NOTES ON THE BLACK SAND DEPOSITS
OF SOUTHERN OREGON AND NORTHERN CALIFORNIA

R. R. HORNER
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NOTES ON THE BLACK SAND DEPOSITS OF SOUTHERN OREGON AND NORTHERN CALIFORNIA.

By R. R. Hornor.

INTRODUCTION.

As a result of the unusual demand for platinum in the manufacture of materials needed in war, and of the decrease in supply through smaller imports resulting from the curtailed production in Russia, the United States has been confronted with a serious shortage of this metal, and the market price has risen to four or five times the price in 1914.

On account of this unusual situation and the need of ascertaining the possible increase of production in this country, the Bureau of Mines decided to investigate some of the more promising localities on the Pacific coast where gold and platinum are known to be associated with such minerals as magnetite, chromite, and ilmenite, with various siliceous minerals, the aggregate constituting what are commonly known as "black sands." The object was to determine whether any of these deposits are large enough and contain sufficient gold and platinum to be profitably exploited, and also to determine whether the base minerals present, especially the iron minerals, might be commercially utilized as a source of iron.

In the latter part of July, acting under instructions from the Bureau of Mines, the writer proceeded to Marshfield, Coos County, Oreg., and spent a month in the field in Coos, Curry, and Josephine Counties, Oreg., and Del Norte County, Cal.

PREVIOUS GOVERNMENT INVESTIGATIONS.

The first systematic investigation of the black sands of the Pacific slope of which there is any record was conducted by Day,* in 1899, under the direction of the United States Geological Survey. According to Day, in 1897 a demand suddenly arose for commercial quantities of osmium, for the manufacture of the filament of a new incandescent electric light. Day and W. E. Barrows, president of the

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Welsbach Light Co., the firm most interested, visited most of the 
platinum-bearing localities of the West. These investigations, 
although not conclusive, stimulated interest in the subject by showing 
the presence of platinum and related metals in beaches and in stream 
gravels at a number of places in northern California and southern 
Oregon.

The growing scarcity of platinum occasioned by the Russo-
Japanese War again led Congress to provide, in 1905, an appropria-
tion for the United States Geological Survey to investigate the black 
sands of the Pacific slope and to devise methods of recovering the 
valuable minerals.

Dr. David T. Day was placed in charge of the work, and a 
laboratory was established at the Lewis and Clark Exposition in 
Portland, Oreg. Prof. R. W. Richards, of the Massachusetts Insti-
tute of Technology, was retained to take joint charge of the concen-
tration experiments and to formulate a scheme of treatment.

Prof. J. F. Kemp, of Columbia University, with a number of 
assistants was placed in charge of the field work. They proceeded to 
collect samples and examine deposits over a wide range of territory 
in the western United States.

A large number of samples, varying in quantity from a few pounds 
up to several carloads, were collected. In all some 931 samples were 
examined and elaborate tests were made to determine the most 
feasible methods for concentrating and separating the useful from 
the worthless minerals. Experiments were carried on until the 
close of the exposition, and the work being incomplete, authority and 
additional funds were requested from Congress to bring it to a con-
clusion. This request was granted and the work was continued sev-
eral months after the exposition had closed.

The report of these investigations⁹ was issued in 1906, and con-
tains the tabulated results of the mineral composition of a large 
number of samples examined and of some interesting experiments 
on electric smelting of the magnetite obtained from the black sands. 
It may be said, however, that the various hopeful statements regard-
ing the commercial possibilities of the black sands that appeared in 
the press at the time of the investigations have not been realized.

**HISTORY OF BEACH MINING.**

For more than 60 years the black sands of the Pacific coast have 
been exploited for their gold content, and at an early date platinum 
and its associated metals, osinium, iridium, and palladium, were 
known to exist in some of the placers of northern California and 
southern Oregon, but in the early days the platinum was given little 
attention by the placer miners on account of its small value and the

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limited market. Indeed, it was considered objectionable, and was usually discarded as worthless when the gold clean-up was made.

Within recent years, however, many of the old clean-up dumps have been worked for their platinum content, some of them with gratifying results.

The first record of beach mining was in 1851 at Gold Bluff, Humboldt County, Cal., where gold was discovered on the sea beach associated with black and gray sands. This discovery was soon followed by others farther north along the California and Oregon coasts. In 1854 Blake* called attention to the occurrence of gold and platinum at Cape Blanco, Oreg., and stated that the platinum was present in a ratio of 10 to 30 per cent of the gold.

In the late fifties and early sixties placer mining was rather active at a number of places along the coast as far north as Coos Bay, Oreg. Some of the diggings proved to be extremely rich, but these rich finds were soon worked out, and the miners passed on to more promising fields in eastern Oregon and southern Idaho.

The principal beaches where gold and platinum bearing black sands have been found and those offering the most attractive field for exploitation are, beginning at the south: Gold Bluff, Big Lagoon, Stone Lagoon, and Little River, in Humboldt County, Cal.; Crescent City, Gilbert Creek, and Smith River, in Del Norte County, Cal.; Chitco, Ophir, Pistol River, Gold Beach, Eucher Creek, Port Orford, and Cape Blanco, in Curry County, Oreg.; Bandon, Old Randolph, and South Slough, in Coos County, Oreg.

In the wake of the pioneer miners came others who extended their search for gold 1 to 5 miles inland from the present beach to the ancient beach lines. In many instances their search was rewarded, and some extensive placers were discovered in the old beaches. Of these the most important are the Old Pioneer and Eagle mines, some 7 miles north of Bandon, Oreg., and the Madden and Butler mines in the vicinity of Sixes River, Curry County, Oreg.

The ancient beaches did not prove as rich as the present beaches, and most of them were rather difficult to work because the gold-bearing beds in many places were deeply buried under sand and clay; besides, the surface was covered with a heavy growth of timber and vegetation and with fallen trees, so that mining was both difficult and expensive.

The period of greatest activity appears to have been from the beginning to the middle seventies, when the richest and most accessible of the old beaches were being worked. From that time until the present many futile attempts have been made to work both the present and the old beaches for the gold and platinum that they

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are supposed to contain. A few individuals, it is true, make a pre-
carious living by working places along the coast where at certain
times of the year the tide and storms effect a rough concentration
of the sands; but wherever an attempt has been made to work the
sands on a large scale, failure has invariably been the result.

Black-sand mining in the past has offered a fruitful field for un-
scrupulous promoters and has been especially alluring to men having
little knowledge of mining or mining methods. These swindlers
usually claim to have some wonderful machine or process for ex-
tracting gold and platinum from the sands.

Many of these agents made the most extravagant claims for the
processes or machines. Some of these process men were so bold as
to claim that they could recover gold and platinum where it could not
be detected by any known scientific method. As a result, the Pacific
coast is strewn with the wrecks of many kinds of experimental ma-
chines and of plants that bear evidence to the credulity and childlike
simplicity of those who had been induced to invest their money in
schemes for treating the sands.

**ORIGIN AND CHARACTER OF DEPOSITS.**

Most geologists who have made a study of the rocks of the Pacific
coast concede that the black sands with their gold and platinum con-
tent have been derived from the disintegration of basic igneous rocks
of the ferromagnesian type.

According to Diller, these rocks underlie wide areas in southern
Oregon and northern California. Diller says:

In southwest Oregon igneous rocks are abundant and cover a greater area
than the sedimentary rocks. They are of great variety in composition, texture,
mode of occurrence, including greenstones, serpentines, granodiorite, dacite,
porphyry, and augite andesite.

The greenstones are widespread and of several different kinds, both effusive
and intrusive, but for the most part they agree in being much altered pyroxyenic
rocks, greenish in color from the presence of chlorite or green hornblende.

The ore deposits are most frequently found in the greenstones. The serp-
entines for the most part clearly cut the great mass of greenstone. This is
best illustrated in the Galice-Kirby region, where they have much to do in pro-
ducing ore deposits in the associated greenstones, although the serpentine itself
rarely contains bodies of ore except copper.

Serpentine is derived chiefly from the alteration of peridotite, an intrusion
rock that is composed for the most part of olivine with considerable pyroxene,
usually enstatite, and small crystals or grains of magnetite, chromite, and
ilmenite.

Peridotite and the serpentine derived from it are generally considered to be
the native rocks from which platinum is derived, and the abundance of ser-
pentine in southwest Oregon may account for its presence in that region,
although the platinum has not yet been found in place.

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The black sands represent the hard and more resistant minerals left from the erosion of these ferromagnesian rocks, and consist of particles of quartz, olivine, garnet, zircon, and other silicates, with magnetite, chromite, ilmenite, and hematite, and frequently a little gold and platinum. These particles are found in small quantities in nearly all water-borne sands and gravels. Edman states that in the original gravel deposits the black sands are present in quantities varying from 0.25 up to, but seldom exceeding, 2 per cent, and are distributed throughout the mass of the deep gravel beds, generally being somewhat concentrated in the lower strata and on the underlying bedrock.

