

VOLUME 2

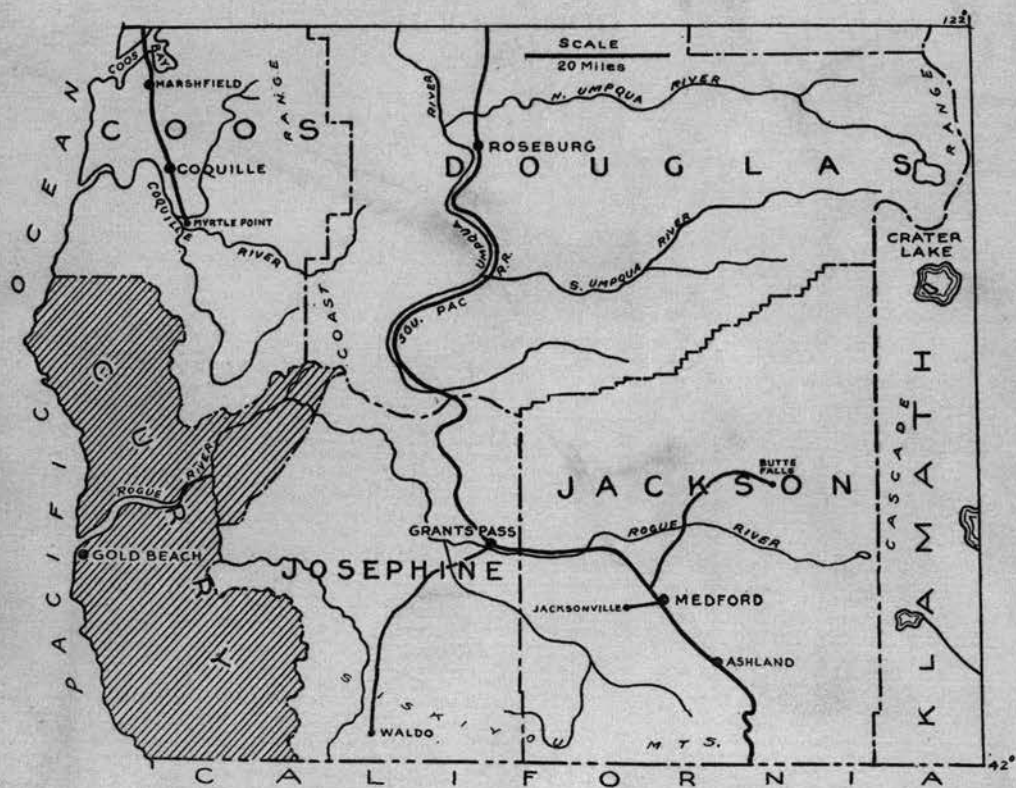
NUMBER 2

OCTOBER, 1916

# THE MINERAL RESOURCES OF OREGON

Published Monthly By

The Oregon Bureau of Mines and Geology



Sketch Map Showing Location of Curry County

## Preliminary Survey of the Geology and Mineral Resources of Curry County, Oregon

By G. M. BUTLER and G. J. MITCHELL

136 Pages

41 Illustrations

Entered as second class matter at Corvallis, Ore. on Feb. 10, 1914, according to the Act of Aug. 24, 1912.

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Volume 2

Number 2

October Issue

of the

# MINERAL RESOURCES OF OREGON

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CONTAINING

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Resources of Curry County, Oregon

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1916

### ANNOUNCEMENT

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The present (October) issue of the Mineral Resources of Oregon constitutes the second number for the year 1916. It treats of the resources of a section of the state concerning which there has been heretofore but little information available.

Two more issues of this journal will be published in the present year. One of these will be a descriptive handbook or directory of the mining companies, mines and prospects in Oregon. The other will comprise an illustrated geologic explanation of the scenic features of the gorge of the Columbia river through the Cascade Range, semi-popularly interpreted from the celebrated Columbia River Highway.



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VOLUME II

NUMBER 2

OCTOBER, 1916

# THE MINERAL RESOURCES OF OREGON

*A Periodical Devoted to the Development  
of all her Minerals*

PUBLISHED MONTHLY AT CORVALLIS BY  
THE OREGON BUREAU OF MINES AND GEOLOGY  
H. M. PARKS, Director

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## PRELIMINARY SURVEY OF THE GEOLOGY AND MINERAL RESOURCES OF CURRY COUNTY, OREGON

By G. M. BUTLER and G. J. MITCHELL.

