STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
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OREGON'S GOLD PLACERS

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FOREWORD

To answer many requests received by the Department for information on location of gold placers and placer mining in Oregon, the staff has compiled the accompanying paper. Material contained is mainly from The Ore.-Bin, but a portion of U.S. Geological Survey Circular No. 6, "Beach Placers of the Oregon Coast," by J. T. Pardee, is included to cover the subject of gold placers on present beaches and ancient elevated beach terraces.

A large proportion of inquiries received are from people who have had little or no experience in mining but who wish to learn, and at the same time get some recreation. In an article of this kind only the barest outline of placer mining technique can be given. The Department does not have detailed information on which recommendations may be made concerning the location of profitable placers.

F. W. Libbey
Director

May 11, 1954

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OREGON'S GOLD PLACERS

History

The discovery of gold in the rich placers of the Sacramento Valley of California in 1848 profoundly affected the course of events in western United States. The first direct effect was the rapid spread of gold prospecting into Oregon, Washington, Idaho, Montana, and British Columbia.

Gold was found in the sands of the Rogue River in 1849 by men on their way to California gold fields; but the discovery was overshadowed by the excitement in California and, too, the low concentration of the Rogue River gold, where first found, was probably somewhat discouraging.

In 1851 prospectors from California came into Oregon and discovered rich placers on Jackson Creek. This discovery resulted in the founding of Jacksonville and was the beginning of the mining industry of the State. Reports of the rich Jackson Creek placers brought in a large number of prospectors from California. In fairly rapid succession gold discoveries were made on many of the tributaries of the Rogue River, notably the upper Illinois and the Applegate. Soon thereafter, in 1853, gold was found in fairly heavy concentrations on the beaches near Bandon and at Gold Beach.

There is no official record of production for the first ten years of mining in the State, nearly all of which was in southwestern Oregon.* The value undoubtedly amounted to many millions of dollars, probably fifty millions or more.

In 1861 rich gold concentrations were found in Griffin Gulch, west of the present city of Baker. A rush occurred and the productive areas spread out to Auburn, Canyon City, upper Powder River, upper Burnt River, and to some of the high bars or terraces above Willow Creek.

As in all gold placer mining areas, activities in Oregon began with mining of the easily accessible placers by hand methods. These were followed by large-scale methods, at first using hydraulic giants and later, where conditions allowed, dredges. Application of the dragline dredge was something of an innovation and grew out of developments in seeking cheap methods of earth moving.

When the United States Government advanced the price of gold in the early 1930's, there was a great increase in gold mining activities throughout the West. In Oregon this increase was mainly noticeable because of a large number of dragline dredges which came into the State. The principal areas affected were the Sumpter Valley area in western Baker County, the John Day Valley, the North Fork and Middle Fork of the John Day in Grant County, and tributaries of the Rogue River in Josephine and Jackson counties. The high point in production came in 1940 when a total of 56 dredges, including dry land equipment, worked in the State. In addition there were 82 hydraulic mines, 10 drift mines, and 44 hand-operated properties, making a total of 192 producing placers. Gold production from placers during 1940 amounted to 71,577 ounces, valued at $2,505,000.

The death blow to gold mining came in 1942 when, in October, War Production Board Order L-208 was put into effect. Gold mines were shut down without recourse and remained closed until July 1, 1945, when L-208 was somewhat tardily rescinded. Since that time a few dredges and hydraulic operators have resumed work - a very

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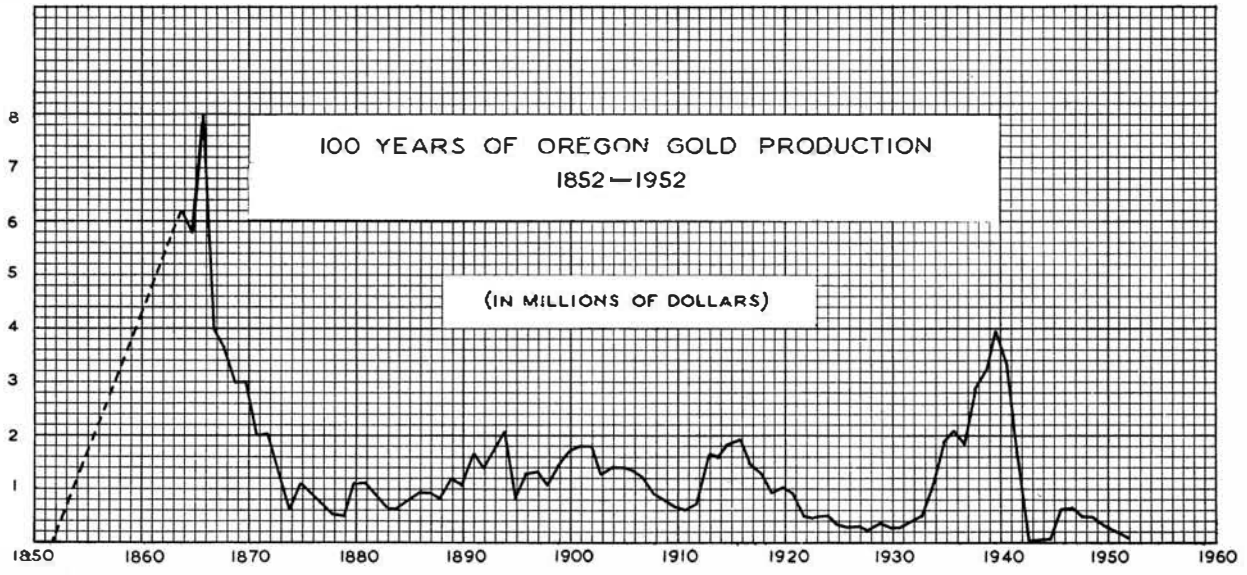
*According to articles and news items in the Oregonian during the early 1850's, prospecting at that time was being done with some success on the Malheur, John Day, and Burnt rivers, but trouble with Indians and the richer discoveries in Washington and Idaho held Oregon prospecting back until the rich discoveries were made at Griffin Gulch near Baker.



bare skeleton of the pre-war industry. In early June 1948 there were five producing dredges, and during the season when water was available there were sixteen hydraulic operations. A small number of "snipers" have worked sporadically during the year. High costs of exploration and operation, together with the fixed price of gold, are effective in throttling gold mining, both lode and placer.