The origin of the gold-bearing black sands on both the present and ancient beaches is chiefly the result of natural concentration of slightly auriferous sands and gravels that have been transported to the ocean by streams, and perhaps to a less extent to the erosive action of the waves on the rocks forming the coast line that may contain in places a slight amount of gold and platinum.

The concentration action of waves is erratic and changing, consequently the deposits vary in both composition and extent within comparatively narrow limits. The beds are lenticular in shape and are frequently made up of thin layers of concentrated black sands interstratified with layers of gray sand. The geology of the beach placers has been described by Diller.

In some of the ancient beaches examined some of the beds are rather homogeneous and in many places cemented into a compact mass by the decomposition of the iron minerals present. These beds are 150 to 200 feet wide and sometimes reach a maximum thickness of 10 feet, averaging 3 to 4 feet thick as a rule. In section they are thickest at the center and gradually thin down on either side. The heaviest and largest particles were concentrated on the landward side, where the wave action was the greatest, and here also the gold and platinum content is highest.

EXPLORATION AND UTILIZATION OF THE BLACK SANDS.

As has already been pointed out, black sand deposits of the Pacific coast have been worked for their gold content with indifferent success for many years, and in more recent years for their platinum content at a few localities in southern Oregon and northern California.

The impression has gone forth that many of these deposits are of large extent and are fairly rich in gold and platinum that can not be successfully recovered by any of the known methods, because these metals are supposed to exist in some peculiar form.

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The gold and the platinum are usually in fine thin scales that are somewhat difficult to save in the sluice box or other gold-saving machine, and much of the gold in the old beach deposits is tarnished and difficult to amalgamate. However, the chief trouble lies in the meager content of gold or platinum. Occasional small isolated areas have a good content through local concentration, but in most places the material contains only a few cents' worth of gold and platinum per ton.

Another erroneous idea is that the gold in the black sands, and especially in the old beach deposits, is difficult to treat metallurgically. According to Day and Richards, and other investigators, this is not true except as regards amalgamation.

The gold in the black sands is known to be entirely amenable to cyanide and to chlorine, with comparatively small consumption of these reagents, and Lang points out that if the sands are found in quantity and quality that warrant erecting a plant using either cyanidation or chlorination, there would be no difficulty in recovering the gold.

An important consideration in estimating the value and extent of any alluvial deposit is careful and systematic prospecting, either by sinking pits, at regular intervals, or by drilling with some approved type of churn drill.

No attempt whatever has been made to prospect systematically the majority of the black sand deposits examined. Such prospecting as had been done was confined to exposing a few outcrops or sinking an occasional shaft on an old beach, and panning random samples from the surface of the present beaches.

On one ancient beach examined, haphazard drilling had been done some years ago, but few beaches have been drilled with the care and precision generally shown in prospecting dredging ground.

Lang points out an example where a deposit of 200 acres, on the Oregon coast, was carefully drilled, and gave disappointing results, as, instead of a content of $4 per yard in gold as was claimed, the highest assay was only 60 cents per yard, and many pannings showed no trace of gold.

Assay results obtained from a number of samples taken by the writer, presented on page 13, confirm Lang's observations, as many of the assays show no value whatever.

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* Lang, Herbert, work cited.
BLACK SANDS AS SOURCE OF IRON.

From time to time it has been proposed to utilize the magnetite in the black sands as a source of iron ore for the manufacture of iron and steel, and also to recover, so far as practicable, other useful minerals present, such as chromite, ilmenite, monazite, and zircon.

The first serious attempt of this kind was in 1893, when a San Francisco company was organized to exploit various deposits in California to recover the gold and platinum and then employ the magnetite in the production of iron and steel. This attempt resulted in failure.

Public attention was not again directed to the subject until 1905, when the investigation by the United States Geological Survey was begun. During the experiments at the Lewis and Clark Exposition a large number of tests were made in smelting the magnetic iron minerals in the electric furnace, and the results were very satisfactory. However, no attempt was made to determine the actual extent of the deposits, nor whether the sands could be profitably worked as a source of iron.

The various steps that are involved and on which the success of the operation depends are:

1. Thorough prospecting to insure that sufficient material is available.
2. Mining or collecting the material.
3. Concentration of the material to get rid of waste and separation of concentrate into its various constituents.
4. Treatment of the valuable ingredients.

Obviously the success of the operation depends upon the cost of collecting the material, yet in most instances little or no attention is given to this important problem. Those who undertake to exploit the deposits generally assume that the material can be cheaply mined and give no further consideration to the matter. As a matter of fact, the mining cost is usually the biggest item and is one of the chief factors contributing to the large number of failures.

It may be said, therefore, that the chief obstacles to the profitable exploitation of these deposits are lack of uniformity, both as to metallic content and occurrence, and the high cost of mining and treatment.

MAGNITUDE OF THE DEPOSITS.

The investigations of the writer led him to conclude that there are no large or concentrated deposits of black sands in southern Oregon or northern California, and that it is not commercially feasible to utilize the sands as a source of iron ore.
In this connection Edman\(^a\) says:

Any deep and extensive deposits of iron sands have not yet been discovered on this coast, and so far exist only in the vivid imagination of unscrupulous promoters of mining schemes or patent processes. If, however, they did exist, such sands are of little commercial value for the manufacture of iron in any country where pure iron ores in mass are relatively abundant, as is the case even in California. They could not, even under the most favorable conditions, compete with the iron ores of Lake Superior.

L. E. Aubury, former State mineralogist of California, states\(^b\) that his department has thoroughly investigated the subject of black sands in California, and he personally has investigated deposits outside of the State, and could find no workable deposits.

An editorial comment in the Engineering and Mining Journal\(^c\) states:

The utilization of black sand as an iron ore, by electrothermic smelting or otherwise, is an old one. The practical difficulty is that the black sand is too widely scattered. An iron mine extending over 100 miles or so of seacoast or river bottom would be rather diffuse. Its value as a source of iron ore is problematical.

In the past year the Bureau of Industrial Research of the University of Washington has conducted an investigation of the iron ore resources of the Pacific Northwest. In a preliminary report\(^d\) it is stated that the geologic work has shown that the magnetic sands as a source of iron ore in commercial quantity are not important enough to warrant further investigation, particularly as magnetic iron ore is known to exist in quantity.

\(^{a}\) Edman, J. A., Black sands of California: Bull. 45, California State Mining Bur., 1907, p. 7.


DESCRIPTION OF DEPOSITS VISITED.

During the field work in connection with the black-sand investigation conducted by the Bureau of Mines, deposits were examined along the coast of Coos and Curry Counties, Oreg., from Marshfield south to Port Orford, and in the interior of Josephine County in the vicinity of Waldo, and also a deposit in Del Norte County, Cal., near Crescent City. A map showing the places visited is presented in Plate I.

All the deposits examined were carefully sampled, and the samples were sent to the Seattle station of the bureau to be assayed for gold and platinum, and one typical sample was analyzed for its base metal content.

A tabulated list of the assay results follows. The numbers of the samples are the same as in the descriptions:

*List of assay results.*

[Results in ounces per ton.]  

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COOS COUNTY, OREG.

A map showing the deposits examined and sampled in Coos County is presented in Plate II. The numbers on the map correspond to the numbers in the table of assays and in the descriptions.

DEPOSITS IN THE VICINITY OF SOUTH SLOUGH.

The first locality visited is near the head of South Slough, in Coos County, Oreg., about 9 miles southwest of Marshfield in a direct line, but some 15 miles by wagon road.

The black-sand deposits in this locality are all ancient beaches and lie at an elevation of 50 to 125 feet above sea level.

WEST BLUFF, HEAD OF BROWN SLOUGH.

The most promising of these deposits is situated on the M. J. Mathews property, in the SE. ¼ of SW. ¼ of sec. 25, T. 26 S., R. 14 W. The bed outcrops on the west face of a bluff near the head of Brown Slough, about 60 feet above sea level. It is opened by a tunnel 30 feet long having a direction of S. 60° W. At this opening the bed is exposed for a length of about 40 feet and is nearly 10 feet thick.

The upper part of the bed is brownish-black consolidated material nearly 5 feet thick, with light-colored and dark sands in alternating bands in the bottom 18 inches. The lower part, approximately 4 feet 6 inches thick, has three partings 3 to 4 inches thick and 6 to 8 inches apart. These consist of alternating layers of black and white sand about ½ to ⅜ inch thick.

The bed rests on a rather coarse-grained, iron-stained beach sand of undetermined thickness. The overburden is 25 to 50 feet of fine sand, clay, and soil covered with vegetation, timber, and fallen logs.

