ag, net $667.56. Prod: 2 carloads, one in 1941, one in 1945.

Mountain Beaver (84)

Loc: NW¼SE¼ sec. 15, (38-20E). Elev: 4,400 to 4,800 feet. Ore min: Pyrite, chalcopyrite. Deposit: Mineralized andesite agglomerate. Dev: 4 adits; one 275 feet long, another with 200 feet of work, 2 shorter ones. Assays: Crude ore shipped av. 1.53 oz. Au, 1.13 oz. Ag, 1.81 percent Cu. Minor amount of bismuth reported. Prod: Small shipments in 1922. 1931, 1934, 1935.

Okanogan (102)

Loc: West of Hunter adit, secs. 10 and 11, (30-22E), Squaw Creek dist. Deposit: Quartz vein as much as 8 feet wide in granodiorite. Vein exposed on surface for at least 300-foot length and 142-foot depth. Dev: 160-foot adit.

Okanogan Free Gold (Owasco, Allison) (175)

Loc: SE¼NW¼ sec. 19, (40-27E). Prop: 5 patented claims. Deposit: A quartz vein up to 12 feet wide occurs in country rock of limestone, quartzite, and schist. Ore minerals are disseminated in the quartz. Dev: 3 adits, glory hole. Assays: 2 assays show $3.92 and $5.37 Au, at $20 gold Ag. Prod: 1914, 1918, 1936, 1938-1939.

Palmer Mountain Tunnel (173)

Loc: NE¼NE¼ sec. 1, (38-25E). Elev: 1,610 feet. Ore min: Malachite, pyrite, chalcopyrite, galena. Deposit: Quartz veins as much as 3 feet wide in diorite and greenstone. Smaller veins contain much calcite. Dev: 6,610-foot adit, and drifts aggregating 2,000 feet. An 800-foot diamond drill hole extends beyond face of main adit. Assays: 20-foot sample from 3-foot vein in tunnel 1,300 feet from portal assayed 0.56 oz. Au, 0.28 oz. Ag. Other assays from $1.80 to $40 per ton.

Paymaster (110)

Loc: SW¼NW¼ sec. 14, (30-22E), Squaw Creek dist. Ore min: Free gold, scheelite. Deposit: A vein 3 feet wide composed of sheared granitic rock and quartz. Iron oxide bands from 1 inch to 3 inches wide on each wall of the vein carry free gold. Dev: 150-foot shaft, 175-foot adit. Prod: Some gold ore produced from the oxidized ore.

Pinnacle (169)

Loc: SW¼ sec. 19, (39-26E) and sec. 25, (39-25E). Elev: 2,000 feet. Ore min: Free gold, pyrite, chalcopyrite, sphalerite. Gangue: Quartz, some calcite. Deposit: Quartz vein 4 to 10 feet wide in altered gabbro, and disseminated ore minerals in sheared gabbro. Dev: Approx. 2,000 feet of workings in 3 adits. Assays: $11 Au at $20 gold, across the vein 4 to 10 feet wide. Prod: $200,000 prior to 1910 (gold).

Poland China (Molson, Overtop) (187)

Loc: SW¼SE¼ sec. 11, (40-29E), Myers Creek dist. Elev: 3,850 feet. Ore min: Pyrite, marcasite, galena. Deposit: Quartz vein from a stringer to 14 feet wide enclosed in graphitic argillite. Av. width 6 feet. Dev: 1,500 feet, consisting of a 436-foot adit, various shafts, and crosscuts. Assays: Ore worked in 1911 av. about $4.75 Au, at $20 gold, 1 oz. Ag. 2 cars shipped in 1938 assayed $13 Au. Prod: More than $100,000 by 1936, 1937, at least 2 cars in 1938, 1939.

Rainbow (183)

Loc: NE¼ sec. 22, (39-26E). Elev: 2,600

feet. Ore min: Pyrite, arsenopyrite, chalcopyrite, galena, malachite, limonite, free gold. Deposit: Vein consists of quartz lenses enclosed in limestone, quartzite, and schist. The lenses pinch and swell within short distances. Dev: 3 adits. Assays: Rich free gold samples assayed 50 to 60 oz. Au, 18 to 20 oz. Ag, 2 percent Cu, 2.9 percent to 3.5 percent Pb. Prod: Has produced.

Reco (190)

Loc: SW¼ sec. 16, (40-30E). Ore min: Arsenopyrite, free gold, chalcopyrite, pyrite, marcasite, bornite. Gangue: Quartz, some calcite. Deposit: Veins 1 foot to 2 feet wide in granitic rock. Dev: About 1,100 feet in 3 adits, also some open cuts. Assays: Ore shipped said to av. $20 per ton, at $20 gold. Prod: 150 tons shipped to Northport smelter in 1916 and 1917.

Red Shirt (93)

Loc: SE¼ sec. 18, (33-23E). Elev: 3,800 feet. Prop: 1 patented claim: Red Shirt. Ore min: Pyrite, chalcopyrite, arsenopyrite. Deposit: Quartz vein, with a width of 1 foot to 5 feet, in schist. Dev: 100 feet of drift from a 425-foot crosscut, and 375 feet of drift from a 200-foot crosscut. Assays: 35 oz. Ag, ½ oz. Au. Ore av. about $10 per ton. Prod: Credited with more than $100,000. Produced intermittently for 50 years. Latest work in 1936 to 1938.

Roosevelt (108)

Loc: SW¼NW¼ sec. 18, (30-23E). Ore min: Pyrite, chalcopyrite, scheelite. Deposit: Quartz vein associated with basaltic dike in gneissic granitic rock. It varies from less than 1 inch to 6 feet in thickness and av. 2½ to 3 feet. Sulfides occur in pods on walls of the vein. Scheelite is in pockets and stringers throughout the vein. The vein is exposed in adits and on the surface for length of more than 700 feet and depth of 400 feet. Dev: 665-foot drift, a lower 240-foot drift, both caved in 1938. Assays: Less than ¼ percent scheelite. Assays for the back 180 feet of the lower adit av. 0.50 percent to 0.75 percent WO_3 over an av. width of 2 feet. Lower scheelite values in the upper adit.

St. Anthony (99)

Loc: SW¼SW¼ sec. 5, (30-22E), Squaw Creek dist. Ore min: Free gold. Gangue: Quartz. Deposit: Vein in gneissic diorite is 5 feet wide. Dev: Adit consisting of 90 feet of crosscut and 125 feet of drift, a shaft of unknown depth, and several open cuts. Assays: Ore from surface to 35-foot depth said to run $50 Au at $20 gold.

Silver Bell (196)

Loc: Secs. 25 and 36, (38-31E) and secs. 30 and 31, (38-32E). Prop: 6 claims: Silver Bell, Silver Bell No. 2, Uncle Sam No. 1, Uncle Sam Extension, Valley, Valley Extension. Deposit: 2 ore shoots reported. Dev: 340-foot adit. Assays: $3.28 to $28 per ton reported from one ore shoot. Prod: High-grade ore reported shipped from surface pit prior to 1907. In 1940 a 28-ton shipment gave net smelter returns of $244.03.

Silver Ledge (96)

Loc: Near center sec. 11, (31-21E). Elev: 300 feet above Gold Creek. Access: 4 miles by road up Gold Creek from Methow highway. Prop: 3 claims. North Star, Truax, Seattle. Ore min: Pyrite, arsenopyrite, silver sulfide, cerargyrite, bromyrite. Deposit: Quartz veins in sandstone and shale. Vein at collar of shaft is in a 5-foot shear zone and consists of 2 parts, one 1½ feet wide at footwall and the other 4 inches wide on hanging wall. Dev: 150-foot

inclined shaft, 1,500-foot crosscut. Assays: 2 tons shipped av. $20 per ton at $20 gold. Prod: 2 tons of unsorted ore prior to 1921.