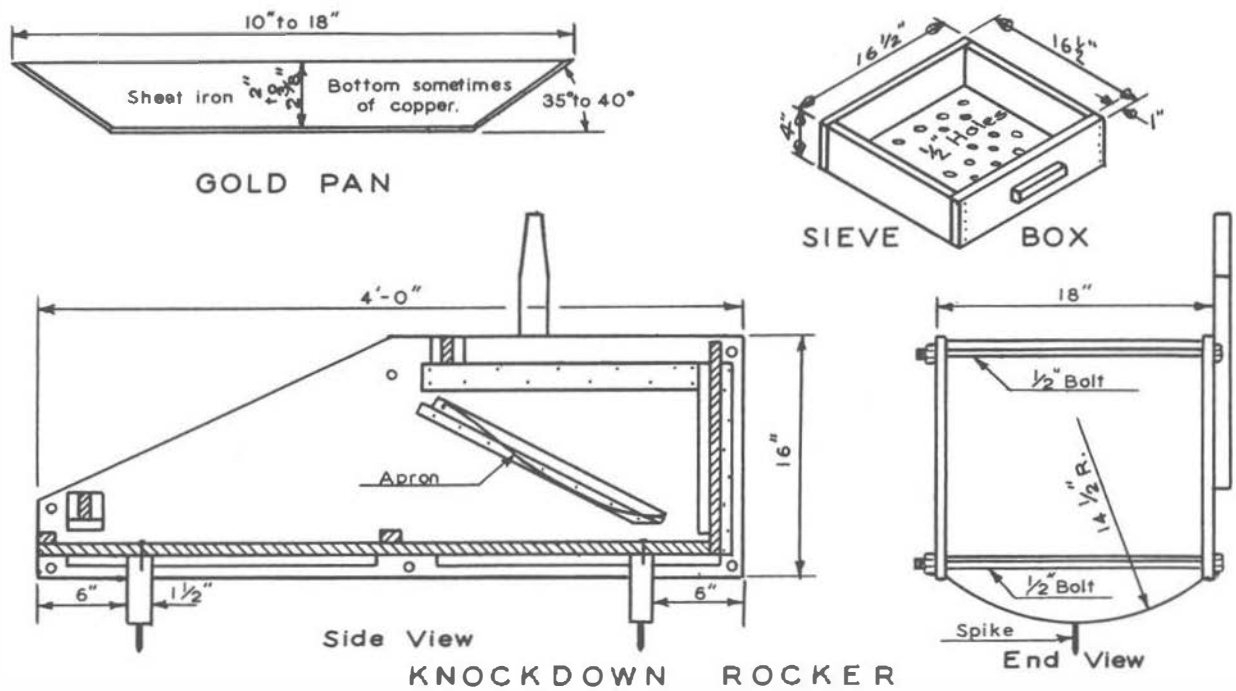
Placer activities

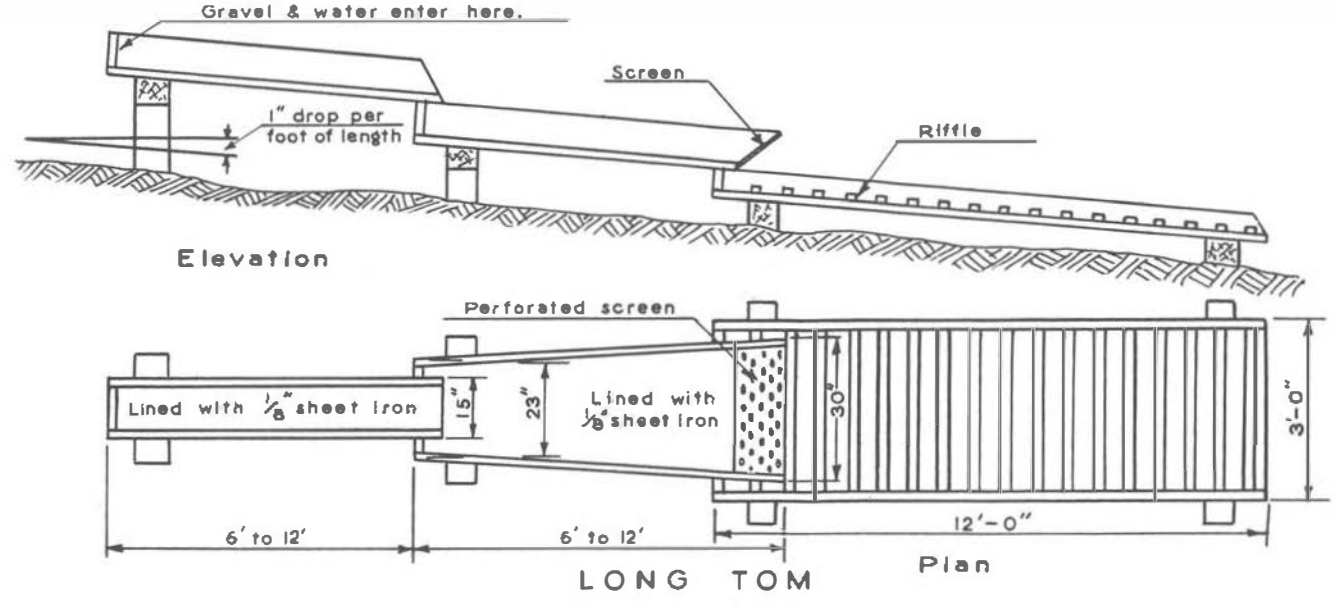
During 1941 a total of 49 gold dredges of all types operated in the northeastern and southwestern parts of the State. In 1948 only seven gold dredges were operating in the State and not all continuously. Only one dredge operated by the Powder River Dredging Company in Sumpter Valley was active in 1954.