The exposure was sampled in two sections at the portal of the tunnel, and the samples were assayed with the following results:

- **Au and Pt, ounces per ton.**
  - Sample H–122, over upper 4 feet 10 inches.---------- 0.00
  - Sample H–122A, over lower 4 feet 4 inches.---------- 0.02

An approximate analysis of a composite of the two samples gave for the base metals present the following results: Fe₂O₃ (calculated from Fe), 30 to 33 per cent; TiO₂, 10 to 15 per cent; SiO₂, 30 to 35 per cent. The balance consisted of CaO, MgO, Al₂O₃, and probably some zirconium.

A sample (H–123), taken at a point 130 feet north of the tunnel, representing a thickness of 8 feet 2 inches, showed no gold and no platinum.
MAP OF PART OF OREGON AND PART OF CALIFORNIA, SHOWING SITUATION OF BLACK-SAND DEPOSITS SAMPLED.
This bed can be traced for probably 200 feet north of the tunnel and some 300 feet to the south. In the southerly direction the exposures are not so prominent as to the north. The bed, where exposed in a ravine that cuts it some 300 feet south of the tunnel, thins out to 3 to 4 feet thick.

The breadth of this deposit could not be definitely determined, but probably does not exceed 200 feet. The outcrop could not be traced continuously for more than 400 to 500 feet, as it is concealed by vegetation and no systematic attempt has been made to expose the bed along its strike. The continuity of the outcrop is frequently broken by ravines, and evidently a large part of the bed has been eroded.

No accurate estimate can be made of the quantity of material available, but from the nature of the deposit no large tonnage may be expected. The sand has little value for the precious metal it contains and is not promising in either quantity or quality as a source of iron ore or the associated metals—chromium and titanium.

EAST BLUFF, HEAD OF BROWN SLOUGH.

Situated in the SW. ¼ of SE. ¼ of section 25 on the land of M. J. Mathews, and about one-quarter of a mile east of the outcrop mentioned in the previous paragraph is a small isolated bed of black sand mixed with fine and coarse gravel. This deposit is at the top of the bluff on the east side of Brown Slough at an elevation of about 120 feet. It appears to cover an area of less than one acre and where opened is 3 feet 4 inches thick with a covering of 6 feet of soil and gray sand. (See Pl. III, A.)

The workings consisted chiefly of an open cut, a pit 60 feet long, 10 feet deep, and 15 to 20 feet wide, and short tunnels.

The valuable material removed from the tunnels and pit was carried by a surface tram about 200 feet long to a ravine, where it was washed in crude sluice boxes containing riffles and burlap.

When visited the workings were idle, but judging from the small quantity of material removed and treated work had not been profitable.

Two samples were taken at this place and assayed as follows:

<table>
<thead>
<tr>
<th>Sample</th>
<th>Sample H-121</th>
<th>Sample H-121A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold and platinum</td>
<td>0.06</td>
<td>0.23</td>
</tr>
<tr>
<td>Gold</td>
<td>do</td>
<td>.14</td>
</tr>
<tr>
<td>Platinum</td>
<td>do</td>
<td>.09</td>
</tr>
</tbody>
</table>

The first assay (H-121) represents a sample of 38 pounds, taken over a width of 3 feet 4 inches, from which was sorted 6 pounds of coarse gravel. The remainder was quartered down and assayed. The second assay (H-121A) represents a concentrate of one-half pound
from panning down 8 pounds of the original sample after the gravel was removed.

RAVINE AT HEAD OF BROWN SLOUGH.

A sample (H-117) was taken from the face of a sand bank, over a width of 6 feet 4 inches. The exposure consists of iron-stained siliceous sand with thin bands of black sand one-eighth to one-sixteenth inch thick throughout. Assay of a sample gave negative results for both gold and platinum.

The bed outcrops at an elevation of 50 feet on the west side of a ravine emptying into the head of Brown Slough, in the NE. ¼ of SW. ¼ of section 36, on land owned by M. J. Mathews. The cover is fine gray sand having a thickness of 20 to 50 feet near the place sampled and gradually increasing to 100 feet about 300 feet to the west. The surface is thickly covered with vegetation and timber.

Sample H-118 was taken from an outcrop on the land of M. J. Mathews at an elevation of 50 feet on the east side of the ravine emptying in the head of Brown Slough, about 150 feet east of where sample H-117 was taken. The outcrop is exposed along the ravine for 40 to 50 feet and is then obscured by a landslide and vegetation. The bed where sampled is 4 feet 2 inches thick, and is black, heavy, consolidated material with fine black sand above and below. The cover has a maximum thickness of 50 feet. The sample showed no gold and no platinum per ton.

WEST BLUFF, HEAD OF BROWN SLOUGH.

Sample H-119 represents a bed 2 feet 4 inches thick of soft, unconsolidated black and gray sand underlain by 6 inches of yellow clay. Beneath the yellow clay is a bed of blue clay.

The bed outcrop is on the western side of a bluff near the head of Brown Slough in the NW. ¼ of SW. ¼ of section 25. The cover is fine beach sand, perhaps 25 feet thick. The deposit is unimportant. The sample had a gold and platinum content of 0.01 ounce a ton.

HEAD OF TALBOTT SLOUGH.

Sample H-120 was taken from the face of an old cut showing 4 feet 10 inches of black, heavy, consolidated sand with probably 5 to 6 feet of sand and soil covering. Beneath the bed of black sand is fine iron-stained beach sand.

The deposit outcrops at an elevation of 60 feet near the top of a heavily wooded bluff near the head of Talbott Slough on land owned by H. Sengstaken in the SE. ½ of NE. ¼ of section 25, T. 26 S., R. 14 W. The deposit has been opened by a number of prospect cuts
and shallow pits and appears to be of small extent. No work has been done in recent years.

The sample showed a gold and platinum content of 0.01 ounce a ton.

**HEAD OF SOUTH INLET.**

Sample H–115 represents a bed 3 feet 4 inches thick of consolidated, homogeneous, brownish-black material, with fine gray beach sand above and below. The covering will probably not exceed 25 feet.

The bed outcrops on the roadside for a distance of 60 feet near the head of South Slough on the Boutan property in the NW. ¼ of SW. ¼ of section 36, T. 26 S., R. 14 W. The deposit lies in a low, flat ridge between an arm of South Slough on the south and a ravine on the north. The sample showed no gold nor platinum.

Sample H–116 was taken from an outcrop near an old logging road near the bottom of a ravine on a small stream flowing west into South Slough. The bed outcrops at an elevation of 25 feet and is 5 feet 6 inches thick at the place sampled. The deposit is situated on the Bernell property in the NW. ¼ of NW. ¼ of section 36, T. 26 S., R. 14 W.

The outcrop shows at the top about 2 feet of white beach sand containing thin streaks of black sand, then 3 feet 6 inches of hard, consolidated black sand, with 1 foot of gray and black sand at the bottom, resting upon a bed of beach sand. The overburden is sand and clay, and varies from 25 to 50 feet thick. The surface is thickly covered with vegetation and timber. The sample showed no gold nor platinum.

What seems to be a continuation of the same black sand beds as those on the Bernell land was traced about 2 miles south from the head of South Slough, a tract owned by Mr. Boutan, comprising sections 1 and 12, T. 27 S., R. 14 W. Here the beaches have an elevation ranging from 75 to 100 feet above sea level, indicating a gradual tilting to the south. They lie near the surface and have been largely removed by erosion, being cut by numerous ravines and small streams. Only isolated remnants at the highest elevations have been preserved.

The deposits in this locality are too widely separated and too small to be of commercial importance.

Five samples were taken at widely separated points. The assay results are given below.

Sample H–124 represents black sand float found at an elevation of 100 feet on the north slope of a gentle rise from the southeast branch of Winchester Creek near the fork in the NE. ¼ of section 12. The sample contained no gold nor platinum.
Sample H–125 was taken from an outcrop in a ravine in the SW. 4 of section 1. The bed was 2 feet 6 inches thick of consolidated black sand. The sample was barren.

An attempt had been made to work the sand some years ago, but with poor success, judging from the small quantity of material handled. The remains of old sluice boxes are still to be seen.

Sample H–126 was taken on the east side of a ravine at an elevation of 75 feet about 200 feet north of the place where H–125 was obtained. It represents a bed 5 feet thick of iron-stained beach sand with bands of black sand throughout. Beneath the bed is a stratum of coarse iron-stained sand. There is about 20 to 25 feet of sand and soil covering. (See Plate III, B.) The sample was barren.

Sample H–127 was taken from a bed of black sand 3 feet thick, which outcrops in the SW. 4 section 1, near the top of the south bank of a large east and west ravine, at an elevation of 100 feet. The bed is hard and compact and shows light-colored bands. This sample had a gold and platinum content of 0.03 ounce a ton.

Sample H–128 represents a bed 4 feet thick, which outcrops near the top of a large north and south ravine in the NE. 4 of section 1. The bed is well exposed at this point along the steep side of the ravine, but can only be traced a short distance north and south. The sample was barren.

EAGLE MINE.