Spokane (American Rand) (180)

Loc: Near center E½ sec. 10, (39-26E). Prop: 13 patented claims. Ore min: Pyrite, galena, chalcopyrite, molybdenite, reportedly free gold. Deposit: Quartz vein 15 inches wide in argillite a short distance above a granite contact. Ore minerals occur in fractures in the quartz. Pyrite disseminated in the wall rock. Dev: 100-foot inclined shaft from which short drifts have been driven. Assays: Ore from adit: 8 oz. Au, 2 oz. Ag. From shaft: 7.5 oz. Au, 2 oz. Ag. From dump: 7.5 oz. Au, 2.5 oz. Ag. 1.05 percent molybdenum reported. Prod: 1916-1918, 1935-1938.

Spokane (Gold Crown) (92)

Loc: Sec. 12, (33-21E). Ore min: Sphalerite, arsenopyrite, chalcopyrite, pyrite, galena. Deposit: Irregular quartz-calcite vein from few inches to 3 feet thick in andesite. Ore minerals occur in bunches in vein. Dev: Several hundred feet of crosscuts and drifts and some stopes. Assays: 6 tons shipped in 1941 assayed 0.40 oz. Au, 20.25 oz. Ag, 4.5 percent Zn, 3.8 percent Pb. Prod: Small amount in 1939 and 1941.

Sullivan (Pateros)

Loc: S½ sec. 20, (30-23E). Ore min: Pyrite, chalcopyrite. Gangue: Quartz, carbonate minerals. Deposit: Sheared zones up to 6 feet thick but av. less than 3 feet in granite along margins of "andesite" dikes contain small scattered pods of shipping-grade ore. Dev: 1,200 feet of underground workings on 3 levels. A block of ore 75 feet long, 30 feet high, and up to 6 feet thick was stoped above the upper adit in early days. Assays: $6 to $30 per ton, mostly in gold. 7 tons shipped in 1940 showed 0.63 oz. Au, 0.80 oz. Ag, 0.17 percent Cu. Prod: Reported 60 carloads of ore prior to 1897 valued at $72,000. 1940, 1941.

Summit (Alice) (172)

Loc: Sec. 30, (39-26E). Prop: 1 patented claim: Summit. Ore min: Free gold. Gangue: Quartz. Deposit: 2 veins. Dev: 3 shafts totaling 420 feet, 5 adits totaling 1,200 feet. Assays: Av. about $20 at $20 gold. Mill recovered $1,538 from 85 tons in 1937. Prod: 1937 ($1,900), 1938.

Triune (Crescent) (181)

Loc: NE¼ sec. 10, (39-26E), Wannacut Lake dist. Elev: 2,300 feet. Ore min: Pyrite, galena, chalcopyrite, molybdenite, free gold, malachite, azurite. Deposit: At least 4 quartz veins varying in width from a stringer to 10 feet occur in argillite a short distance above intrusive granite. The granite is sericitized and kaolinized. Dev: 140-foot shaft with adit on lower level together with drifts total more than 2,000 feet. Assays: Early assays $10 to $40 per ton at $20 gold. An av. assay of 4,000 tons of tailings gave 0.01 oz. Au, 0.3 oz. Ag. Sample of 3 ledges on south side of gulch (veins from 4 to 10 feet wide) assayed 0.32 oz. Au, 0.5 oz. Ag. Prod: More than $300,000 prior to 1938, 1939.

War Eagle (185)

Loc: SE¼ sec. 36, (39-25E). Prop: 1 patented claim. Ore min: Free gold. Deposit: 5-foot quartz vein. Dev: 100-foot adit, two 70-foot drifts. Assays: Ore av. about $18 Au, Cu, Ag. Values chiefly in Au. Prod: Has produced.

Whitestone (194)

Loc: Sec. 34, (39-30E), Wauconda dist.

Ore min: Galena, sphalerite, tetrahedrite. Deposit: Limestone beds with low dips are mineralized on tops and bottoms and along stringers cutting the beds. Prod: 1938. Produced intermittently 1918-1938.

PEND OREILLE COUNTY

Deemer (253)

Loc: Sec. 2, (39-45E), Metaline dist. Deposit: Quartz vein from a few inches to 4 feet in width is said to carry gold and silver. Dev: 200 feet of adits and numerous open cuts, mostly caved.

Gilbert (254)

Loc: Sec. 24, (31-44E), Newport dist. Prop: 160 acres of deeded land. Deposit: Said to be a gold-bearing quartz vein 6 inches wide which has been traced for 200 feet on the surface. Dev: Caved open cuts.

Hansen (256)

Loc: Sec. 14, (30-43E), Newport dist. Prop: 160 acres of deeded land. Deposit: Fracture zone said to be impregnated with narrow mineralized quartz stringers. Zone is 20 feet wide. Dev: Inclined shaft, caved.

Rocky Creek (252)

Loc: SE. cor. sec. 23, (37-41E). Ore min: Galena, chalcopyrite, sphalerite, free gold. Deposits: Fine-grained sulfides in a quartz vein 2 to 16 inches wide exposed for 50 feet in a schist roof pendant in granite. Dev: 10-foot shaft, 70-foot drift. Assays: One assay showed 0.44 oz. Au. Some ore carried free gold to the extent of several thousand dollars per ton.

Sunrise (255)

Loc: Sec. 22, (30-44E), Newport dist. Prop: 160 acres of deeded land. Deposit: Quartz vein from a few inches to 3 feet in width is said to carry values in gold and silver. Dev: 250 feet of adit and shaft, caved (1941). Assays: Handpicked sample assayed $10.50 per ton.

PIERCE COUNTY

Blue Grouse and Sure Thing (65)

Loc: NE¼ sec. 36, (17-10E), Summit dist. Ore: Gold, silver. Deposit: Series of parallel veins. Assays: $3 to $51 Au, at $20 gold, 31 oz. Ag.

Campbell (66)

Loc: Sec. 36, (17-10E). Elev: 5,500 to 6,000 feet. Ore min: Free gold. Deposit: Small quartz veins in volcanic rock. Both veins and volcanics reputedly carry gold values. Assays: Gold values from 20 cents to a few dollars per ton.

Seigmund Ranch (63)

Loc: Sec. 30, (17-5E). Ore min: Free gold. Deposit: Vein 20 to 40 feet wide of free-milling gold-bearing quartz. Assays: Gold values are very low.

Silver Creek (67)

Loc: Sec. 25, (17-10E), Summit dist. Ore min: Pyrite, chalcopyrite, pyrrhotite, some marcasite, sphalerite, and arsenopyrite. Gangue: Quartz, calcite. Deposit: Altered and silicified andesite is mineralized along narrow joints and in places heavily impregnated with pyrite. Dev: 42-foot shaft, 28-foot drift, 300-foot crosscut, 25-foot adit, 38-foot adit, 70-foot adit, several open cuts. Assays: 100 tons shipped reported ran more than $50 per ton. Prod: 100 tons of ore prior to 1945; 3 oz. Au,

14 oz. Ag, 100 pounds Pb in 1941.

Silver Creek Gold & Lead (64)

Loc: Sec. 12, (17-10E), Summit dist. Ore Min: Arsenopyrite, pyrite, chalcopyrite, galena, sphalerite. Deposit: Rhyolite cut by fault zone 1 to 4 feet wide containing limy gouge and bands of quartz with sulfides. Dev: 100-foot crosscut with 100-foot drift. Improv: Small cabin, rails, mine car, 10-ton ore bin (1951). Prod: 20 tons (1945) reported to have contained $89.75 per ton in gold, silver, lead, copper. Unknown amount of placer gold has been produced from stream gravels.