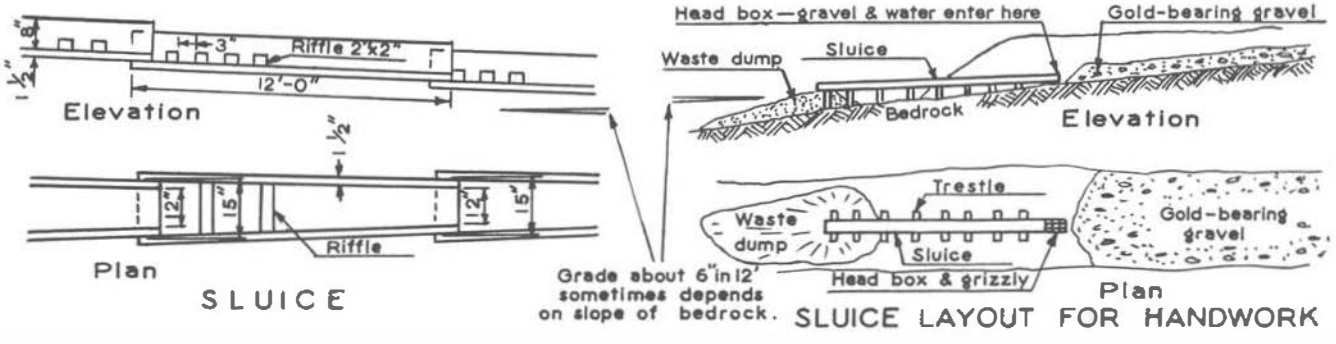
Hydraulic mining activities are centered principally in southwestern Oregon. Hydraulicking is used on gravel banks which are so situated that gravels may be broken up by water under pressure from nozzles, washed down, and carried beyond the pit, usually through sluices. The method is cheap but, of course, water under a high head is required. The efficiency of a hydraulic operation depends upon the amount and head of the water available and ease of tailings disposal.

Ground sluicing is a method of excavating placer gravels by flowing water, and, when plenty of water is available, it is a cheap method of washing gravel away leaving the gold behind. Various adaptations may be used depending upon the conditions of gravel bank and amount and fall of water. Essentially, in ground sluicing a stream "is diverted to flow against or over a bank of placer ground, eroding it and washing it to and through box sluices."*

*U.S. Bur. Mines Inf. Circ. 6611R, 1938, Small-scale placer mining methods, by C. F. Jackson.







SMALL SCALE PLACER MINING APPARATUS
(Taken from U.S.B.M. I.C. 6611R)

D. I. B.

Placer areas

The accompanying maps of northeastern and southwestern Oregon show the generalized locations of known placer deposits. Many of these areas which have been dredged would offer little likelihood of finding commercial gravels. However, some potential gold placer areas have not been worked, and many of the hydraulic operations contain fairly good reserves. Since these operations are limited, both by water supply and by regulations of the Rogue River Coordination Board, the reserves will last for a long time. There is, too, the probability that at some time in the not too distant future the price of gold will be raised substantially. This will increase the reserves of the hydraulic gravels as well as bring into the commercial picture some low-grade gravels which may be worth dredging.

It should be emphasized that no placer areas have been tested by the Department and no recommendations can be made.

Beach placers of the Oregon coast*

"Beach placers along the Oregon coast were richly productive for a time after their discovery in 1852 and have since yielded small amounts of gold and platinum annually. Renewed interest in them was caused by the industrial depression that followed 1929.

"The generally mountainous Oregon coast is bordered in places by coastal plains that range from a quarter of a mile to 4 miles in width and are mostly less than 100 feet high. The plains are of two different geomorphic types. One consists of lowlands composed of bay-mouth bars or barrier beaches and the filled embayments behind them; the other is a group of slightly elevated marine terraces.

"In addition to these terraces a remarkable series of marine benches, the results of a Pleistocene submergence described by Diller (1902), appear at intervals between sea level and an altitude of 1,500 feet.

"The original irregular outline of a submerged land surface has been straightened and simplified into the present shore by the action of the waves in cutting back headlands and building bars across embayed areas. Stretches that have retreated, however, show small-scale irregularities due to differences in the resistance of the rocks.

"Around many of the capes and headlands the wave-cut bench is generally swept bare of debris by the waves, and stretches that are nearly always devoid of any noteworthy beach deposit aggregate about 50 miles in length. On the other hand, reentrants in the retreating shores are generally bordered by transitory beaches 50 to 200 feet or more wide, and such stretches aggregate about 100 miles in length. Along certain other stretches the retreat has ceased for the time being, and the shore has readvanced by wave-added beach material constituting a backshore deposit. Such retrograded and prograded shores aggregate 12 miles or more in length, and the maximum advance has been 1,000 feet.

"Along the remainder of the Oregon coast the shore has advanced a quarter of a mile to 2 miles or more from its original position as the result of wave-built barrier beaches, bay-mouth bars, and spits. All of the prograded stretches are characterized by a simple shore line and a voluminous beach deposit.

"The distribution and height of the islands, the character and profile of the submarine bench and other features shown by the charts of the Coast and Geodetic Survey indicate a shore recession ranging from a quarter of a mile to 4 miles and averaging at least a mile. The prograded shores have advanced as much as 3 or 4 miles in places, but the net result of the shore movements is apparently a loss of land area.

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*Pardee 1934 (see list of references).

"The different terraces are capped with Pleistocene marine sediments, the largest area of which is between Port Orford and Cape Arago and is related to an ancient shore line at an altitude of 170 feet. Beds formed offshore compose a terrace plain about South Slough that is somewhat lower, and there are remnants of beaches in some of the other terraces.