This placer mine has to its credit perhaps the largest gold production of any of the black-sand operations of southwest Oregon. The deposit was discovered about the middle 60’s and actively worked until 1873. Of late years the mine has been worked with indifferent success from time to time. When visited it was idle and in litigation.

The mine is about 6 1/2 miles north of Bandon, Oreg., where the Marshfield road crosses Cut Creek, and is 22 miles from Marshfield, the nearest railroad point. The holdings of the company comprise an area of 19.51 acres in the NW. 4 of NE. 4 of section 33, T. 27 S., R. 14 W., and 80 acres in the NW. 4 of section 28.

OLD WORKINGS.

All the mining has been done on the smaller tract. The 80-acre tract is said to contain deposits of black sand, but their value and extent have not been proven.

The old beach sands that were successfully worked in the early days outcrop a few feet above the bed of the creek and have a cover of 50 to 60 feet of fine gray sand. A short distance up the creek they reach water level and soon disappear beneath the creek bed.
A. BLACK-SAND WORKINGS, SHOWING PIT ON LAND OF M. J. MATHEWS, SOUTH SLOUGH, COOS COUNTY, OREG.

B. BLACK-SAND OUTCROP ON BOUTAN LAND, SOUTH SLOUGH, COOS COUNTY, OREG.
The workable bed is 6 to 8 feet thick, and averages about 200 to 250 feet wide and several hundred feet long. It is of lenticular section, thinning to the east and to the west. The deposit is rather soft, unconsolidated, black and gray sand, carrying a small amount of gold and platinum. The black minerals, which comprise magnetite, ilmenite, and chromite, constitute about 25 to 30 per cent of the entire mass; the gray sand consists of various siliceous minerals.

The gold is not uniformly distributed, but appears to be in well-defined streaks or shoots, the richest part of the bed being the east or landward side. The gold content of the material mined in the early days must have been fairly high, but the unworked part of the deposit will probably not average more than a few cents a ton, although claims of $1 to $5 a ton in gold are made by those most interested. Platinum and its associate minerals, osmium and iridium, occur in a ratio of 5 to 10 per cent of the gold content.

At first the creek channel was worked for the gold that had concentrated from the erosion of the black-sand beds. Later tunnels were driven into the outcrops above water level, and drifts were run in either direction following defined pay shoots. As the workings were extended to the east, water was encountered, which stopped mining in that direction. To the west the shoots were worked until the limit of the pay dirt was reached. Finally pumps were installed and an attempt made to carry the workings below water level, but this proved too expensive, and the mine was closed down; probably, however, not before the richest part of the deposit had been worked out.

The material mined was trammed in cars to sluice boxes, fitted with riffles and having the bottom covered with burlap, where it was washed to obtain a black-sand concentrate containing gold and platinum. The concentrate was treated by amalgamation for the gold, little attention being given in the early days to the platinum.

In recent years a number of attempts have been made to open and work this mine, but all efforts have invariably met with failure.

RECENT DEVELOPMENTS.

About four years ago the property was acquired by some San Francisco parties and, under the direction of G. W. Bradford, was extensively prospected by drilling with an Empire hand drill. In all, about 50 holes were drilled, all of which are reported to have shown the presence of gold and platinum.

Seemingly the drilling was not done in a systematic manner, and the results, which were not available to the writer, are likely to be unreliable and misleading. The drill holes indicated an overburden of 60 to 75 feet with an average of perhaps 65 feet.
Mr. Bradford and his associates had opened the deposit by means of a vertical shaft, 30 feet deep, situated on the south side of the ravine, about 15 feet above the level of the creek, and 35 feet below the level of the surrounding country.

From the bottom of the shaft an inclined tunnel containing pumping equipment extends to the surface. There is, also, 135 feet of drifting to the south. Additional drifts were run to the east, but were lost by caving.

The mine is equipped with a small gasoline hoist, a gasoline-driven 5-inch centrifugal pump, and a treatment plant.

A view of the plant is shown in Plate IV, A. At the collar of the shaft is a receiving bin of 50-ton capacity. The material was shoveled from the bin into the hoppers of two Challenge feeders, and fed into two launders with undercurrent attachments. The material from the undercurrent was fed to a series of eight parallel sluice boxes fitted with ripples of No. 8 gage galvanized iron. Each riffle is 12 inches long by 1 inch wide and set on an angle of 60°. A ½-inch space is left between the riffle and the bottom of the box. The sluice boxes are 28 feet long by 10 inches wide, and set on a grade of 2½ inches to the foot. The bottoms of the boxes are lined with galvanized iron. The concentrate from the sluice boxes was re-treated in a small hydraulic undercurrent machine where a rich concentrate was made, which received further laboratory treatment to recover the gold and platinum. The plant has a capacity of 40 or 50 tons of material per day.

**ATTEMPT TO RE-TREAT TAILINGS.**

An attempt was made some three years ago to re-treat the accumulated tailings from the early operations. These tailings had been impounded in an old lagoon, through which Cut Creek flows, about one-half mile below the camp. A Mr. Richards, of Seattle, obtained a lease on these tailings, estimated at several thousand tons and to carry gold and platinum in commercial quantities. Sherwood bumping tables were installed on an elevated platform about 20 feet high. The material was delivered to the plant by horses and scrapers, and elevated to the hopper above the platform by skip and hoist. It was then fed into sluice boxes, provided with undercurrent, the product from the undercurrent passing over the tables. This crude contrivance was operated only a few days and was then abandoned as being a complete failure.

**SAMPLES.**

Three samples were taken at the Eagle mine, from which the following assays were obtained:
A. BLACK-SAND PLANT, EAGLE MINE, 6 MILES NORTH OF BANDON, OREG.

B. SIDE VIEW OF BLACK-SAND PLANT UNDER CONSTRUCTION ON BEACH, 6½ MILES NORTH OF BANDON, OREG.
RESULTS OF DEPOSITS VISITED.

RESULTS OF ASSAYS OF THREE SAMPLES COLLECTED AT EAGLE MINE.

[Results in ounces per ton.]

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>H–129</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>H–130</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>H–130A</td>
<td>3.08 1.43 1.60</td>
<td></td>
</tr>
</tbody>
</table>

No. H–129 is an average sample of black sand from the south drift at the bottom of shaft, and was taken from the end of the drift, near the boundary of the Pioneer mine.

No. H–130 is an average sample of tailing from the sluice boxes. Note the gold losses.

No. H–130 A is a sample of the concentrate from the small clean-up machine, before being treated in the laboratory for the gold and platinum.

PIONEER MINE.

This property adjoins the Eagle to the south, and comprises one patented claim of 19.56 acres, reported to have been patented in 1872. The claim was located in 1866 by A. H. Hinch and John Dame, and later sold to Simon Lane, who worked the mine actively until the middle 70’s, when it was closed. Some years later the claim was sold to Capt. Smith & Son, of San Francisco, the present owners, but no attempt has been made to work it. At the time of the author’s visit, C. W. Smith, one of the owners, was on the ground for the purpose of interesting men in the property.

The workings are in the same deposit as the Eagle mine, and the methods of mining and treatment were similar to those used at the Eagle.

ABANDONED PLANT AT MOUTH OF CUT CREEK.

About 1915 J. R. Peters, of Bandon, representing Astoria, Oreg., men, installed a steam-driven suction pump to handle the gray and black sands from the present beach at the mouth of Cut Creek.

The sands were first delivered to a sump by ground sluicing. The pump was supposed to lift the sand containing the gold and platinum from the sump and deliver it through a pipe to a centrifugal gold-separating machine, built on the principle of the Sweet machine.

When tried, the pump failed to lift the heavy material, as might have been expected, and also frequently became clogged with foreign matter, such as leaves, grass, and roots. In addition, the gold machine did not save the gold.

The plant, after being operated for a few days, was abandoned as a complete failure.
PLANT ON BEACH NORTH OF CUT CREEK.

At time of the writer’s visit to the vicinity, a plant having an estimated capacity of 400 to 500 tons per day was being built a short distance north of Cut Creek, to excavate and treat the beach sands for their gold and platinum content.

The plant is designed with the idea of shifting it up or down the beach whenever the material at any given point is exhausted. A view of the incompletely plant is shown in Plate IV, B.

CONSTRUCTION OF PLANT.

The construction consists of a heavy deck or platform mounted on massive timber girders. On this deck a frame structure having two floors was erected.

The material from the beach was to be excavated with a drag-line scraper having a capacity of 2 cubic yards, operated by a 50-horsepower donkey engine. The scraper is drawn up a runway at an angle of about $60^\circ$, to the top of the structure, where it is discharged into a chute over which is placed a grizzly with the bars spaced $1\frac{1}{2}$ inches apart.

The oversize gravel goes directly to waste. The undersize is delivered to a 6-foot conical screen having an inner section with 1-inch round holes and an outer section with $\frac{1}{4}$-inch slotted openings. The inner screen removes all pebbles 1 inch and larger in size, and the undersize drops onto the fine screen, where the small gravel and coarse sand are removed.