### INTRODUCTION

The ensuing report has been prepared from data obtained by the writers in the employ of the Oregon Bureau of Mines and Geology during the summer of 1915. The field party consisted of G. Montague Butler of the Department of Geology, Oregon Agricultural College in charge; G. J. Mitchell, Department of Geology in the University of Oregon, and Harry B. Hillis, guide, of Powers, Oregon. Mr. Butler paid especial attention to the ore deposits and economic features of the region covered and Mr. Mitchell more particularly to the areal geology.

The area assigned to the party included all of Curry county and an effort was made to cover this territory as well as could possibly be done in the time available. It was soon recognized, however, that the time was too limited to permit even a cursory examination of the whole of the county. Since the United States Geological Survey has already published a folio dealing with the resources of the northern portion of the county, it was decided to concentrate

attention to a considerable extent on that portion south of Rogue river.

The first locality visited was the Mule creek district, and from here the course of the party was about as follows: Shasta Costa copper district, Agness district, Boulder Placer creek district, Rock creek district (Coos county), Wake-Up-Riley iron district, Dry lake, Pebble Hill copper mine, Frank Fry's ranch on the Illinois, Frank Berry's ranch on Lawson creek, Frank Berry's upper camp on the divide between Lawson and Horse Sign creeks, Burt camp south of Horse Sign butte, Collier creek camp, Sourdough camp, Meadow camp near the head of Collier creek, Craggie camp southwest of the big Craggies, junction of Miss Latney creek and Chetco river, Harbor, unnamed camp a little west of the junction of Smith river and Baldface creek, summit Mount Emny, Lone ranch borax mine, R. C. Walker's ranch near mouth of Pistol river, Gold Beach, McKinley copper district, MacGrubbe ranger station near Elk river, Port Orford, mouth Sixes river, south fork Sixes river, Barklow ranch, Powers, Johnson mountain chrome-iron district.

The localities just named represent camping places, but do not, perhaps, give a proper idea of the territory covered, as horse-back and foot trips were taken from these as centers to distances of as much as 10 miles. It is believed that all of the most promising mineral-bearing areas in the county were visited, excepting those in and around Gold Basin, in the southwestern part of the county.

Great difficulty was experienced through the lack of reliable



Fig. 2. A portion of Gold Beach, the county seat of Curry county

maps. The few available were found incorrect in many details, and it was impossible to rely upon many of the trails indicated thereon. In fact it would have been almost impossible to satisfactorily follow the route selected without the willing assistance and cooperation of prospectors and others met in the field during the course of the investigation.

Owing to the large area involved, a lack of suitable base maps, difficulty of transportation, and other factors, it was found impossible to make the examination anything more than a reconnaissance. There was not sufficient time for a detailed examination of any district, and the conclusions herein expressed must necessarily be regarded as tentative. The aim of the whole investigation was to ascertain whether any promising mineralized areas exist in the county, and to corroborate or disprove reports concerning various deposits that have come with increasing frequency from prospectors and others. It was at first hoped that a rather detailed description of the petrography of the county might be included in this report, and many specimens were gathered with this end in view. This plan later proved impracticable for a general report such as this is, so few microscopic thin slides were made or studied. The very great diversity in and common fineness of grain of the igneous rocks encountered, and the consequent uncertainty in their detailed classification, have made it necessary to group rocks probably quite distinct under general family names, such as greenstone, and has been one reason for the subordination of all questions of geologic theory to economic considerations.

#### ACKNOWLEDGMENTS

Mr. Frank Berry who lives near the mouth of Lawson creek spent 11 days in the field and Mr. M. C. Woods of Harbor and A. M. Collins of Agness, each donated several days' time in the capacity of guides for the party. In addition to the gentlemen named, there were many others who extended aid in various ways. One of the pleasant memories of the summer will be the uniform cordiality with which the party was greeted by every one encountered during the course of the trip.

The reports of J. S. Diller<sup>1</sup> were found extremely useful and many quotations therefrom will be found in the following pages.

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<sup>1</sup> U. S. Geol. Surv. Folio No. 89 and Bul. No. 546.