"The placer deposits are wave-concentrated layers in the beaches and offshore beds and are generally called black sands for the reason that they are composed largely of magnetite, chromite, and other heavy minerals, most of which are dark colored. Commonly these layers contain small particles of gold and platinum, and in places the metallic particles are abundant enough to be extracted profitably. In the beaches that are retreating under wave attack the deposits are variable and inconstant, but certain beaches are likely to be richer or more often workable than others. The backshore of the present beach and the ancient beach at an altitude of about 170 feet have been the most productive. The pay streak generally ranges from a few feet to 200 or 300 feet in width, is 3 or 4 feet thick in the middle, and tapers toward the edges. It consists largely of alternating layers of black and gray sand with more or less cobbles, boulders, and driftwood and, in the ancient beach, is mostly covered with a barren sand 'overburden' 20 to 60 feet thick.

"The immediate sources of the beach minerals, including gold and platinum, are the shores that are being cut back by the waves. Most of the gold-bearing beaches are south of Coos Bay, along the coast opposite the Klamath Mountain region, described by Diller (1902), which contains several areas of gold-bearing lodes. The lodes of the interior were the ultimate sources of the gold from which it has been carried seaward at intervals since middle Tertiary time. As a result of stream sorting only the finer particles reached the coast. No definite source of the platinum has been found, but its distribution and its association with chromite suggest the abundant serpentinous and other basic intrusives of the region. However, no relation of the platinum and chromite of the beaches to any particular rock mass could be made out.

"Owing to the transitory character of the foreshores of the present beach no definite estimate of reserves can be made, but it is concluded that deposits suitable for small-scale operators will continue to form here and there along certain parts of the coast. Ordinarily these deposits may be expected, under the working conditions possible, to yield from a few cents to $2 a day per man (with gold reckoned at $20* an ounce). In places the backshore contains noteworthy amounts of gold and platinum, but in the decade immediately preceding 1932 attempts to mine the deposits apparently met with no success, and no basis for an estimate of their value exists.

"Parts of the ancient beach at 170 feet above sea level remaining between stream valleys aggregate 8 or 10 miles in length and contain pay streaks 50 to 300 feet wide and a few inches to several feet thick. These pay streaks are generally covered with 20 to 60 feet of barren sand, and in most places their richer parts have been mined. How much of the remainder can be profitably worked under given conditions remains to be determined by prospecting. Black sand layers occur also in ancient offshore beds and in places, at least, contain a little gold and platinum. The 'black sand' beds may be regarded as a possible future reserve of chromite and other minerals in case of emergency."

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*Price since February 1, 1934, $35.00.

River-terrace placers

Some of the high bars or perched river-terraces in eastern and southwestern Oregon appear to offer interesting possibilities for gold placer mining, provided that operators are experienced. Such operations will need to have water brought to them, or, in some places, it may be feasible to screen the gravel and haul the fines to water. Such projects should receive thorough investigation before money is spent on a plant.

It may be mentioned also that platinum metals occur with the gold in some places on the southern Oregon coast as well as in inland placers. Under present prices for platinum metals such occurrences would materially influence the gross values in the sands and gravels.

Summary

The attraction of gold hunting and gold finding will never diminish as long as there are prospectors or persons with the prospector's urge. However, without systematic exploration there is no hope of a real gold-mining industry, and under present economic conditions there is no incentive to carry on gold mining exploration, either lode or placer.

Oregon's placer mining industry is nearly 100 years old and has been worth to the State upwards of $100,000,000 in value of production. That as much or greater gold value remains in Oregon's placer gravels can hardly be doubted, but how much of the remaining gold may be won at a profit is highly problematical.

There are a few gold-bearing alluvials which are overlain by good cropland; there are other areas which are privately owned by people who know very little about, and are not interested in, placer mining; still other gold-bearing gravels might have physical conditions such as large boulders or too much clay or too much overburden, all or any of which might prevent profitable operation. It is probably needless to state that no project involving capital expenditure should be undertaken without thorough investigation.

For the new small-scale operator, the prospector, "sniper," "pocket" hunter, or amateur gold hunter, the placer areas available would be generally included in the following classifications:

1. Unreserved and "open" public domain. Such areas may be located under the placer mining laws. No single agency would be able to give complete information on areas which may be "open." Anyone seeking an area which may be located should first find out from the nearest district U.S. Land Office the extent and location of the unreserved public land. In order to find out if a particular section of this land is open for location, he should search on the ground and in the county recorder's office for evidence of prior location or abandonment. He should of course familiarize himself with Federal and State mining laws covering location and assessment work.*

2. State land. The State Land Board has control of such land. The location and extent may be determined from Land Board records at Salem or from the records of the County Assessor. A mining lease may be negotiated with the Land Board.

3. Privately owned land. In order to prospect or work such land it is necessary to make arrangements with the owner of the land.