The fine sand is discharged into a log washer, where a large part of the light sand and organic material is removed. From the log washer the sand is split into two parts and fed by means of two screw conveyors onto two batteries of 20 bumping tables. In each battery the tables are arranged in two rows of 10 each, one above the other. The batteries are on opposite sides of the structure.

The bumping tables are about 16 inches wide and 4 feet long, having on the sides and one end a frame 4 inches high. The deck or bottom of the table is covered with canvas, on top of which is placed, in a removable frame, a set of metal riffles. The riffles are made of galvanized-iron strips about 1 inch wide, and placed about the same distance apart, not at regular intervals but where they may become filled according to the richness of the sand.

The table is pushed forward by means of a cam and then released, when a strong spring jerks the table back against a bumping block. This bumping tends to settle the heavy particles and permit the lighter material to flow away. At regular intervals the riffles must be removed and a clean-up made. While the clean-up is going on,
the table is put out of commission temporarily by placing a wooden wedge between the bumping block and the end of the table. The ratio of concentration that was to be attained was estimated at about 500 to 1.

Some 400 to 500 gallons of sea water per minute is the maximum required. This water was to be delivered by a 6-inch centrifugal pump.

DIFFICULTIES THAT MAY CAUSE FAILURE OF PLANT.

According to the company's engineer, excellent results had been obtained on the experimental machine. A claim that a tailing loss not to exceed one-fifth of 1 per cent of the gold content was attained is made. How these results were obtained was not stated.

The quantity of material available or its average metallic content could not be estimated, nor could any authentic data on this subject be obtained from the management. Provided the gold is present in the sand and can be successfully recovered, a serious problem to be solved, and one that had apparently been given little thought, was how to shift the ponderous machine from place to place in order to collect the material for treatment.

OLD DREDGE AT MOUTH OF WHISKEY RUN.

Probably the most unique mechanical curiosity of all the devices for recovering the gold from the black sands was seen on the beach at the mouth of Whiskey Run, about 7 miles north of Bandon, Oreg.

In 1910 Smith R. Bassett, representing Minneapolis, Minn., parties, designed and built a dredge mounted on hollow cylindrical wheels about 6 feet in diameter and about 5 feet wide. On the steel frame of the dredge was mounted an endless-chain bucket digging device operated by steam engine. The machine was propelled by its own power and was designed to work the beach deposits lying between high and low tide. It proved a complete failure, as it was unstable and nearly capsized on the first trial run. With great difficulty it was finally dragged back to a point above high tide, where it now rests. This venture is said to have cost between $60,000 and $75,000.

The beach at Whiskey Run was the scene of great activity about 60 years ago, when an important amount of gold was recovered from the sands. The sands were known to contain considerable platinum, but that metal received little attention at that time. Since then the beach has been worked in a desultory manner from time to time by various individuals, who generally have had little success.
ROSE MINE.

An old placer mine, the Rose, is on the south branch of Twomile Creek, at an altitude of 150 feet, in the NE. ¼ of section 21, T. 27 S., R. 14 W., about 7 miles north of Bandon, Oreg.

This mine was located and worked for a number of years by Abraham Rose, who is reported to have recovered considerable gold and platinum from the black sands and gravel by ground sluicing. The property in recent years passed into the hands of a Detroit, Mich., company, headed by Dr. Ewell and George De Foe, and they equipped it with a gasoline-driven centrifugal pump to operate a hose and nozzle. The sand and gravel were washed from a 20 to 25 feet bank and carried by a bedrock flume to a mechanically driven rocker, which removed the light material and part of the black sands. The concentrates from the rocker were passed over a Pinder circular table, mercury and soda being added. The gold and platinum were collected as an amalgam and the black sand went to waste.

The plant ran about four months, when it was closed down, having proved a failure.

A sample (H-131) was taken from a bed of massive black sand 4 feet thick, exposed in an old ditch near the foot of the 25-foot bank. The bed at this point rests on a shale bedrock. The sample was barren.

FLETCHER-MYERS PROPERTY.

This property is situated in the SW. ¼ of section 16, T. 27 S., R. 14 W., and joins the Rose mine on the north.

So far as determined the black sand outcrops on the property at two points, one on the main branch of Twomile Creek and the other on a small branch flowing into the creek from the east.

On the east side of Twomile Creek near an old logging camp, about 50 feet above the level of the creek and at an elevation of 140 feet, a tunnel 95 feet long having a direction of N. 55° E. was driven on a bed of soft, loosely consolidated black sands more than 7 feet thick. This tunnel is reported to have been driven nearly 50 years ago, and, so far as known, no work has been done in recent years.

On the east and west branch of Twomile Creek, about one-quarter of a mile north of the tunnel opening, black sands outcrop in the bottom of a ravine. The sands were worked to some extent in the early days. Considerable ground sluicing of the bed of the stream was done, also a tunnel was driven to the northeast under a ridge between this ravine and another one. The old tunnel is now caved. The cover at this point is probably 50 feet thick and is sand and fine gravel. The surface is thickly covered with brush, timber, and fallen logs.
A sample was taken from each of these deposits. One of the samples (H-132) was collected in the 95-foot tunnel at a point 40 feet from the portal and represents a thickness of 6 feet. The bed consists of alternate bands of iron-stained gray and black sand. Near the bottom is a band about 6 to 8 inches wide of coarse sand and gravel. The sample assayed 0.01 ounce of gold and platinum per ton. The other sample (H-133) was from the bed exposed in the bottom of the ravine and represents 4 feet of black sand. The assays showed a gold and platinum content of 0.04 ounce a ton.

**GEIGER MINE.**

The Geiger or Little mine is situated on the south branch of Fairy Creek, in the SE. ¼ of NE. ¼ of section 32, T. 28 S., R. 14 W.

This property was opened in the early days by John Geiger, who worked it by ground sluicing. Some two acres of ground were worked over, and it is reported that considerable gold and platinum were recovered.

As the workings were advanced toward the hillsides the overburden became heavier and the gold and platinum content less, until the sluicing was no longer profitable. Also, the pay sands were gradually getting below water level.

These difficulties all contributed to the closing of the mine. In recent years several attempts have been made to work the mine, and the wrecks of numerous gold-saving devices of which much was expected may be seen on the property.

A sample (H-134) was taken from an exposure in the south end of the old workings at the foot of a 35 to 40 foot bluff. At this point the deposit is just above the water level. The sample represents 2 feet of black sand. It assayed 0.01 ounce of gold and platinum a ton.

**CURRY COUNTY, OREG.**

**MADDEN MINE.**

The Madden mine, also known as the Blanco mine, was discovered July 24, 1871, by Cyrus Madden, the present owner. This placer mine is about 7 miles north of Port Orford, Curry County, Oreg., in the SE. ¼ of NE. ¼ of section 4, T. 32 S., R. 15 W., on Crystal Creek, a tributary of Sixes River.

The deposit is a gold and platinum bearing ancient beach, lying at an elevation of about 150 feet above sea level. In downward order a section of the deposit is as follows: 12 to 14 inches of soil and vegetation; 8 to 10 feet of fine to coarse gray sand, frequently containing streaks one-half to 2 inches thick of iron-stained material; 2 to 3 feet of coarse iron-stained cemented sand; 3 to 4 feet thick of
coarse grayish sand and gravel containing streaks of black sand one-
eighth to one-fourth inch thick; and then a shale bedrock.

A number of samples taken at different places in the deposit were
panned; they all showed 20 to 30 fine colors of gold, but no plati-
num was observed. Platinum, however, is reported to be present
in the proportion of 20 per cent of the gold, but this estimate is
probably too high, 5 to 10 per cent being probably nearer the
amounts.

The proportion of black sand present is not large, probably not
exceeding 5 per cent of the entire mass of material.

The mine is worked with a hydraulic giant, the water being brought
about 2 miles, by ditch, from Crystal Creek. The sand and gravel
are washed from the bank into about 500 feet of sluice boxes con-
taining riffles, where the coarse gold and platinum are caught. Near
the lower end of the sluice boxes the black sand is taken out by an
undercurrent, and treated on tables covered with burlap, where most
of the fine gold passing over the riffles is recovered.

In past years the mine was worked six or seven months in the
year, during the period of high water, but in recent years work
has been more or less intermittent. It has never been a large pro-
ducer, but has maintained a small output for nearly 40 years.

In all, several acres of ground have been worked to a depth of 20
to 25 feet to a false bedrock composed of cemented coarse sand and
gravel. The true bedrock of shale, 6 to 10 feet deeper, is too low for
drainage without the use of a hydraulic elevator.

Three samples taken for assay yielded the following results:

Results of assays of three samples from Madden mine.