Washington Cascade (New Deal, Tacoma) (68)

Loc: Sec. 25, (17-10E), Summit dist. Deposit: 5-foot vein in andesite. Dev: 755-foot adit. Assays: 30 tons returned $180. Prod: 1936 (5 tons), 1938 (30 tons).

SKAGIT COUNTY

Mount Vernon (Devils Mountain, Pacific) (27)

Loc: S½ sec. 4, NE¼ sec. 9, N½ sec. 10, and NW¼ sec. 11, (33-4E). Elev: 250 to 1,750 feet. Prop: 2,100 acres. Ore min: Chromite, free gold, nickeliferous ankerite, marcasite, pyrite, bravoite. Gangue: Quartz, chalcedony, carbonates. Deposit: Fault zone between serpentine and sandstone is made up of silica-carbonate rock with a central core of sulfide-bearing breccia. Silica-carbonate rock portion is 2 miles long and 100 to 400 feet wide. Sulfide breccia is in small lenses along the core. Dev: 300 feet of adits and 6,375 feet of diamond drilling. Assays: 157 assays on 2,598 feet of core av. 0.0195 oz. Au, 0.251 percent Ni. Prod: Test shipments only.

SKAMANIA COUNTY

Brown and Livingston (79)

Loc: SW¼ sec. 3, (10-8E). Assays: $6.00 to $30.00 Au, Ag, at $20 gold.

Bruhn (74)

Loc: Sec. 10, (10-8E). Ore min: Sulfides and free gold.

Camp Creek (75)

Loc: Center sec. 10, (10-8E). Ore min: Free gold. Deposit: Quartz stringers in an oxidized zone 300 feet wide. Prod: $75,000 prior to 1934.

Golconda (72)

Loc: Near W¼ cor. sec. 16, (10-6E), St. Helens dist. Elev: 3,120 feet. Ore min: Pyrite, some chalcopyrite and sphalerite, and a little galena. Deposit: Quartz veinlets along a fracture zone in granite. Dev: Adit. Assays: Reportedly $4.00 Au at $20 gold. Prod: An 18-ton shipment in 1933.

Johnson (76)

Loc: Sec. 10, (10-8E). Ore min: Free gold. Deposit: Gold in a seam 2 to 3 inches wide.

Primary Gold (78)

Loc: Sec. 10, (10-8E). Elev: 3,200 feet. Deposit: 30-foot ledge of coarsely crystalline pyrite in quartz gangue. This carries only traces of gold, but narrow stringers of free gold in quartz cut the pyrite. Dev: Numerous open cuts, some placering. Assays: Said to range from $2.10 to $1,500.00 per ton. Prod: Minor.

SNOHOMISH COUNTY

Ben Butler (43)

Loc: NE¼ sec. 6, (28-11E). Deposit: 12-

to 15-foot vein carrying 12 to 30 inches of ore containing gold. Dev: 60-foot adit.

Blue Bird (28)

Loc: Sec. 24, (32-9E) and sec. 19, (32-10E), Darrington dist. Ore min: Chalcopyrite, pyrrhotite. Deposit: Vein av. 8 feet in width. Dev: 200 to 300 feet of adits. Assays: High-grade ore runs $30 per ton. Prod: Small amount reported about 1940.

Calumet (48)

Loc: Near center N½ sec. 27, (29-10E). Elev: 4,600 to 5,000 feet. Ore min: Chalcopyrite, pyrrhotite, marcasite, arsenopyrite, sphalerite, galena. Deposit: Quartz vein from 6 to 24 inches wide along a fracture zone in metamorphic rocks. Dev: 250-foot adit, 9 open cuts. Assays: Tr. to 1.03 oz. Au, 0.56 to 5.33 oz. Ag, 0.48 percent to 6.50 percent Cu, 0.10 percent to 4.85 percent Zn.

Caplin-Holbrooke (38)

Loc: Sec. 33, (29-11E). Deposit: 10-foot vein with two 12-inch paystreaks of ore. Dev: 75-foot adit. Assays: As high as $90 Au, Ag, Cu.

Copper Independent (Independent) (32)

Loc: NE¼ sec. 19, (30-10E). Elev: 3,000 feet. Prop: 3 claims. Ore min: Pyrite, arsenopyrite. Gangue: Sheared granite and quartz. Deposit: Mineralized shear zone in granite contains ore bodies from 100 to 200 feet in diameter and 2 to 3 feet wide. Dev: 3 adits, drifts, and raises totaling about 700 feet. Assays: 0.6 to 0.7 oz. Au. Prod: 1 carload of picked ore shipped to Everett smelter prior to 1901.

Del Campo

Loc: On the east slope of the ridge dividing the Sauk, Sultan, and Stillaguamish watersheds, overlooking Crater Lake, 2½ miles west of Monte Cristo. Prop: 3 claims. Deposit: 10- to 30-foot fracture zone that can be traced for 2,000 feet on the surface. Dev: 25-foot adit, several open cuts. Assays: Surface ore runs $44.86 Au, Ag, at $20 gold, 13.8 percent Cu.

Edison (49)

Loc: NE¼ sec. 29, (29-11E), Silver Creek dist. Ore min: Chalcopyrite, arsenopyrite. Deposit: 50-foot vein in granite. Assays: $10 to $15 per ton, at $20 gold.

"45" (Magus) (34)

Loc: Secs. 29 and 30, (30-10E). Elev: 2,500 to 4,500 feet. Prop: 25 patented claims and fractions. Ore min: Galena, sphalerite, ruby, silver, chalcopyrite, arsenopyrite, pyrite, pyrrhotite, marcasite, scheelite, tetrahedrite. Gangue: Quartz, calcite. Deposit: Mineralized fracture zones in metamorphic rocks. One vein, the Magus, has an indicated length of 3,000 feet. Dev: More than 4,000 feet of underground workings. Assays: Ore shipped returned 0.35 to 1.06 oz. Au, 48.4 to 171.4 oz. Ag. Other assays show 3.7 percent to 43 percent Zn, 4.6 percent to 6.5 percent Pb, 6.2 percent to 18.5 percent As, 0.28 to 0.6 oz. Au, 8.0 to 10.4 oz. Ag. Prod: Approximately 3,185 tons of ore 1896 to 1902.

Glory of the Mountain (35)

Loc: SE¼ sec. 2, (29-11E). Ore min: Arsenopyrite, pyrite. Deposit: Wide mineralized fracture zone contains an ore body 20 feet wide. Dev: 40-foot adit. Assays: $21 to $27 Au, $1.80 to $4.80 Ag. Prod: Has produced.

Good Hope (39)

Loc: Sec. 33, (29-11E). Prop: 10 patented claims. Dev: About 2,000 feet of adits. Prod:

1 carload in 1909.

Great Northern (47)

Loc: NW¼ sec. 35, (29-8E). Ore min: Chalcopyrite, pyrite. Deposit: Mineralized shear zone 60 feet wide along a contact between granite and slate. Ore minerals are disseminated throughout the zone. Assays: Av. of 6 assays showed $32 Au at $20 gold, $3.45 Cu, $1.76 Ag.

Index Gold Mines, Inc. (45)

Loc: Secs. 18 and 19, (28-11E), Silver Creek dist. Ore min: Arsenopyrite. Deposit: Said to be a vein more than 18 inches wide. Dev: 300-foot adit. Assays: Typical assay said to be 5.4 oz. Ag, 6.4 percent Pb, 1.3 oz. Au, 11.59 percent As. Prod: 10 tons of ore per day in 1939.