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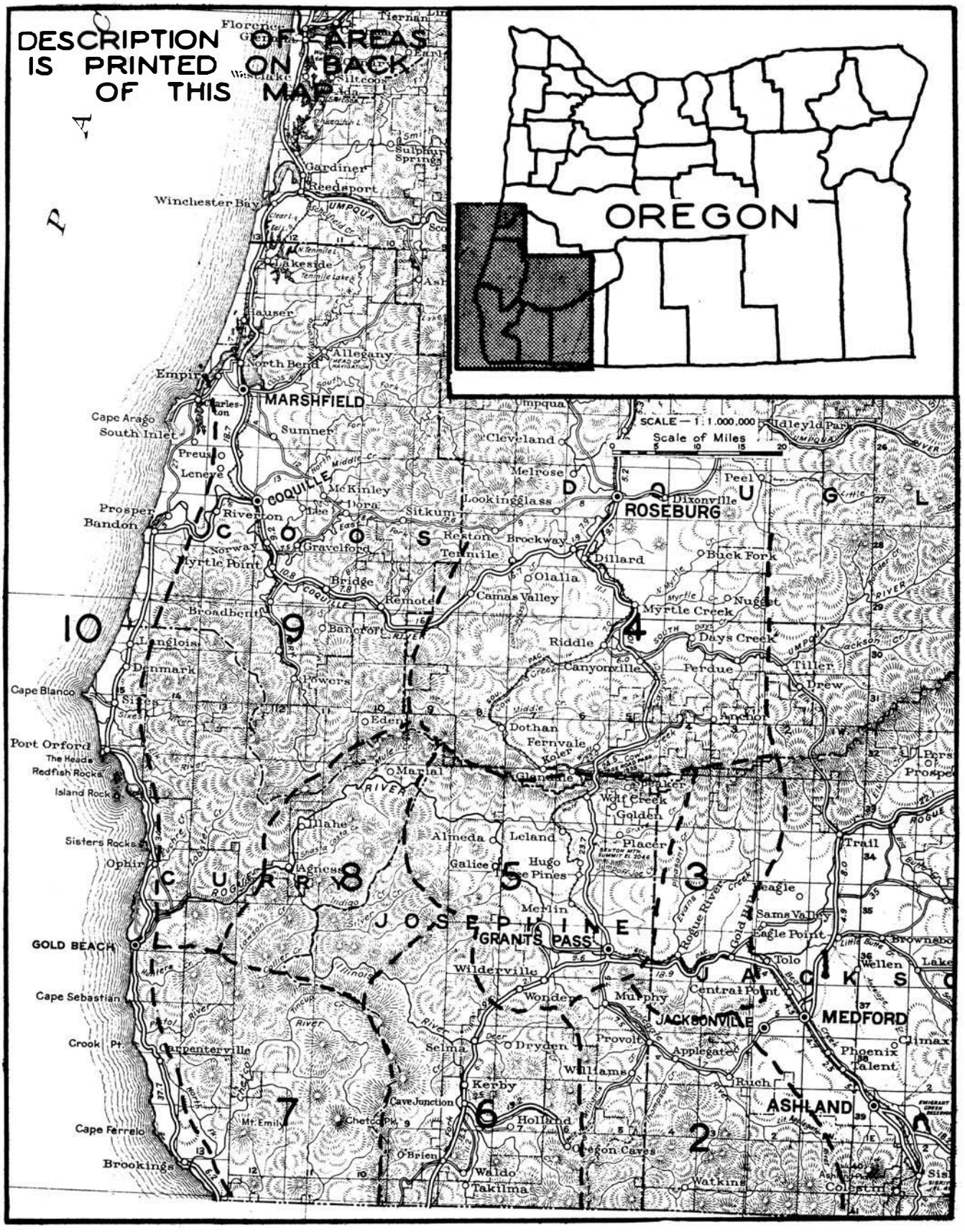
*Mining laws of the State of Oregon: Oregon Dept. Geology and Min. Industries Bull. 1.



PLACER MINING AREAS OF SOUTHWESTERN OREGON

Description of Southwestern Placer Mining Areas

1.* Jacksonville - Talent area: Placer mining has been limited to Bear Creek and its tributaries draining the Siskiyou Mountains. It was the strike in this area on Rich Gulch, a tributary of Jackson Creek, in 1851 that first attracted the many prospectors to southwestern Oregon. The first placers worked were usually of the gulch type. One of the first dredges in Oregon was near Tolo in 1898; in later years small dredges operated on Jackson Creek and in parts of Bear Creek Valley in and near Jacksonville. The auriferous gravels at the base of the Cretaceous sediments, found in the foothills of the Siskiyou Mountains, have been placered sporadically.

2. Applegate drainage: Many of the tributaries of the Applegate River have been placered at one time or another. All main placer mining methods have been used, and in some areas, mainly along the Applegate River and Forest Creek and its tributaries, the more modern methods have had profitable operations after older methods had reached their economic limit. The hydraulic operations of the Sterling Mine and the dredging operations on Forest Creek are typical. All types of placer deposits occur.

3. Evans Creek - Rogue River area: Parts of nearly all of the tributaries of the Rogue River south of Gold Hill have run the gamut of placer mining operations. Dredges have worked on Kane, Foots, and Pleasant creeks, and in the Rogue River. Evans Creek has long provided sites for placer operations but most of the work has been confined to the area from Sykes Creek to its junction with the Rogue. The "old channels" west of Wimer, although the scene of activity in early times, have not been worked for many years.

4. Umpqua drainage: Very little work has been done in this area in comparison to that in the areas of Nos. 2, 3, and 5. Cow Creek and "high channels" adjacent to it have received the most attention. The Victory Mine near Glendale is a typical operation. Other areas that have reported some production are on Olalla Creek, tributaries of Myrtle and North Myrtle creeks, and tributaries of the South Umpqua between Days Creek and Tiller.

5. Grants Pass - Wolf Creek area: Grave Creek and its tributaries Wolf and Coyote creeks, Jumpoff Joe, Taylor, and Galice creeks have been the most consistent producers in recent years. At one time or another, however, work of some type has been done on portions of practically every stream in the area. Dredges have worked on Grave Creek and in the Rogue River. "Old channel" deposits are found in many places and are scenes of periodic activity.

6. Upper Illinois area: The Esterly Mine in this area is one of the famous old mines of Oregon. Hero gold and platinum are found in both the Tertiary and Quaternary gravels, with most of the production from the latter. Mining has also been done on Sucker, Althouse, Josephine, and Briggs creeks ever since gold was discovered in Jacksonville. All types of mining have been utilized, from the crudest methods to large dragline dredges, and gold has been found in all classes of deposits, from Crotaceous gravels to Recent stream channels.

7. Chetco drainage: Very little recent work has been done in this area. It is quite possible that its inaccessibility has much to do with this. The work that has been done has been mainly in Quaternary stream channels or high on the hillsides, such as in Gold Basin. There has been no dredging in this area. Most of the work has been limited to ground sluicing.

8. Lower Illinois - Rogue River area: Most of the mining has been confined to gravel bars and "high channels" bordering the two rivers. Some hydraulicking and ground sluicing have been done on Silver, Collier, and Mule creeks, but the operations were usually small.