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Au and Pt, ounces per ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>H-135</td>
<td>0.02</td>
</tr>
<tr>
<td>H-135A</td>
<td>0.00</td>
</tr>
<tr>
<td>H-136</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Sample H-135 was taken from a bed of iron-stained, cemented, and
rather coarse sand, and represents a thickness of 3 feet 6 inches. At
the point of sampling the bed has a covering of 10 feet of coarse to
fine gray sand and 12 to 14 inches of soil and vegetation. (See
Pl. V, A.)

Sample H-135A is from a bed of iron-stained sand and gravel
underlain by coarse grayish sand containing streaks of black sand
one-eighth to one-fourth inch thick. The sample was taken over a
width of 4 feet and represents a bed lying beneath the one from
which sample H-135 was taken.

Sample H-136 is from a bed of fine to coarse sand with about 6
inches of gravel near the base. The sample represents a thickness of
A. MADDEN MINE, SIXES RIVER, CURRY COUNTY, OREG. SHOWS PLACE WHERE SAMPLE H-135 WAS TAKEN.

B. ANOTHER VIEW IN MADDEN MINE, SIXES RIVER, CURRY COUNTY, OREG. SHOWS PLACE WHERE SAMPLE H-136 WAS TAKEN.
9 feet 4 inches. The bed has a covering of 3 feet of beach sand and contains bands one-half to 2 inches thick of hard iron-stained material at irregular intervals over the entire width. (See Pl. V, B.)

ZUMALT OR BUTLER MINE.

The Zumalt or Butler mine is situated about 9 miles north of Port Orford and about 3 miles south of Denmark, Oreg. It is on a tributary of Floras Creek, near the line between sections 27 and 34, T. 31 S., R. 15 W., at an altitude of nearly 200 feet above sea level. This old placer mine was worked extensively some years ago, but at the time of the writer’s visit it was idle, the ditches, flumes, and other equipment being in a state of ruin. The remains of a hydraulic elevator, spiral iron water pipe, and giant were to be seen.

Altogether about 3 acres of ground has been mined. The gold and platinum bearing beds are 10 to 20 feet thick; they comprise 5 to 10 feet of fine gray sand and soil, underlain by 2 to 5 feet of coarse gray sand and gravel, beneath which is 3 to 5 feet of black sand interstratified with coarse gray sand and gravel. The black sand rests on a sandstone and shale bedrock.

The quantity of black sand available is comparatively small and unimportant. Both gold and platinum are present in varying amounts, but it is questionable if the quantity of either is enough for profitable operation, even under the most favorable conditions. Moreover, owing to the increased depth of the overburden and the lack of adequate water supply and sufficient tailing dump, the cost of operation would be too high to permit a profit.

The ratio of the platinum to the gold was not determined, but in some rich concentrates tested by panning, the platinum appeared to be present in a ratio estimated at 25 to 30 per cent. This ratio, however, would not likely hold for the material in place.

Two samples (H-137 and H-138) were taken for assay; both of them were barren.

Sample H-137 was taken from the face at the north end of the mine and represents 6 feet of black sand and gravel. The section showed iron-stained sand in the upper part, about 2 feet of gray and black sand in the middle, and coarse sand and gravel in the lower part.

Sample H-138 was taken from a face in the southwest corner of the workings, and represents 3 feet of black sand. The cover of gray sand with streaks of black sand is 15 to 20 feet thick.

PECK MINE.

The Peck mine is in the northwest quarter of section 2, township 32 south, range 15 west, about 10 miles northeast of Port Orford on a
tributary of Crystal Creek. The property comprises 80 acres of patented placer ground and 640 acres of additional land. The principal owner is J. N. Watt, of Sacramento, Cal.

This alluvial deposit is especially interesting, as it shows a second ancient beach line at an altitude of nearly 800 feet above sea level. The mine represents only a small remnant, preserved on the top of a rounded hill composed chiefly of serpentine, of what was perhaps an extensive deposit.

The mine was worked rather extensively some years ago, but for several years past has been idle. As a result, the equipment and buildings have gone to ruin, and the mine is now overgrown with brush and vegetation.

The deposit was first opened on the west side of the hill where a large amount of sand and gravel were excavated and washed by means of a hydraulic giant and sluice boxes. It is reported that the work returned a profit in the early stages, but as the workings were advanced and the overburden increased to 50 or 60 feet, operation was no longer profitable.

Later the deposit was opened on the east side of the hill, where the distance to bedrock was less. A ditch was excavated in the serpentine bedrock at a heavy cost and a small concentrator was built, equipped with hydraulic classifiers and impact tables of the Wilfley type. The auriferous sand and gravel were excavated with a hydraulic giant and washed into sluice boxes containing riffles. Near the lower end of the sluice boxes an undercurrent took out the black sand and fine gold, which was delivered to the concentrator for treatment. The plant was operated for a short time, but did not prove profitable, and was finally abandoned after about 1½ acres of ground having an average depth of 8 to 10 feet had been washed.

In all, four samples (H–139 to H–142) were taken—two from the old and one from the recent workings. Samples H–139, H–140, and H–142 were barren; sample H–141 showed a gold and platinum content of 0.02 ounce a ton.

Sample H–139 was taken from the lowest bed in the old workings and represents a thickness of 6 feet. The upper 3½ feet is yellow, iron-stained sand; the lower 2½ feet is sand containing numerous streaks of black sand one-sixteenth to one-eighth inch wide; some large pebbles are scattered through the 6 feet of sand. The bed rests on a bed of coarse pebbles having an exposed thickness of 2 feet.

Sample H–140 was taken from a bed of slightly iron-stained coarse beach sand and represents a thickness of 6½ feet. The bed lies directly over the bed from which sample H–139 was obtained. It contains a few streaks of black sand, but on the whole is not promising.
Sample H–141 represents a bed of consolidated black sands 3 feet thick exposed in a prospect pit about one-fourth mile west of the old workings and at about 100 feet lower elevation. No work has been done at this point and the extent and thickness of the deposit is not known.

Sample H–142 was taken from an exposure of iron-stained sands in the more recent workings about one-fourth mile east of the old workings. The sample represents a thickness of $6\frac{1}{2}$ feet.

**JOSEPHINE COUNTY, OREG.**

**LOGAN MINE.**

What is perhaps the largest and most important placer mine in Josephine County, if not in southwestern Oregon, is known as the Logan. It is situated in the Waldo mining district, about 1 mile northeast of Waldo and some 40 miles from Grants Pass, Oreg.

The mine was actively worked for more than 25 years by the former owner, J. T. Logan. Recently it was acquired by John Esterly and associates, of Seattle, who operated the mine last season and are now actively engaged prospecting the ground with a Star power drill. (See Plate VI, A.)

The property embraces 1,285 acres of patented and 258 acres of unpatented land, lying partly in sections 10, 15, 16, 22, and 27, township 40 south, range 8 west. Also, the company owns three ditches known as the "upper," "middle," and "lower," together with three water rights to 500, 518, and 1,100 miner's inches from the east fork of the Illinois River. A view of the camp at this mine is shown in Plate VI, B.

The mine was opened in section 15 in what is known as Carroll Slough, where 30 to 50 acres were mined by hydraulic methods. The operations were in two separate stages: First, a bench 10 to 15 feet high was washed down to drainage level; later, a hydraulic elevator was installed and a second bench 15 to 20 feet thick was washed down to the sandstone bedrock. Both operations were reasonably profitable and mining was carried on continuously for a number of years, but as the workings advanced to the south the gold content decreased until the ground would no longer pay, when the work was suspended.

In recent years mining has been done in section 27 on what is known as French Flat, where 12 to 15 acres of ground has been mined.

Mining is by means of three hydraulic giants and a hydraulic elevator using water under a head of 200 to 300 feet. Two giants are employed in the pit to break down the auriferous sand and gravel, which is washed through 350 to 400 feet of sluice boxes and then
raised 35 to 40 feet by a hydraulic elevator having about 300 feet head. The elevator discharges into a line of tailing sluices about 400 feet long. Near the lower end an undercurrent removes the heavy sands and any fine gold and amalgam that may have escaped from the first line of sluices. The undercurrent discharges into a short line of sluices having their bottoms covered with burlap and expanded metal riffles. At the lower end of the tailing sluice the third giant stacks the coarse sand and gravel, the fine sand and silt being carried to waste through the main tailing race.

The main sluice boxes are equipped with various types of riffles, both wooden and steel.

The bed being mined is chiefly fine to coarse sand and clay, containing perhaps 10 to 15 per cent of pebbles seldom ranging above 6 inches in diameter, with a very small proportion of black sand and a little gold and platinum. The thickness varies from a few feet at the upper end of the workings to 15 to 20 feet at the lower end. The lower part of the bed is in most places firmly cemented and difficult to excavate. The quantity of black sand in the deposit probably does not exceed 0.1 per cent.