Jasperson (Clara Thompson, Webster, Commonwealth, McCombs) (44)

Loc: Sec. 36, (29-10E) and sec. 6, (28-11E). Elev: 3,400 feet. Ore min: Cinnabar, pyrite, arsenopyrite, chalcopyrite, galena, sphalerite, stibnite, vanadinite. Gangue: Quartz. Deposit: Narrow mineralized fracture zones in granodiorite. Ore shoots are sporadic and only 3 to 8 inches wide. Dev: Adit more than 30 feet long and other workings said to total 3,000 feet. Assays: 8 samples show 0.02 to 0.44 oz. Au, tr. to 19.20 oz. Ag, tr. to 4.5 percent Cu, 0.8 percent to 15.1 percent Pb.

Justice (Golden Chord) (40)

Loc: N¼ cor. sec. 27, (29-11E). Elev: 4,000 feet. Ore min: Arsenopyrite, pyrite. Gangue: Quartz. Deposit: A 1- to 3-foot mineralized shear zone in andesite contains ore bodies from 70 to 400 feet in length. Nearly all the known ore has been removed. Dev: 3 adit levels totaling about 2,200 feet. Assays: Av. assays showed 0.43 oz. Au, 3 oz. Ag, 12.4 percent As. Prod: Considerable ore produced from 1903 to 1905.

Last Chance (46)

Loc: Sec. 18, (28-11E). Deposit: Nearly vertical vein that strikes northwest. Dev: 1 crosscut adit. Prod: Small amount in 1935.

Mineral Center (Bonanza, Edison, Louise, Washington-Iowa) (50)

Loc: W½ sec. 32, (29-11E). Elev: 3,500 feet. Ore min: Pyrite, chalcopyrite, malachite, azurite, galena, arsenopyrite, pyrrhotite, sphalerite, molybdenite. Gangue: Silicified rock. Deposit: Mineralized shear zones in metasediments. One zone is 40 feet wide and contains abundant pyrite and some chalcopyrite. Dev: Workings on 3 levels total 3,500 feet. Assays: Various assays show from 0.04 to 0.18 oz. Au, 0.04 to 7.38 oz. Ag. The large zone assays 0.10 oz. Au, 7.38 oz. Ag.

Monte Cristo (Mystery, Pride) (37)

Loc: Secs. 23 and 27 (29-11E). Elev. 3,000 to 5,500 feet. Prop: Several patented claims. Ore min: Arsenopyrite, pyrite, chalcopyrite, galena, sphalerite, jamesonite, realgar. Gangue: Quartz, calcite, sheared rock. Deposit: Shear zone in schist and tonolite contains lenses of sulfide ore from 100 to 300 feet in diameter and 1 to 15 feet thick. Mineralization in other minor fractures. Dev: 3 main levels of adits and several smaller adits. Total underground work about 12,000 feet. Assays: 0.20 oz. Au, 3.00 oz. Ag, more than 6 percent As. Other assays showed, for surface ores: 0.95 oz. Au, 12 oz. Ag, 4 percent Cu, 5 percent Pb; for deeper ores: 0.6 oz. Au, 7 oz. Ag, 1 per-

cent Cu, 2½ percent Pb. Prod: 300,000 tons of ore. The ore came mainly from the Mystery and Pride claims above the 700-foot level.

Peabody (41)

Loc: NE¼ sec. 27, (29-11E). Elev: 3,400 feet. Prop: 1 patented claim. Ore min: Arsenopyrite, pyrite, galena, sphalerite. Gangue: Quartz and altered andesite. Deposit: Mineralized fracture zone in andesite ranges from a few inches to 18 inches wide. Dev: 200-foot adit, several short adits and open cuts. Assays: 0.3 to 0.6 oz. Au, 1 to 36 oz. Ag. Prod: 1905.

Queen Anne (29)

Loc: SE¼ sec. 27, (32-9E), Darrington dist. Ore min: Chalcopyrite, galena, sphalerite, arsenopyrite, bornite. Gangue: Quartz. Deposit: Ore minerals associated with quartz in a 3-foot fracture zone in granite. Dev: 1 adit. Assays: Tr. to $550 Au, tr. to $60 Ag, tr. to $35 Cu.

Rainy (Ben Lomond) (36)

Loc: SW¼ sec. 22, (29-11E). Elev: 3,000 feet. Prop: 1 patented claim. Ore min: Arsenopyrite, pyrite. Deposit: Mineralized fracture zone in schist and andesite. Main ore body is 300 feet in diameter and 8 inches to 5 feet wide. Dev: 800-foot adit, 200-foot shaft. Assays: 862 tons shipped to smelter in 1913 to 1915 av. 0.638 oz. Au, 2.20 oz. Ag, 19.6 percent As. Prod: 20,000 tons of ore reported.

Sidney (42)

Loc: Sec. 27, (29-11E), Monte Cristo dist. Ore min: Pyrite, chalcopyrite. Gangue: Quartz. Dev: Small amount.

Sunrise (North Star, Oldfield) (30)

Loc: NE¼NE¼ sec. 29, (32-9E). Ore min: Chalcopyrite, galena, molybdenite, arsenopyrite, sphalerite, pyrite. Gangue: Quartz. Deposit: Narrow fractures cutting granite are filled with quartz and ore minerals. Dev: 2 adits aggregating 155 feet. Assays: 0.08 to 0.55 oz. Au, 1.3 to 9.1 oz. Ag, 0.8 percent to 1.67 percent Cu, 0.1 percent Mo, 9 percent As.

Undaunted (51)

Loc: Sec. 31, (29-11E), Silver Creek dist. Ore min: Pyrite. Deposit: 6 mineralized shear zones that range from 1½ to 6 feet in width and carry from 6 to 36 inches of ore. Dev: 35-foot adit and several open cuts. Assays: $12 to $70 per ton at $20 gold.

Wayside (31)

Loc: SE¼ sec. 8, (30-7E). Elev: 1,200 to to 1,500 feet. Prop: 15 patented claims. Ore min: Chalcopyrite, pyrite, galena, sphalerite, bornite. Gangue: Cherty quartz. Deposit: Vein 6 to 18 inches wide cutting slate and siliceous limestone. Dev: Shaft and 7 levels, 6 under water. Assays: 0.01 to 0.25 oz. Au, 6 to 10 oz. Ag, 10 percent Cu. The reported occurrence of vanadium has not been verified. Prod: About $500,000 worth of high-grade ore shipped.

STEVENS COUNTY

Antelope (246)

Loc: Sec. 20, (39-38E), Orient dist. Elev: 3,650 feet. Ore min: Pyrite, pyrrhotite, chalcopyrite. Gangue: Quartz. Deposit: 2½- to 4-foot vein in Jumbo volcanics. Dev: Inclined shaft about 100 feet deep. Assays: Sample taken across the vein said to assay $26.25, at $20 gold. Prod: 50 tons of ore said to have been mined.

Beecher (235)

Loc: Near center sec. 31, (40-37E), Orient dist. Elev: 2,500 feet. Ore min: Free gold, pyrite, sylvanite, galena, limonite, chalcopyrite. Gangue: Quartz, calcite. Deposit: 2 quartz veins, one 4 to 24 inches wide, another as much as 8 feet wide. Country rock is schist and Rossland volcanics cut by diabase. Dev: 65-foot shaft with 115-foot drift at bottom. Other short drifts. Assays: Av. $4 to $24 Au, high-grade $136 to $296 Au at $20 gold. Prod: 2 shipments aggregating 22 tons prior to 1913.