9. Coquille - Sixes - Lower Rogue area: Only minor production has been reported from this area. Streams on which most of the past work has been done are Boulder Creek and the Rogue River; Rook, Johnson, and Salmon creeks of the South Fork of the Coquille River drainage; Elk River and Sixes River. Work has been confined to hydraulicking and ground sluicing in present-day stream channels.

10. Coast area: Beach placers include both present beaches and elevated marine terraces. Rich sands were found at Gold Beach and Bandon in 1852, and beaches have been prospected and worked for gold and platinum as far north as Cape Arago. In former years, several operations on the elevated terraces were attempted, including the Eagle and Pioneer mines, north of Bandon, and the Madden Mine, north of Sixes.

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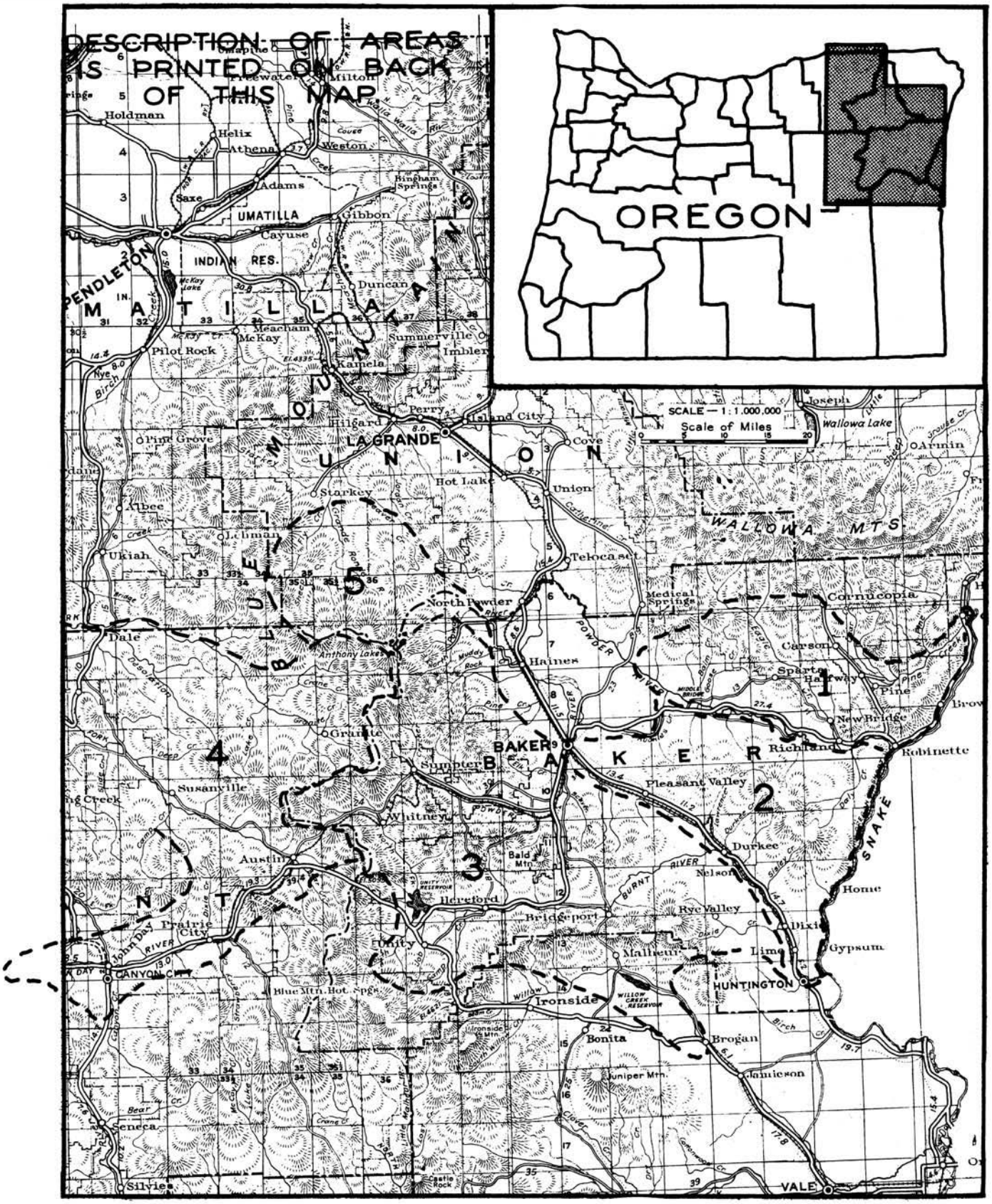
*Numbers refer to areas shown on map opposite page 6.



PLACER MINING AREAS IN NORTHEASTERN OREGON

Description of Northeastern Placer Mining Areas

1.* (Covered by this area are the Cornucopia, Eagle Creek, Homestead, and parts of the Sparta-Sheep Mountain mining districts.) Eagle Creek provides the principal drainage within the area. Placers include the well known old Shanghai and other old time placer diggings in the Sparta district and in the old Hogem (Sanger) camp. Gulch and bar gravels have been worked on Eagle Creek and on some of its smaller tributaries as well as on other creeks in the area. The New York Bar on Eagle Creek and Pine Creek Valley below the Cornucopia lode mine are examples. Remnants of gold-bearing high channels reportedly exist in the dry hills extending generally eastward from Sparta. Powder River, which is taken as the southern boundary of this area, has supported a limited amount of placering almost exclusively in the vicinity of the Macy Mine.