The bedrock is a purplish conglomerate which has been extensively fractured in all directions; many of the fractures extend into the beds above, showing that a movement took place after the conglomerate was deposited. It has been noted in mining that the richest pay streaks in the gravel are along the more prominent bedrock fractures. This seems to indicate that an enrichment by solution took place after the deposition of the beds.

The gold is mostly fine and in thin flat scales, but occasionally some of the gold is coarse. The gold content varies in different parts of the deposit, but probably averages 20 to 25 cents a cubic yard.

According to Mr. Logan, who has had many years' experience in placer mining in this locality, the platinum is present in a ratio to the gold of about 1 to 100. In his opinion there is not a placer mine in Josephine County or southwestern Oregon that will repay work for its platinum content alone.

The working season lasts seven to eight months, from November to June. During this period 150,000 to 200,000 yards of material are mined.

**OSGOOD MINE.**

The Osgood mine, also known as the High Gravel mine, is situated 1 mile south of Waldo, at the head of Allens Gulch. The workings are on the flanks of a north-south ridge at an elevation of
A. PROSPECTING WITH STAR POWER DRILL, LOGAN PLACERS, JOSEPHINE COUNTY, OREG.

B. ESTERLY CAMP, LOGAN PLACERS, NEAR WALDO, OREG.
A. OSGOOD PLACER MINE, TAKILMA, JOSEPHINE COUNTY, OREG.

B. BLACK-SAND CONCENTRATOR, CRESCENT CITY, DEL NORTE COUNTY, CAL.
about 1,800 feet above sea level, and about 300 feet higher than the valley of the Illinois River.

The mining property embraces 40 acres of patented placer ground and 636 acres of land held by mineral location, lying in sections 33 and 34, T. 40 S., R. 8 W. In addition, the company owns a high-line ditch and a right to take water from the east fork of the Illinois River.

The mine has been opened along both sides of the ridge. The principal workings are on the east side of the ridge, where several acres have been mined. On the west side the workings extend for 500 to 600 feet parallel with the ridge, and have an average width of about 150 feet. Plate VII, A shows a view in the workings on the east side of the ridge.

At the top of the ridge is a bed of gravel 25 to 30 feet thick, firmly cemented by reddish clayey material. Beneath this bed is a bed of purplish conglomerate 30 to 35 feet thick, consisting of gravel and bowlders ranging in diameter from the size of a marble to 8 or 10 inches. The conglomerate rests on a bedrock of highly altered greenstone. The gravel and conglomerate beds represent a comparatively small area that has escaped erosion, and do not extend very far down the slope.

The bedrock shows evidence of extensive fracturing and faulting, which extends into the conglomerate and gravel beds above. Also it contains innumerable small veinlets, ramifying in all directions, many of which are filled with quartz.

In many places the bedrock is decomposed and iron stained to a depth of 2 to 10 feet. This dark iron-stained material resembles impure hematite, and is reported to carry both gold and platinum. A sample taken by the writer and panned showed no evidence of either gold or platinum.

The best gold values are found on or near the bedrock, but some gold is distributed throughout the entire mass of conglomerate and gravel. It has been noted that the greatest enrichment is along the trend of the principal fractures.

The mine has been worked for the past three or four years under lease to Mr. Logan, who says that the ratio of platinum to gold is about 1 to 75. The gravel and conglomerate beds are mined by means of a hydraulic giant. In many places the beds have to be drilled and blasted in order to loosen them. The excavated material is washed through 200 to 250 feet of sluice boxes containing riffles where the gold and platinum, with a small quantity of black sands, are recovered. The mining costs are necessarily high.

Four samples (H–143 to H–146) were taken for assay which gave the following results: H–143 showed 0.7 ounce gold and 0.04 ounce
platinum a ton; H-144 and H-145 were barren; H-146 showed a
gold and platinum content of 0.04 ounce a ton.
Sample H-143 was black-sand concentrate from the sluice boxes.
No data were available showing the degree of concentration.
Sample H-144 was decomposed and iron-stained bedrock reported
to contain gold and platinum.
Sample H-145 represents cemented gravel lying directly on the
greenstone bedrock.
Sample H-146 was taken from the cement conglomerate at a
point about 25 feet above bedrock.

DEEP GRAVEL MINE.

The Deep Gravel mine is situated 1 mile north of Waldo, Oreg.,
and extends from the head of Butcher Gulch 1\(\frac{1}{2}\) miles northwest to
the west fork of the Illinois River.
The holdings of the company include 350 acres of patented placer
land, and 410 acres of land held by mineral location, in sections 20,
21, and 28, T. 40 S., R. 8 W., and also a water right to take 2,800
miner’s inches from the east fork of the Illinois River at a point
about \(\frac{1}{4}\) mile above Takilma.
The principal workings are at the head of Butcher Gulch, but
there are also important workings in Joe Smith, Little, Deer Lick,
and China Gulches, which are tributary to Butcher Gulch.
The gravel beds at the upper end of the main gulch, where recent
work has been done, range from 50 to 65 feet thick, measured to
bedrock; they have an upper bench about 25 to 30 feet thick and a
lower bench 25 to 35 feet thick. At the lower end of the gulch the
gravel varies from 100 to 135 feet thick.
In the recent workings at the head of the gulch the bedrock, where
exposed, is in some places soft, fine-grained sandstone and in others
is shale. In the workings in Joe Smith Gulch the bedrock is a
purplish conglomerate similar to the conglomerate in the Logan
mine.
In the early mining only the upper gravel lying above the drain-
age level was worked. In more recent times an attempt has been
made to work the lower bench with a hydraulic elevator, but with in-
different success, because of the insufficient head of water and the
clayey, cemented character of the ground.
Some years ago an attempt was made to work the gravel at the
lower end of gulch by sinking a shaft 135 feet deep to bedrock, and
then mining the gravel by drifts and stopes. Several hundred feet
of underground workings were driven and a considerable quantity of
gravel mined and treated. Owing to the low gold content and the
high cost of mining the work was unprofitable.
A. DEEP GRAVEL MINE, WALDO, JOSEPHINE COUNTY, OREG.

B. ANOTHER VIEW IN DEEP GRAVEL MINE, JOSEPHINE COUNTY, OREG.
A number of samples were taken from the lower bench in the recent workings (see Plate VIII) by the writer and panned by R. H. Clark, mining engineer, of Takilma, Oreg. Judging from the results obtained, the gold is fine and is not uniformly distributed but is confined to two bands of fine sand and gravel, one on the bedrock and the other about 8 feet above.

In only one panning was platinum recognized, and that was confined to a single color.

A section of the bed at the place sampled is as follows:

Section of bed where sampled.

<table>
<thead>
<tr>
<th>Thickness, Ft. in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine gravel and clay (no colors)--------------------- 4 9</td>
</tr>
<tr>
<td>Fine gravel sand, and clay (two small gold colors)----- 6 0</td>
</tr>
<tr>
<td>Bluish clay with some fine gravel (no colors)---------- 3 6</td>
</tr>
<tr>
<td>Coarse to fine gravel (10 large and small gold colors) 3 0</td>
</tr>
<tr>
<td>Clay and some fine sand (3 small gold colors, 1 platinum) 2 6</td>
</tr>
<tr>
<td>Coarse and fine gravel, some clay (15 large gold colors) 4 8</td>
</tr>
</tbody>
</table>

Total thickness --------------------------------- 24 5
Bedrock (no colors).

BEACH EAST OF CRESCENT CITY, CAL.

The Ore Del Norte Co. was organized by San Francisco parties about 7 or 8 years ago to work a black-sand deposit in the beach, near shore line, about 2 miles east of Crescent City, Del Norte County, Cal.

The management of the company was under the direction of T. R. Heintz, who was also engineer and metallurgist for the company. He designed and built an elaborate plant (see Pl. VII, B) to excavate and treat 70 acres of ground, owned by the company, containing black sands supposed to carry workable quantities of both gold and platinum. Mr. Heintz had a secret process for recovering the gold and platinum, and proposed to utilize the black sand for the useful minerals it contained.

The plant was designed to dig the sand by means of a drag-line excavator, at first the Bagley and later the Weeks type being used. The excavator delivered the material to a bin at the head of the plant, whence the material was hoisted by a bucket elevator to the top of the building, and passed through a revolving screen, where the coarse sand and gravel were removed. The screened product was discharged into a hydraulic classifier, from which the pulp was fed to a series of troughlike, stationary tables about 20 feet long and 2 1/2 feet wide. These tables were fitted with a special plate, the composition of which was kept secret. From the tables the material went to dewaterers and then to a series of electric plates. The deposit is a fine, gray,
beach sand containing thin bands of black sand, with a little beach gravel. The quantity of black sand in the deposit probably does not exceed 3 to 5 per cent. No attempt was made to prospect the ground to determine its gold content before the plant was built. Later a small amount of prospecting was done, with what results could not be learned.

After experimenting for nearly two years and spending more than $100,000, the company abandoned the undertaking as a complete failure.