Easter Sunday (237)

Loc: Near center E½ sec. 22, (40-37E), Orient dist. Elev: 3,550 feet. Prop: 2 patented claims: Easter Sunday, Cairn. Ore min: Pyrite, chalcopyrite, sphalerite, galena, boulangerite, tetrahedrite. Deposit: 2- to 6-foot quartz vein in cherty argillite. Vein sparsely mineralized, and cut off by a monzonite dike. Dev: 130-foot inclined shaft and 2 short levels run at 70 and 100 feet from the collar total 550 feet of workings. 480-foot diamond drill hole. Assays: 20-ton shipment av. 1.21 percent Cu, 0.44 oz. Au, 12.4 oz. Ag. Prod: Shipped approx. 20 tons of ore in 1909.

Eureka (Eureka and Orient, Indian, Orient Eureka) (236)

Loc: Secs. 13, 24, and 25, (40-36E), Orient dist. Elev: 2,485 feet. Prop: 11 patented claims. Ore min: Galena, chalcopyrite, sphalerite, pyrite. Deposit: Several quartz veins in schist and diabase. Dev: 1,500 feet workings in adits, shafts, and open cuts. Assays: Some veins returned $32 Au at $20 gold, others $60 Pb and Zn. Prod: Produced in 1890's.

F. H. and C. (Faith, Hope, and Charity; or Acme) (233)

Loc: Secs. 19 and 30, (40-37E), Orient dist. Elev: 2,600 feet. Prop: 3 patented claims. Ore min: Pyrite. Deposit: 3- to 5-foot quartz vein. Dev: 250-foot shaft with drifts on 4 levels, total 1,500 feet. Large amount of open-cut work. Assays: Smelter shipment said to return 2.36 oz. Au, 1.9 oz. Ag. Prod: 1 small shipment to Tacoma smelter about 1917, produced 1929.

First Thought (239)

Loc: Secs. 7 and 18, (39-37E). Elev: 2,900 feet. Prop: 17 patented claims. Ore min: Pyrite, free gold. Gangue: Quartz, calcite. Deposit: Mineralized zone 15 to 110 feet wide in rhyolite porphyry and quartz latite. Richer ores in the zone occur at intersections of faults. Dev: 1½ miles of workings on 7 levels. Assays: 40,000 tons of ore av. 3/4 oz. Au, ½ oz. Ag. Prod: $1,350,000 in gold prior to 1948. Produced 1904, 1906-1909, 1934-1942.

First Thought Extension (240)

Loc: Sec. 18, (39-37E), Orient dist. Deposit: Latite flows cut by monzonite dikes Numerous fault zones in both formations are mineralized by pyrite said to carry gold. Dev: 650 feet of work in main adit. Assays: Said to assay up to $400 Au.

Gem (244)

Loc: Sec. 19, (39-37E). Elev: 3,440 feet. Ore min: Auriferous pyrite. Gangue: Quartz. Deposit: Lavas and interbedded sediments cut by monzonite and fine-grained granite dikes. Ore occurs in a 4-foot fracture zone in one of the granite dikes. Dev: 250-foot adit, 105-foot shaft, and 4 drifts from 12 to 60 feet long. Assays: Some selected samples assayed $1,000 Au. Ore said to av. $40 per ton.

Gold Bar (248)

Loc: Secs. 15 and 22, (37-38E). Elev: 1,600 to 2,100 feet. Prop: 8 patented claims. Ore min: Pyrite, tetrahedrite, sphalerite. Deposit: Quartz veins from $\frac{1}{2}$ inch to 8 inches wide filling fractures in quartzite and argillite. Veins sparsely mineralized. Small tonnage of ore exposed. Dev: About 1,000 feet of workings in 4 adits and 2 inclines. Assays: 7 assays show from 0.005 to 0.15 oz. Au, 1.2 to 62.0 oz. Ag. tr. to 1.3 percent Pb, tr. to 1.7 percent Zn, tr. to 0.3 percent Cu, 1.02 percent to 2.70 percent As. Prod: 400-pound test shipment to Bunker Hill smelter prior to 1945.

Gold Ledge (249)

Loc: SW$\frac{1}{4}$ sec. 4, (36-38E), Kettle Falls dist. Prop: 460 acres of deeded land. Deposit: Quartz vein along contact of argillite and porphyry. Dev: 150-foot inclined shaft, large open cut. Assays: 6 tons shipped netted $40 per ton Au, Ag, at $20 gold.

Gold Reef (Benvenue, Golden Reef) (250)

Loc: SW$\frac{1}{4}$SE$\frac{1}{4}$ sec. 9, (36-38E) Kettle Falls dist. Elev: 3,100 feet. Deposit: Quartz vein said to av. 2 to 3 feet wide and to be traceable for 800 feet. Vein is along contact between argillite and acidic dike. Dev: 750 feet of adits and 165 feet of shafts and inclines. Improv: Small homemade mill. Assays: 24 tons shipped to smelter assayed 0.542 oz. Au, 0.834 oz. Ag. Prod: $100,000 reported prior to 1935. 1939 (24 tons). 2 or 3 carloads in 1946 and 1947.

Homestake (245)

Loc: Sec. 19, (39-38E). Elev: 3,800 feet. Ore min: Chalcopyrite, pyrite, pyrrhotite. Gangue: Quartz. Deposit: 4$\frac{1}{2}$-foot vein in Jumbo volcanics. Dev: 2 shafts 27 and 12 feet deep. Trenching for 100 feet along the vein. Assays: Said to assay $17.00 Au, at $20 gold, $8.60 Cu, $3.15 Ag. At one place the vein is reported to show 4$\frac{1}{2}$ feet of $31 ore. Prod: 100 tons of ore shipped.

Michigan (241)

Loc: S$\frac{1}{2}$ sec. 7, (39-37E), Orient dist. Prop: 4 patented claims: Climax, Plutania, Moonlight, Butte. Deposit: Gold-bearing pyrite occurs along zones of crushing and faulting in latite flows. The latite has been cut by numerous dikes of monzonite porphyry. Dev: 800-foot and 400-foot adits, shallow shaft.

St. Crispin (247)

Loc: Sec. 25, (40-39E). Elev: 1,400 feet. Gangue: Quartz. Deposit: Mineralized zone in argillite. Said to be 8 more similar zones. Dev: 470-foot shaft, 50-foot shaft, and about 150 feet of crosscuts, all caved (1941). Assays: 4 percent Cu, $26 Cu, at $20 gold, 13 oz. Ag.

Second Thought (243)

Loc: Near center SW$\frac{1}{4}$ sec. 18, (39-37E). Elev: 2,700 feet. Prop: 5 claims and 3 fractions. Ore min: Pyrite. Deposit: Pyrite impregnations and joint and fault fissure fillings in quartz latite cut by quartz monzonite dikes. Dev: 64-foot shaft, 40-foot shaft, 22-foot shaft, 5 other shafts, and some open cuts. Assays: Pyritiferous material said to assay $2 Au; some surface ore from Searchlight claim assayed $8 Au at $20 gold.

Sunday (Sunday Morning Star, Golden Hope) (251)

Loc: S$\frac{1}{2}$SE$\frac{1}{4}$ sec. 7, (36-38E). Elev: 2,000 to 2,300 feet. Deposit: 2 quartz veins 4 to 6 inches wide in argillite and limestone. Dev: 3 adits, one 350 feet long; shaft 150 feet deep; other shallow shafts and open cuts. Assays: Ore

said to av. $25 per ton at $20 gold. Prod: 1912, 1915.

Swamp King (234)

Loc: Sec. 30, (40-37E). Elev: 2,650 feet. Ore min: Free gold, pyrite. Deposit: Quartz vein about 8 inches wide in diabase cut by camptonite dikes. Dev: 60-foot adit and 3 shafts total 200 feet of workings. Prod: Small shipment reported.