## HISTORY, GEOGRAPHY, TOPOGRAPHY AND CULTURAL FEATURES

*History.* The first settlement in Curry county was made by nine men under J. M. Kirkpatrick in June, 1851, at Port Orford. These men were, however, attacked by the Indians and forced to flee to the northward, reaching settlers at the mouth of the Umpqua on the 8th day after their flight commenced. Captain William Tichenor of the *Sea Gull*, who had brought this party to Port Orford, returned to San Francisco after their apparent establishment there and gathered forty men with whom to reinforce those he believed to be already settled at Port Orford. The second party arrived on the 23rd of June, and the town was then firmly established. Information concerning the date of the establishment of Gold Beach was sought unsuccessfully, but it is known that this town was formerly called Ellensburg, and was selected as the county seat in 1858. Six years earlier than this, gold had been discovered on the beach, and near the mouth of Whisky Run at Port Orford, and in 1856 a mining town called Elizabeth had sprung up thirty miles south of Port Orford. This name is no longer found on any map. The county was named after Governor George L. Curry, and was organized December 18, 1855. Indian wars occupied the attention of the settlers from 1851 to 1853, and during 1855 and 1856. Since that period, the history of the county has been an uneventful one.

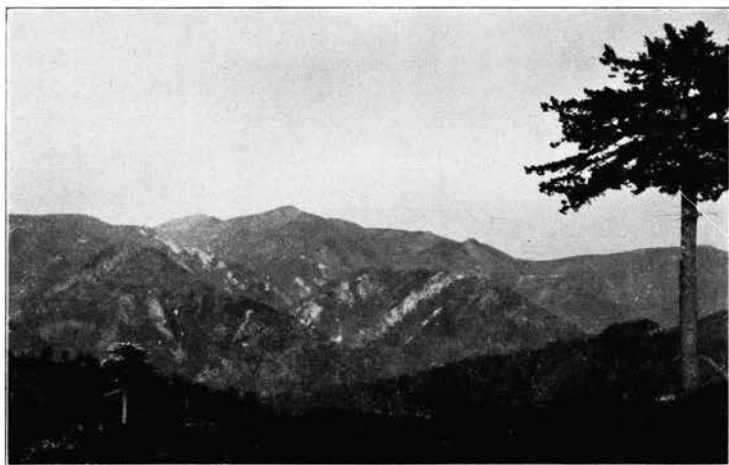


Fig. 3. Big Craggy from Sourdough camp

*Geography.* Curry county lies in the extreme southwestern corner of the state of Oregon, is bounded on the south by the state of California, on the west by the Pacific Ocean, on the north by Coos county, and on the east by Josephine county. Its length in a north-south direction is  $66\frac{1}{2}$  miles, and its greatest width about 36 miles, although the average width is considerably less than this. Its general configuration and the location of the principal streams, towns, and mountains can best be ascertained by referring to Figure 1, op. page 7.

*Topography.* Curry county is decidedly mountainous, in fact it is completely covered with mountain ridges and peaks, all of irregular contour. These mountains form a portion of the Coast Range. Although the altitude of the higher peaks seldom runs much above 3,500 feet, the bases of the mountains are often but a few hundred feet above sea level, and this makes the scenery quite bold and impressive. J. S. Diller<sup>1</sup> states that these mountains are the eroded remnants of an old plateau or peneplain which he calls the Klamath Plateau or Peneplain, and he cites<sup>2</sup> the comparatively even crest of Iron Mountain in the northern part of the county as a proof of this hypothesis. Although observation to the east and south seems to point to the likelihood of the former existence of such a plateau at an elevation of about 4,000 feet, very few evidences of the correctness of this supposition were found during the trip. Flat-top peaks are comparatively rare, and what even-crested ridges are found have altitudes much less than those of the peaks. The only sky-lines observed which strongly bore out Mr. Diller's theory were seen along the Oregon-California line. Erosive agencies seem elsewhere to have been so unusually effective that they have not only excavated deep valleys, but have also obliterated all traces of the Klamath plateau or peneplain.

Although mountains are perhaps the most striking topographic features in the county, the river valleys are decidedly interesting. As a usual thing they are narrow and show quite precipitous slopes near their bottoms; and in some cases where the rock structures are favorable, the streams flow through picturesque canyons or gorges. This is especially true of Rogue, Illinois, and Elk rivers. In the case of the first named, west of Mule creek the stream flows for several miles through a narrow, vertical-walled rock gorge, with sides

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<sup>1</sup> U. S. Geol. Surv. Bul. 546, p. 13, 1914.