2. (Included in this area are the Conner Creek and Virtue and portions of the Baker, Lower Burnt River and Sparta-Sheep Mountain mining districts.) The area is bounded for the most part by the Burnt, Powder, and Snake rivers, but contains within its bounds no single large distinctive drainage system. For the most part, the creeks that do exist radiate from the Lookout Mountains. The most notable placer was that on Conner Creek. Fairly extensive, but less notable placering operations have been conducted in various gulches on Little Lookout Mountain. Smaller, widely scattered operations have existed around Pleasant Valley and as far north as Virtue Flat where placering was done in the early days in the vicinity of the surface exposures of the Virtue and White Swan veins. A series of bars, both river level and elevated, exist at various places along the Snake River, and have long been the object of attention by "snipers." The Powder River has already been mentioned in the discussion of area 1. Burnt River, which from Durkee to Huntington is taken as the southwestern boundary of this area, has never proved of much interest to placer operators.

3. Two major drainages and several mining districts are included in this area. (The mining districts are the Cracker Creek, Greenhorn, Morman Basin, Rich Creek, Sumpter, Upper Burnt River and portions of the Baker and Lower Burnt River districts.) The drainages are the Powder and Burnt rivers. The headwaters of these drainages, around Whitney and the Sumpter Valley, are characterized by rather extensive placers of the valley-fill type. Gold values are found on down both of these rivers, but in progressively decreasing quantity with locally valuable concentrations dependent largely on contributions from tributary streams. Many such streams are tributary to both rivers. In the case of Powder River, the celebrated Auburn placer is an example. Similar gulches draining the mountains on the north side of the river have been found to contain gold-bearing gravels from Baker to Sumpter. This does not appear to be the case in the creeks draining in to the Powder River from the south. The placer on Stices Gulch is a notable exception. As in the case of the Powder River, only limited and sporadic attempts have been made to work the lower reaches of Burnt River. Tributary streams such as Clarks Creek, which drains from the Morman Basin district and Pine and Cow creeks which drain to the south from Dooley Mountain, have all sustained productive operations. Other placers, not directly connected with these major drainages, occur in Morman Basin and Rye Valley, and on the drainage basin of Willow Creek in Malheur County. Also, various creeks draining into Baker Valley from the Elkhorn Mountains have been worked. Throughout the area small-scale operations of a seasonal kind are carried on regularly by utilizing snow waters.

4. (This area embraces parts of the Canyon, Granite, Greenhorn, Middle Fork, North Fork, Quartzburg, and Susanville mining districts.) Included in the area are the John Day River and the headwaters of the Middle and North forks of the John Day with all their tributary streams. The placers here are predominantly of the river and gulch type although some Tertiary placer exists, such as that represented by the French diggings. No western boundary can be given to this area with the information that is available. Gold is known to extend considerable distances down these drainages to the westward, but evidence concerning the limit of economic concentrations is lacking.

5. This area covers the headwaters of the Grande Ronde River in Union County. The Camp Carson placers probably represent Tertiary deposition; otherwise the placers worked in the past have been predominantly of the gulch type of Recent age.

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*Numbers refer to areas shown on map opposite page 8.

Is It Gold?

Physical properties of Gold
Specific gravity - 15-19
Hardness - 2.5-3.0, malleable, ductile
Color - Pale to silvery yellow
Streak - Pale yellow
Luster - Metallic
Cleavage - None
Fracture - Hackly
Melting point - 1100° C.
Crystal system - Isometric; crystals rare

The positive identification of placer gold is of prime importance to any prospector or miner. All too often worthless minerals are mistaken for gold when a few simple tests, which can be made in the field, would quickly remove any doubt. Gold is a heavy mineral and will "hang back" in a gold pan. Much so-called "gold" that is lost in panning is in reality flakes of mica. It is true, however, that extremely fine gold tends to float on the surface of the water, particularly if any oil or grease is present, and may be lost over the lip of the pan.

Gold is very soft and can be cut or flattened easily with a knife. A fragment of gold rubbed over a streak plate leaves a golden streak. Pyrite is brittle, leaves a greenish-black streak, and gives off sulphur fumes when heated. Gold has a metallic luster and is commonly golden in color, inclining to silver white if alloyed with silver. It should be noted that placer gold commonly does not shine like jewelers' gold which is refined and highly polished. The surface of placer gold is nearly always roughened or pitted by abrasion in the stream due to its softness. This explains why mica and particularly pyrite crystals, which have shiny surfaces, are so often mistaken for gold. A further test for gold is to try dissolving the specimen in nitric acid. Gold is completely insoluble while sulphides such as pyrite and chalcopyrite are attacked.

Placer gold occurs in a variety of shapes, the coarser particles indicating closer proximity to the original source while the particles become progressively finer the farther they are transported. Rolled, curved, or flattened grains, angular or subrounded pieces, plates, scales, and tiny specks of "flour gold" are common forms of placer gold. Very coarse gold may be spongelike, irregular masses, sharp-edged crystals, or a mass of tiny, intertwined wires. Gold particles large enough to be retained on a 10-mesh screen may qualify as nuggets. Some placer gold is coated with iron oxide, which tends to conceal its true identity, and makes recovery by amalgamation difficult.

The purity of gold is usually expressed in fineness. Pure gold is 1000 fine, and is called "fine gold." A fineness of 900 indicates that 900 parts are pure gold and 100 are of some impurity such as silver.

Assay certificates generally report the amount of fine gold in a sample as troy ounces per ton. A troy ounce of fine gold is theoretically worth $35.00. Actually the United States mints discount this figure one-quarter of one percent, and pay $34.9125. Gold buyers pay substantially less than this figure since they usually buy unrefined placer gold containing unknown amounts of silver. Troy ounces can be calculated from avoirdupois ounces by multiplying the avoirdupois ounces by 91.1458 percent.

R.S.M.

Prospecting With a Gold Pan

By

A. O. Bartell*

Do you know that valuable clues to the geology and mineralization of a district can be found in a handful of sand from a stream bed draining the area? This handful of sand has a story to tell to those who have a little patience.