Titanic (Valley Dew) (238)

Loc: Sec. 7, (39-37E), Orient dist. Elev: 3,500 feet. Ore min: Pyrite. Deposit: Latite cut by numerous monzonite dikes. Fracture zones in these rocks are mineralized by auriferous pyrite. Dev: 551-foot adit, 540-foot adit, and 400-foot Gettern adit. Assays: One zone said to assay $8 Au at $20 gold. Assay in 1909 reports $18.85 Au, 1 oz. Ag.

Trophy (242)

Loc: Sec. 18, (39-37E), Orient dist. Ore min: Pyrite. Deposit: Latite and interbedded shale cut by monzonite porphyry dikes. Fracture zones mineralized with pyrite carry some gold. Dev: 300 feet of adit and 100 feet of shaft work. Assays: Said to range from tr. to $12 Au at $20 gold.

White Elephant (Kettle River) (232)

Loc: Near center sec. 19, (40-37E), Orient dist. Elev: 2,650 feet. Ore min: Pyrite. Deposit: Mineralized zone in limestone and quartzite cut by fine-grained dikes and quartz veins. Dev: 225-foot shaft; 85-foot crosscut and 110 feet of drifting on 100-foot level; 50 feet of drifting and 50 feet of crosscutting on 200-foot level. Assays: Ore said to av. $7.00 Au at $20 gold.

WHATCOM COUNTY

Allen Basin (15)

Loc: NW¼ sec. 34, (38-17E), Slate Creek dist. Prop: 14 patented claims. Ore min: Free gold, arsenopyrite, pyrite, and some galena and sphalerite. Deposit: At least 2 quartz veins 3 to 30 inches thick cutting sedimentary and igneous rocks. Dev: 2 shafts, a caved adit, and several open cuts. Assays: Average grade of ore is $1.25 to $3.00 Au at $20 gold. All values average $12 to $15 per ton. Prod: Some ore apparently shipped in early 1900's and a few tons in 1938-1940.

Anacortes (14)

Loc: W½ sec. 25, (38-16E), Slate Creek dist. Ore min: Free gold, tellurides, sulfides. Deposit: Quartz vein averaged 2 feet wide in slate and conglomerate. Dev: 310-foot drift, 100-foot drift, 90-foot drift. Assays: Averaged $18 to $20 Au, Ag at $20 gold. Prod: Has produced.

Azurite (25)

Loc: E½ sec. 30, (37-17E), Slate Creek dist. Ore min: Chalcopyrite, sphalerite, pyrite, pyrrhotite, galena. Deposit: A 2- to 7-foot quartz vein cutting through argillite is mineralized in places. Other undeveloped veins are also reported. Ore-producing body has been depleted. Dev. About 3,000 feet of adit work, chiefly on 2 levels. Since 1941 a 125-foot winze was sunk and crosscuts were driven both ways from the winze. Assays: 58,358 tons shipped averaged 0.473 oz. Au. Prod: 1920, 1930, 1934, 3,000 tons in 1936, 27,530 tons in 1937, 36,515 tons in 1938, 5,375 tons in 1939. Produced 1941.

Gross value of production reported $972,000.

Beck and Short Grub (16)

Loc: NE¼ sec. 35, (38-17E), Slate Creek dist. Prop: 2 patented claims. Deposit: Quartz vein 3 to 6 inches wide in slate intruded by porphyry. Assays: 2.75 oz. Au, 51.0 oz. Ag.

Boundary Red Mountain (Red Mountain) (7)

Loc: W½ sec. 3, (40-9E), Mount Baker dist. Prop: 6 patented claims: Klondike, Rocky Draw, Mountain Boy Lode, Glacier, Climax, Climax Ext. No. 1. Ore min: Free gold, pyrite, chalcopyrite, pyrrhotite. Deposit: Finely divided gold in a quartz vein which varies from 6 inches to 7 feet and average 3 feet in width. The vein can be traced for 4,500 feet on the surface. Diorite country rock. Dev: 3,000 feet of drifts equally divided among 3 levels. Ore developed to depth of 433 feet below No. 1 level and 100 feet above. Assays: Mine-run ore averaged $15 at $20 gold. An ore shoot 520 feet long and average 26 inches wide had an average value of 1.13 oz. Au. Prod: 1912-1917, ($148,578 in 1916, $131,918 in 1917), 1920-1922, ($95,000 in 1922), 1925, 1929-1930, 1935, 1936 (200 tons), 1937-1942, 1947.

Evergreen (8)

Loc: NW¼ sec. 21, (40-9E). Elev: 200 feet above Swamp Creek. Ore min: Sphalerite, galena, pyrite, chalcopyrite. Gangue: Quartz, calcite. Deposit: Small ore stringers from 1/8 inch to 8 inches wide in argillite. Pyrite is also disseminated in the argillite. Dev: 2 drifts 40 and 30 feet long. Assays: Ore said to average $17 in all values. Prod: Shipped to Tacoma smelter in 1938.

Gargett (5)

Loc: N½ sec. 9, (40-9E), Mount Baker dist. Elev: 5,000 and 7,000 feet. Ore min: Sphalerite, galena, chalcopyrite, pyrite, malachite, chalcocite, azurite, massicot, pyrrhotite. Deposit: Mineralized quartz vein in limestone and a band of mineralized siliceous limestone in argillite and quartzite. The vein averaged 12 inches in width for a length of 20 feet. Dev: Open cut on upper property and a 2,000-foot adit on the lower property, also a second adit. Assays: A 5-ton test shipment averaged 1.03 oz. Au, 4.34 oz. Ag, 0.78 percent Cu. 8 percent Pb and Zn reported from upper adit. Prod: 5 tons in 1940.

Goat (18)

Loc: SE¼ sec. 4, (37-17E), Slate Creek dist. Elev: 4,800 feet. Ore min: Chalcopyrite, malachite, pyrite, free gold. Deposit: Quartz vein 9 to 18 inches thick in quartzite. Dev: 2 adits with connecting raise. Assays: Select samples of quartz contained 0.52 to 1.14 ounces per ton in gold. Representative vein samples contained only traces of gold. Prod: Minor production around 1900.

Goat Mountain (Blonden) (11)

Loc: NE¼ sec. 28, (40-9E), Mount Baker dist. Ore min: Pyrite, free gold. Deposit: Quartz vein 6 to 12 inches wide, 450 feet long. Dev: Open cuts. Assays: $60 to $70 Au. Prod: Small amounts in 1902 and 1903.

Gold Basin

Loc: Sec. 6, (40-9E), Mount Baker district. Elev: 2,500 to 4,500 feet. Ore min: Free gold. Deposit: Quartz veins in quartz diorite and argillaceous sedimentary rocks. Ore milled in early 1900's consisted of quartz float rich in free gold. Assays: Up to 2 oz. per ton in Au. Prod: $17,000 in gold between 1900 and 1920's.

Golden Arrow (Tacoma) (21)

Loc: NE¼ sec. 34, (38-17E). Ore min: Free gold, galena, sphalerite, pyrite, arsenopyrite. Deposit: 2 veins, one said to average 2 feet thick. One is 3 to 12 inches thick. Dev: Shaft, lower adit about 300 feet long. Assays: Tr. to $34 Au. Prod: 10-ton test shipment netted $60 per ton.