At the time of the writer's visit the plant was practically dismantled. No clear conception could be gained of how the plant was supposed to work; seemingly it had been a complicated affair.

A sample (H-147) taken from the bank of the old pit gave negative results for both gold and platinum.

**ELECTRIC SMELTING EXPERIMENT.**

While in Marshfield, Oreg., the writer, in cooperation with Mr. J. D. Mereen, who has constructed a small experimental furnace, undertook to smelt some consolidated black sand from the land of M. J. Mathews, near South Slough, without any preliminary treatment except crushing.

About 50 pounds of the material was crushed to 10 to 20 mesh and mixed with 10 to 1½ pounds of pulverized coke. This charge was introduced into the furnace without previously heating the furnace. A direct current of 600 amperes at 110 volts was turned on, but as soon as the charge began to get hot there was great difficulty in regulating the current, which could not be increased above 800 amperes with safety. Consequently, to regulate it the electrode had to be frequently raised, with the result that the arc was soon on top of the charge and no smelting action could be obtained. After running the furnace for about two and a half hours without positive results, the experiment was discontinued.

Later Mr. Mereen repeated the experiment with some variation in the charge and reports that from 60 pounds of the black sand he obtained 15 pounds of a ferro-alloy.

A sample of this alloy was submitted to the Seattle station for examination and an approximate analysis was made, which gave the following results:

*Results of analysis of ferro-alloy from black sand.*

<table>
<thead>
<tr>
<th>Element</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron (Fe)</td>
<td>30 to 35</td>
</tr>
<tr>
<td>Titanium (Ti)</td>
<td>12 to 15</td>
</tr>
<tr>
<td>Chromium (Cr)</td>
<td>7 to 8</td>
</tr>
<tr>
<td>Silicon (Si)</td>
<td>30 to 40</td>
</tr>
</tbody>
</table>
The alloy contained some inclosed slag; it had a bronze color and a peculiar arsenical odor.

F. C. Ryan, electrometallurgist connected with the Seattle station, pronounced the alloy to be a ferrosilicon, containing titanium and chromium that in its present form would not, it is thought, have any commercial value.

CONCLUSIONS.

The results of the investigation may be summarized by the statement that in general the black-sand deposits are disappointing in both value and quantity; they rarely contain enough gold and platinum or occur in adequate quantity to be exploited at a profit.

There are, it is true, a few favored places where small areas of the black sand show some precious-metal content, and these may become the site of small operations. The deposits in many places contain appreciable amounts of magnetite, chromite, and ilmenite, but these minerals are generally too scattered and too poor to constitute an important source of iron ore, especially in competition with the known deposits of magnetite on the Pacific coast.

The chief difficulties in the profitable exploitation of these deposits are: First, lack of uniformity in occurrence and metallic content; and, second, the high cost of mining and treating the materials.

MINERALOGICAL COMPOSITION OF BLACK SAND CONCENTRATES FROM CRESCENT CITY, CAL.

Concentrates from chromite-bearing beach sands from near Crescent City, Cal., were carefully examined by F. B. Laney, of the Bureau of Mines, for their mineralogical composition. Most of the chromite had been removed previously; the remaining minerals in the concentrate were as follows in the order of their abundance: Zircon, magnetite, quartz, ilmenite, chromite, garnet, monazite, olivine, apatite, picotite, rutile, and corundum.

Mr. Laney's notes on these minerals are as follows:

The most abundant mineral in the nonmagnetic concentrates is zircon (ZrSiO₄), which crystallizes in the tetragonal system, generally as stout tetragonal prisms terminated by well-defined pyramids; many of the prisms are much elongated and the terminating pyramids may be complicated. The mineral also occurs in irregular forms and grains. Zircon is a common accessory mineral in many types of igneous rocks, forming minute, more or less well-formed prismatic crystals, usually with pyramidal terminations. The mineral is slightly harder than quartz (H. = 7.5) and has a rather high specific gravity (sp. g. = 4.68 to 4.70). As an accessory rock-making mineral it is usually colorless or nearly so, but is often pale yellow, gray, greenish yellow, brown yellow, and reddish brown. Because of their high index of refraction,
the minute crystals have exceptional brilliance, and sparkle almost like little diamonds. This brilliancy with the high specific gravity and the crystal form serves to distinguish the mineral from the other transparent minerals with which it is associated.

**Magnetite.**

The most abundant of the black minerals in the material studied is magnetite (Fe₃O₄), which is easily recognized by its being attracted by a magnet. In sands similar to these, the magnetite present usually contains varying amounts of titanium dioxide and is therefore of doubtful value as an ore of iron.

**Quartz.**

All concentrates made by tableing or panning black sands usually contain a little quartz, which may be distinguished from zircon by its lack of brilliance and by its being in fragments rather than in minute crystals.

**Ilmenite.**

Next in abundance to magnetite in the material examined is ilmenite (FeTiO₃). In color and general appearance ilmenite resembles magnetite, but differs in crystal form and is not magnetic.

**Chromite.**

Most of the black minerals examined are nonmagnetic, but an appreciable proportion of the magnetic material examined is chromite. The chromite noted is mostly in more or less well-defined octahedral crystals and has an unusually brilliant, glossy black color, which serves well to distinguish it from the other dark minerals.

**Garnet.**

All the nonmagnetic concentrates contain a small proportion of garnet, which is recognized easily by its pink or red color and by the irregular shape of the grains.

**Monazite.**

The nonmagnetic concentrates contain a small proportion of monazite, an anhydrous phosphate of the rare earth metals cerium, lanthanum, and didymium; it always contains varying amounts of thorium and silica, and smaller amounts of other rare earths, iron, manganese, magnesia, and lime. The mineral crystallizes in the monoclinic system, is brittle, has a specific gravity of 4.9 to 5.3 and a hardness of 5 to 5.5. It is subtranslucent to subtransparent, and its color varies from light yellow to reddish, brownish, or greenish yellow with a resinous luster. In some crystals the color is gray, brownish, or greenish gray, or deep reddish brown.

Monazite is an accessory mineral in granites, diorites, syenites, pegmatites, and metamorphic rock derived from them, in which it usually occurs as small, generally well-formed crystals or grains. Being extremely resistant to weathering, monazite remains in the sands with other resistant minerals after the parent rock has completely decomposed. Hence the world's supply of
monazite is taken from placers in regions where such rocks occur. The commercial value of monazite depends on its thoria (ThO₂) content, which varies from a trace to more than 6 per cent. In such small quantities as in the material submitted for examination monazite probably has no commercial value.

The mineral is slightly magnetic, and can be removed from the concentrates examined by a powerful electromagnet after the other more highly magnetic minerals, such as iron ore, garnet, etc., have been removed by weaker magnets.

OLIVINE.

A few grains of a dark green or olive green mineral that seemed to be olivine were found in the nonmagnetic concentrates and tailings.

APATITE.

A few grains of apatite were seen in the nonmagnetic material examined. These grains were transparent to subtranslucent and ranged in color from colorless to light grayish, greenish, or reddish brown. The mineral, a phosphate of lime, is of no value.

PICOTITE.

A few grains of picotite, the chrome spinel, occur in the concentrates; it closely resembles chromite in color and physical properties, and has no commercial importance.

RUTILE.

A small amount of rutile was noticed in the nonmagnetic concentrate. This mineral has a metallic to adamantine luster and usually a brown to reddish brown, rarely grayish, color. In such small quantities, as in these sands, it is worthless.

CORUNDUM.

A few grains of a colorless bluish, greenish, and reddish or pink mineral, having, so far as determined, the physical and optical properties of corundum, were noticed in the nonmagnetic concentrates. In such small quantities the mineral is of no value.

PRECIOUS METALS.

A few specks of gold and platinum (?) were noted in the material. Far more of the platinum-like metal than was present in the samples studied is necessary to determine its character.

CONCLUSIONS.

So far as a definite conclusion can be drawn from the material studied, the residues are of no commercial value. If any sands containing appreciable amounts of monazite are found, means for saving that mineral will deserve notice.

Appreciable amounts of chromite are present in all the material, especially in the nonmagnetic concentrates in which practically all the black mineral is chromite.
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PUBLICATIONS ON METAL MINING.

A limited supply of the following publications of the Bureau of Mines has been printed and is available for free distribution until the edition is exhausted. Requests for all publications can not be granted, and to insure equitable distribution applicants are requested to limit their selection to publications that may be of especial interest. Requests for publications should be addressed to the Director, Bureau of Mines.

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PUBLICATIONS AVAILABLE FOR FREE DISTRIBUTION.

BULLETIN 48. The selection of explosives used in engineering and mining operations, by Clarence Hall and S. P. Howell. 1914. 50 pp., 3 pls., 7 figs.

BULLETIN 57. Safety and efficiency in mine tunneling, by D. W. Brunton and J. A. Davis. 1914. 271 pp., 6 pls., 45 figs.

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