<sup>2</sup> Idem.



Fig. 4. View southeast from Sourdough camp across a sea of fog. Photographed at 5:00 A. M.

some thirty feet high. Above this gorge is a rather flat bottomed valley a few hundred feet wide bounded by steep slopes a few hundred to a thousand feet high. The steep lower slopes wherever found usually give place rather suddenly, at varying distances above the water level, to gentler slopes rising to the crests of ridges or peaks. This gives most of the valleys a cross section similar to that shown in Figure 5. In explanation of this peculiarity, it may be said that the Klamath peneplain was probably originally a surface of gentle relief near sea level, and was subsequently raised so gradually as to permit of the erosion of broad, shallow valleys. One or more periods of sudden elevation then followed, and the rejuvenated streams cut rapidly downward to the bottom of the broad valleys, forming the steep sided valleys. A still more recent uplift has caused the development of the gorges.

The peculiarly shaped valleys resulting from the processes just

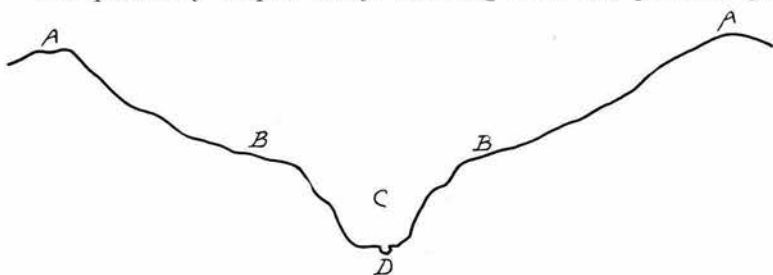


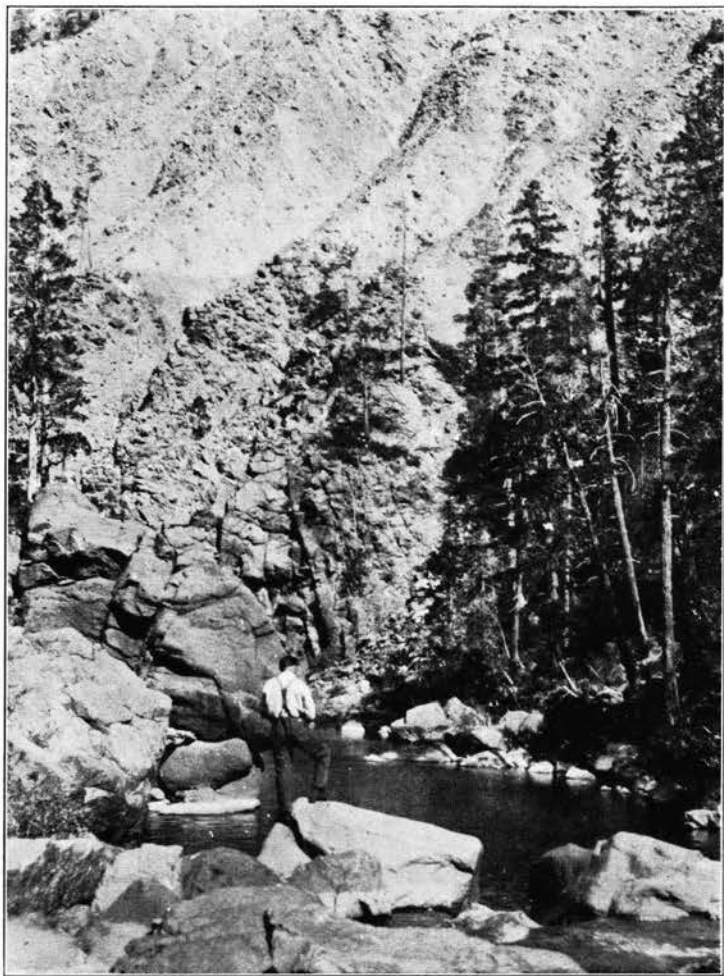
Fig. 5. Generalized cross-section of a typical Curry county river valley. A, mountain peaks; B, first river valley; C, second river valley; D, present gorge

outlined have been in some cases materially modified by landslides. These are not uncommon and have sometimes occurred on a very large scale especially in serpentine areas (see fig. 6).