Great Excelsior (Lincoln, President) (4)

Loc: Sec. 6, (39-8E). Elev: 1,400 to 2,500 feet. Ore min: Pyrite, chalcopyrite, arsenopyrite, galena, sphalerite, tellurides, native silver. Gangue: Quartz, dolomite. Deposit: Brecciated greenstone cemented by sulfides. 2 mineralized zones; one is 75 feet wide and said to be all paying ore. Dev: Several adits and a large stope total several hundred feet of workings. Assays: 64 samples showed tr. to 0.08 oz. Au, the average being 0.02 to .03 oz. In some samples Ag averaged 2.0 oz. Prod: 10,000 tons with net return of $20,276 to 1915. 305.095 tons of conc. shipped averaged 1.857 oz. Au per ton.

Indiana (17)

Loc: SW¼ sec. 26, (38-17E), Slate Creek dist. Prop: 4 patented claims: Indiana, Illinois, Ptarmigan, Chancellor. Ore min: Pyrite, arsenopyrite, galena, sphalerite. Deposit: Quartz-calcite veinlets fill fractures along shear zones in quartzite. Zones are 3 to 12 inches wide. Dev: 2 levels 250 feet apart; one is a 225-foot adit and the other is an adit with 650 feet of drifts and crosscuts. Assays: 119.4 tons shipped averaged 0.735 oz. Au, 3.48 oz. Ag. Prod: 1903, 119.4 tons in 1935-1939.

Lone Jack (Mount Baker, Post-Lambert, Brooks-Willis, Boundary Gold) (9)

Loc: Secs. 22 and 23, (40-9E). Elev: 4,000 to 6,000 feet. Prop: 5 patented claims. Ore min: Free gold, gold telluride. Deposit: Quartz vein in schist has an average width of 30 inches and is traceable for 2,500 feet. Values are localized in payshoots. Gold mostly too finely divided to be seen with the naked eye, but many fancy specimens of free gold were taken out. Assays: Average tenor of the ore said to be $15 to $35 Au at $20 gold. Picked samples ran as high as $850 per ton. Prod: About $275,000 prior to 1915. Produced 1915-1918. Total production reported to be 9,463 oz. Au, 1,961 oz. Ag.

Mammoth (19)

Loc: Sec. 35, (38-17E), Slate Creek dist. Elev: 5,500 to 6,500 feet. Prop: 6 patented claims. Ore min: Pyrite, arsenopyrite, galena, sphalerite, free gold, tellurides. Deposit: A 1- to 3-foot quartz vein in argillite and quartzite carries sulfides together with gold and silver. Dev: 3 adits total about 2,250 feet. Assays: The 15,000 tons of ore produced averaged $26.50 per ton at $20 gold. Prod: Reportedly produced 15,000 tons of ore prior to 1900 and 30,000 tons by 1942. Reportedly more than $1,000,000 total prior to 1942.

New Light (Eureka, Bonita, Slate Creek, Monica) (20)

Loc: E½ sec. 27, (38-17E), Slate Creek dist. Elev: 5,500 to 6,600 feet. Ore min: Free gold, pyrite, sylvanite. Deposit: Fracture zone in limy and graphitic argillite contains interlacing quartz veinlets, graphitic shear zones, and breccia zones cemented by quartz and sulfides. Dev: Several thousand feet on 6 levels. Improv: Camp buildings and 100-ton flotation mill (1975). Assays: Early work, $30 to $40 Au at $20 gold, later work 0.2 to 0.4 oz. Au, in 1950 about $12

Au. Prod: 60,000 tons of ore in the 1900's and several tons of good-grade ore in 1940 to 1942. Small amount 1949.

Nooksack (3)

Loc: W½ cor. sec. 36, (40-4E). Elev: 1,200 feet. Access: Trail. Prop: 3 properties: Nooksack, Givens-Nooksack, Land-Nooksack. Ore min: Gold-bearing sulfide. Deposit: Small quartz stringers in andesite. Dev: More than 1,500 feet of underground workings, mostly caved. Assays: 50 channel samples averaged $2 Au at $20 gold. Prod: Probably produced.

North American (23)

Loc: Sec. 11, (37-16E), Slate Creek dist. Prop: 6 patented claims. Ore min: Chalcopyrite, malachite, pyrite. Deposit: Quartz veins in quartzite and granodiorite; veins are 1 to 3 feet thick. Dev: Several short adits. Assays: Select samples showed up to 3.5 ounces per ton in gold. One ore body averaged 0.75 ounce per ton. Main quartz vein contained 0.15 to 0.35 ounce per ton in gold. Prod: Minor production in 1907.

Ruth Mountain Pyrite (13)

Loc: W½ sec. 8, (39-10E), Mount Baker dist. Elev: 2,500 to 6,600 feet. Ore: Gold, iron. Ore min: Pyrite. Deposit: Said to be 4 veins; one on top of the mountain 30 feet wide, one halfway down 15 feet wide, one nearly down 20 feet wide, and one near the river 10 to 15 feet wide. Dev: Short crosscut adit on 15-foot vein. Assays: Reportedly 28 cents to $176 Au.

Saginaw (10)

Loc: W½ sec. 15, (40-9E), Mount Baker dist. Prop: 4 patented claims. Ore min: Chalcopyrite, pyrite, galena. Gangue: Quartz, calcite. Deposit: 2-inch to 3½-foot quartz veins in diorite. Dev: 300-foot adit with 200 feet of crosscuts, 76-foot adit with 31-foot crosscut, two 36-foot adits. Assays: Picked sample gave 70 percent Pb, 0.20 oz. Au, 200 oz. Ag. Others gave 0.34 to 1.82 oz. Au, 0.78 to 2.06 oz. Ag, tr. to 2.13 percent Cu. Average said to be $6 Au, Ag, Cu.

Verona (Galena) (12)

Loc: Sec. 20, (39-9E), Mount Baker dist. Ore min: Pyrite. Deposit: Shear zone in altered volcanic rock contains stringers and lenses of mineralized quartz and calcite. Some stringers as much as 6 inches wide. Dev: 65-foot adit with a 20-foot drift. Improv: Several old cabins. Assays: $10 to $20 per ton reported. One assay showed 0.21 oz. Au, 80 cents Ag, 14.5 percent Pb.

Whistler (24)

Loc: SW¼ sec. 10, (37-17E), Slate Creek dist. Prop: 4 patented claims. Ore min: Sulfides. Deposit: Ore bodies said to be 2 to 6 feet wide. Assays: Reportedly $15 to $20 per ton at $20 gold. One assay reported to show $48 Au, 3.7 percent Cu.

YAKIMA COUNTY

Fife (Bear Gap, Pickhandle, Manitau, Blue Bell) (70)

Loc: Sec. 31, (17-11E). Elev: 5,000 to 6,000 feet. Prop: 2 patented claims: Cold Spring and Silver Reef. Deposit: Small quartz veinlets in volcanic rock. Volcanic rock itself reputedly carries gold values. Assays: 90 channel samples 10 to 20 feet in length over an area 1,200 by 1,800 feet showed an average value of $1.37 Au at $20 gold.

Gold Hill (71)

Loc: S½ sec. 31, (17-11E), Summit dist. Elev: 4,500 to 6,000 feet. Prop: 4 patented claims: Eureka, Climax, Lake Paragon, and Boston. Ore min: Free gold. Deposit: Small quartz veinlets in volcanic rock. Volcanic rock itself reportedly carries gold values. Dev: 2 adits, each about 500 feet long. Assays: Hand samples assayed 75 cents to $1.50 Au at $20 gold.

SELECTED REFERENCES

Arnold, Ralph, 1905, Gold placers of the coast of Washington: U.S. Geological Survey Bulletin 260, p. 154-157.

Averill, C. V., 1946, Placer mining for gold in California: California Division of Mines Bulletin 135, 377 p.

Bartlett, Clare, 1910, The Pacific coast beach sands: Mines and Minerals, v. 30, no. 6, p. 375-376.