A story to tell

The handful of sand may contain tiny specks of valuable minerals (gold, scheelite, cinnabar, chromite, tourmaline - to mention a few), that will lure you upstream with the hope of uncovering a new deposit. More practically, this handful of sand can indicate the type of rocks that are exposed by the drainage system. Any mineral that has a specific gravity of 3.5 or higher can be separated from soil by panning. Garnet and pyrite, for example (some tiny but perfect textbook-picture crystals may be seen with your hand lens), can indicate an outcrop of metamorphic rocks. In one district where the writer prospected, small boat-shaped orthorhombic crystals of topaz always indicated the presence of andesite outcrops.

How do you read the story the handful of sand has to tell? By panning - yes, by panning, just as the old-time prospector does. The old prospector will tell you sagely that it takes years of experience and a good "wrist" to pan. Don't let him kid you! You don't have to be an expert to read the story in the handful of sand. Panning is a simple process of shaking the heavy particles to the bottom of the pan and washing the lighter particles off the top. It is that simple! The separation achieved by panning is the result of two processes - sizing and gravity concentration. You can put some dry sand and gravel in a fruit jar, gently shake it back and forth, and in a short while you will see that the mixture has sorted itself with the fine sand on the bottom and the coarse gravel on top - you have sized it. Now if you scrape off the gravel, take the sand alone and continue the gentle shaking, you gradually settle the heavy grains (magnetite, etc.) to the bottom of the jar and the lighter grains (quartz, feldspar, etc.) will be displaced and rise to the top - you have concentrated the heavy minerals. Water speeds up the operations by acting as a lubricant and as a medium that makes a greater relative difference in the specific gravity of the various minerals.

The recipe for panning

Fill your pan with the material to be examined. Submerge it in water and knead it with your fingers to break up the lumps of clay. Now agitate the pan (still under water) in a brisk back-and-forth-rotary motion to cause the coarser gravel to rise to the top where you rake it off with your fingers. Size it in this manner several times. Now, more gently, agitate the pan in the water with the same rotary motion but tilt it forward to cause the heavy minerals on the bottom to concentrate in the sharp bend made by the side and the bottom. Next, with the pan tilted forward and with the lip just below the surface of the water, dip the pan in a forward-upward-and-back motion so that the water washes off the lighter upper layer of sand. You can assist this operation by sweeping off the top sand with the back of your fingers. Alternate the rotary agitation with the washing action until only the heavier minerals remain. In the final washing, use your thumb to scrape away the lighter sands that wash away from the heavy minerals. Put in a small amount of clear water and give your pan a light, quick swirl to cause the concentrates to "tail" out so that you can examine them easily with your hand lens. It does take practice and skill to be able to pan quickly and accurately, but proper interpretation of the results is more important than expert manipulation of the pan itself.

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Where to pan

The first and most important step in prospecting with a pan is to select a good sample. In panning streams, one must remember that Nature is roughly sizing and concentrating the rocks and sands that she has eroded from the hills. In fast water the sands will be swept along and, if they do not drop in the little eddies behind the boulders, they will be carried downstream to rest as a bar where the water is quiet. The heavy sands - the ones you are interested in - will drop first. They will be ones that are more likely to be caught behind the boulders and the ones that will be found at the upstream end of the bars along with the pebbles. In the summer when the streams are dry, it is very easy to select your sample, but when the stream is running bank-full, about all you can do is dig out the sands between the boulders along the bank. The heavy mineral sands tend to work towards bedrock in the stream. However, where the stream exposes patches of relatively smooth bedrock, don't expect to find rich pannings in the potholes and bedrock crevices. During high water, when there is the greatest movement and sorting of material, the bottom velocity of the stream will be greater on bedrock where there is no boulder-covered floor to impede its flow; the cobbles will be churning round and round in the potholes; there will be no chance for the sands to come to rest. An exception would be a pothole that had become "dead" by being choked with boulders - in this case the sands between the boulders should give an excellent sample.

In panning the dry washes in an arid country, it is a simple matter to get a good sample if you remember that desert gullies are usually formed under cloudburst conditions. Right after the worst of the storm, when the gullies are running bank-full, the boulders and cobbles will be moving. As the main force of the water passes, the boulders will become quiet and serve to catch the coarse sands and pebbles. When the rush of flood subsides, the silt will drop out. To select a good sample, you must dig down below this silt and fill your pan with the sands lodged between the boulders in the center of the wash.

Other places to select a sample for panning are: Iron-stained outcrops, clay-gouge areas in regions where there has been considerable faulting or magmatic intrusions, and old mining dumps. In samples panned from mining dumps, you can find valuable clues as to the character of the mineralization in the district. Also, there may be minor minerals in tailing piles that were of no value to the old operation but which, due to new techniques or uses developed, may now have sufficient value to make reworking of the dump profitable.

Prospecting tools

The common miner's pan (the one you see in the pictures of the grizzled prospector and his burro) is approximately $2\frac{1}{2}$ inches deep, has flaring sides, and varies from 10 to 16 inches in the largest diameter. A 10-inch tin frying pan with the handle cut off makes a quite serviceable pan. Desert prospectors cut the handle off a "one-egg" frying pan and do their panning in a kettle of water. The panning rejects are scooped out and discarded as they collect in the bottom of the kettle, but the same water is used over and over. In this manner a two-gallon can of water and a kettle can be made to serve a whole day's prospecting.

It might be noted here that dirty water does not hinder the panning. As a matter of fact, the suspended sludge increases the specific gravity of the water, resulting in a greater relative difference in the specific gravity of the minerals.

Besides a pan, you should carry a prospecting pick and a trowel for digging the samples, several sample sacks, and a large-diameter inexpensive hand lens. The writer found that a simple $1\frac{1}{2}$-inch length of 2-inch pipe made a very useful mortar for crushing rock specimens so they could be examined by panning. The piece of pipe is placed on a flat boulder, the sample dropped in and crushed with the prospecting pick.

In conclusion, prospecting with a pan is one of the fastest ways of checking the mineralization of a district. The mechanics of the actual panning are very simple, but care must be exercised in selecting the sample and interpreting the results. (From The Ore.-Bin, June 1948.)

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