Baxter, C. H.; Parks, R. D., 1939, Mine examination and valuation, 2nd edition: Michigan College of Mines and Technology, Houghton, Mich., p. 18-77.

Bethune, G. A., 1891, Mines and minerals of Washington: Washington State Geologist First Annual Report, 122 p.

Blackburn, C. F., 1890, Gold in the Cascades: Mining and Scientific Press, v. 60, p. 412. Continued in v. 61, p. 91.

Boericke, W. F., 1936, Prospecting and operating small gold placers, 2nd edition: John Wiley and Sons, New York, 144 p.

Browne, J. R., 1869, Resources of the Pacific slope: D. Appleton and Company, New York, 678 p.

Butler, G. M., 1935, Some facts about ore deposits: Arizona Bureau of Mines Bulletin 139, 99 p.

Clarke, F. W., 1924, The data of geochemistry, 5th edition: U.S. Geological Survey Bulletin 770, 841 p.

Collier, A. J., 1907, Gold-bearing river sands of northeastern Washington: U.S. Geological Survey Bulletin 315, p. 56-70.

Cooper, C. L., 1940, Mining and milling methods and costs at Knob Hill mine, Republic, Washington: U.S. Bureau of Mines Information Circular 7123, 29 p.

Culver, H. E., 1936, The geology of Washington—Part 1, General features of Washington geology (to accompany the preliminary geologic map [in color], 1936): Washington Division of Geology Bulletin 32, 70 p.

Day, D. T.; Richards, R. H., 1906, Investigation of black sands from placer mines: U.S. Geological Survey Bulletin 285, p. 150-165.

Day, D. T.; Richards, R. H., 1906, Useful minerals in the black sands of the Pacific slope: U.S. Geological Survey Mineral Resources of the United States 1905, p. 1175-1258.

Gardner, E. D.; Allsman, P. T., 1938, Power-shovel and dragline placer mining: U.S. Bureau of Mines Information Circular 7013, 68 p.

Gardner, E. D.; Johnson, C. H., 1934, Placer mining in the western United States—Part 1, General information, hand-shoveling, and ground-sluicing: U.S. Bureau of Mines Information Circular 6786, 73 p.

Gardner, E. D.; Johnson, C. H., 1934, Placer mining in the western United States—Part 2, Hydraulicking, treatment of placer concentrates, and marketing of gold: U.S. Bureau of Mines Information Circular 6787, 89 p.

Gardner, E. D.; Johnson, C. H., 1935, Placer mining in the western United States—Part 3, Dredging and other forms of mechanical handling of gravel, and drift mining: U.S. Bureau of Mines Information Circular 6788, 81 p.

Hill, J. M., 1916, Notes on the fine gold of Snake River, Idaho: U.S. Geological Survey Bulletin 620-L, p. 271-294.

Hodges, L. K., Editor, 1897, Mining in the Pacific Northwest: The Post-Intelligencer, Seattle, Washington, 192 p. Facsimile Reproduction SJS-134 by the Shorey Book Store, Seattle, Washington in 1967.

Huntting, M. T., 1956, Inventory of Washington minerals—Part 2, Metallic minerals: Washington Division of Mines and Geology Bulletin 37, v. 1, 428 p., v. 2, 67 p.

Huntting, M. T.; Bennett, W. A. G.; Livingston, V. E., Jr.; Moen, W. S., 1961, Geologic map of Washington: Washington Division of Mines and Geology, scale 1:500,000.

Ingersoll, G. E., 1932, Hand methods of placer mining and placer mining districts of Washington and Oregon: Washington State College Engineering Experiment Station Bulletin 40, 47 p.

Ingersoll, G. E., 1933, Small scale methods of placer mining and placer mining districts of Washington and Oregon: Washington State College Engineering Experiment Station Bulletin 43, 59 p.

Jackson, C. F.; Hedges, J. H., 1939, Metal-mining practice: U.S. Bureau of Mines Bulletin 419, 512 p.

Jackson, C. F.; Knaebel, J. B., 1934, Sampling and estimation of ore deposits: U.S. Bureau of Mines Bulletin 356, 155 p.

Johnson, F. W.; Jackson, C. F., 1938, Federal placer-mining laws and regulations, and small-scale placer-mining methods: U.S. Bureau of Mines Information Circular 6611-R, 37 p.

Kelly, J. V., 1947, Columbia River magnetite sands, Clatsop County, Oregon, and Pacific County, Washington—Hammond and McGowan deposits: U.S. Bureau of Mines Report of Investigations 4011, 7 p.

McKinstry, H. E., 1948, Mining geology: Prentice-Hall, New York, 680 p.

Masson, D. L., 1953, Small scale placer mining: Washington State Institute of Technology Bulletin 45 M, 64 p.

Mertie, J. B., Jr., 1940, Placer gold in Alaska: Washington Academy of Sciences Journal, v. 30, no. 3, p. 93-124.

Moen, W. S., 1962, Mineral rights and land ownership in Washington: Washington Division of Mines and Geology Information Circular 36, 23 p.

Neff, J. L.; Magnuson, R. L., 1974, Mining laws of the State of Washington: Washington Division of Geology and Earth Resources Bulletin 67, 109 p.

Pardee, J. T., 1929, Platinum and black sand in Washington: U.S. Geological Survey Bulletin 805-A, p. 1-15.

Peele, Robert, 1941, Mining engineers' handbook, 3rd edition, 2 v.: John Wiley and Sons, New York, 2442 p.

Rankama, Kalervo; Sahama, T. G., 1950, Geochemistry: University of Chicago Press, 912 p.

Rickard, T. A., 1907, Sampling and estimation of ore in a mine: Hill Publishing Company, New York.

Sahinen, U. M.; and others, 1964, Handbook for small mining enterprises in Montana: Montana Bureau of Mines and Geology Bulletin 39, 220 p.

Savage, E. M., 1934, Prospecting for gold and silver: McGraw-Hill Book Company, New York, 307 p.

Sharwood, W. J.; von Bernewitz, M. W., 1922, Bibliography of literature on sampling: U.S. Bureau of Mines Report of Investigations 2336, 85 p.

Soderberg, R. L., 1948, Mining methods of the Holden mine, Howe Sound Company, Chelan Division, Holden, Washington: U.S. Bureau of Mines Information Circular 7448, 27 p.

Staley, W. W., 1961, Prospecting and developing a small mine: Idaho Bureau of Mines and Geology Bulletin 20, 106 p.

Stevens, I. I., 1860, Reports of explorations and surveys to ascertain the most practicable and economical route for a railroad from the Mississippi River to the Pacific Ocean, made ... in 1853-4: U.S. Pacific Railroad Explorations, v. 12, Book 1.

Taggart, A. F., 1945, Handbook of mineral dressing: John Wiley and Sons, New York, 1905 p.

Trimble, W. J., 1914, The mining advance into the Inland Empire: University of Wisconsin Bulletin No. 638, 254 p.

von Bernewitz, M. W., 1943, Handbook for prospectors and operators of small mines, 4th edition: McGraw-Hill Book Company, New York, 547 p.

Wells, J. H., 1969, Placer examination, principles and practice: U.S. Bureau of Land Management Technical Bulletin 4, 209 p.

West, J. M., 1971, How to mine and prospect for placer gold: U.S. Bureau of Mines Information Circular 8517, 43 p.

West, J. M., 1974, Gold: U.S. Bureau of Mines Minerals Yearbook 1972, v. 1, p. 567-588.

PROPERTY INDEX

PROPERTY INDEX

PROPERTY INDEX

PROPERTY INDEX

PROPERTY INDEX

PROPERTY INDEX