A third feature of topographic interest is the coastal plain, and the marine terraces sometimes found adjacent to it. This plain varies from nothing up to about four miles wide, and usually lies at an elevation of one hundred feet or more above sea level. It reaches its maximum width and is best developed north of Port Orford, but narrower coastal plains exist elsewhere, especially south of Gold Beach. North of Port Orford, the mountains rarely slope uniformly down to the water's edge or to the coastal plain. Instead, the descent is interrupted by one or more steep slopes and flats or terraces. The former represent the remains of old sea-cliffs, and at their bases are sometimes found remnants of ancient beaches. The long, gentle slopes or flats are wave-cut terraces which were below sea level when the sea beat against the corresponding sea-cliffs. Such wave-cut terraces are now found at about 500, 1,000, and 1,500 feet above sea level, although the last is much less distinct than are the other two. The elevated ancient sea beaches are of economic interest as they are sometimes gold-bearing, as is the present beach.

*Cultural Features.* With the exception of a rather narrow strip along or close to the coast, and other still narrower areas along the streams, Curry county is an almost uninhabited wilderness. This condition is especially noticeable south of the Rogue river where there are several townships without a single permanent inhabitant, and many square miles without known trails. It is probable that the total population does not exceed 2,500 persons, and most of these are concentrated in the towns of Langlois, Port Orford, Wedderburn, Gold Beach, Brookings, Harbor, and Lakeport, along the coast.

All of the towns mentioned are connected by a fair to good wagon road, and roads also run for short distances up some of the larger streams, notably the Chetco river along which two roads have been built as far inland as the Moore ranch. Elsewhere, all travel must be done afoot or on horses over trails. Some of the trails, such as those used by mail carriers and the employees of the U. S. Forest Service, are in excellent condition, but the majority are so little used that they are difficult to follow, and in many places, almost impassable.



**Fig. 6. Bald Face creek, a tributary of Smith river. In the background is a great cliff of unweathered serpentine recently exposed by an enormous slide**

Second-growth timber and under-brush is so rapidly filling trails once well defined and easily traversed that it will not be long before many will be utterly unusable. Within the National Forest, main lines of communication are kept open, but there are, nevertheless, many square miles of virgin, almost jungle-like wilderness without



trails. This condition has greatly retarded prospecting and development of the country. In the old days it was customary to start a forest fire whenever it was desired to prospect a certain slope, and the country was kept comparatively clear by such means. With the creation of National Forests, such methods have become unlawful, yet no substitute for the drastic measures earlier employed has been suggested. It is not to be wondered at, then, that some prospectors feel much dissatisfaction with present conditions, and sometimes revert to old practices, especially when the ground which they wish to clear is covered with under-brush and scrub-growth of no value, yet so thick as to be impenetrable. The Forest Service has built some splendid trails, but at the present rate of work, it is improbable that a large part of the interior of the county will ever be opened up by such means. In fact, it is getting less and less accessible as time goes on. Whether the benefits accruing from timber protection overbalance the stagnation in development resulting from the presence of extensive areas of thick under-brush is a question that should receive careful consideration at an early date.

Most of the mountain slopes are heavily timbered with various species of conifers of which the most valuable are the Port Orford cedar and the redwood, the latter observed in two patches of considerable size near the California boundary.

The best farming land in the county is found on the coastal plain or terraces bordering the Pacific. The soil there is frequently sandy, but in some localities consists of a dark loam that is extremely productive. Good tillable soil is also found bordering some of the larger streams, and there are a few farms on the gentler slopes of the



Fig. 7. Cultivated coastal plain south of Harbor



**Fig. 8. Pistol river crossing coastal plain at its mouth. In the background is a sandspit such as exists at the mouths of most of the Curry county rivers**

mountains. The total amount of tillable land is, however, extremely limited, and distance from market and lack of transportation facilities are not conducive to much activity in agricultural lines.

One of the most important industries of Curry county is the salmon fishing in the Rogue river. Great quantities of these fish are caught every year, and canned by the Wedderburn Trading Company near the mouth of the Rogue. This cannery gives employment to many people residing in Wedderburn and Gold Beach.

It is doubtful if there are many other places in the country as



**Fig. 9. Port Orford cedar and rhododendron. The latter is often so thick as to make travel through it impossible unless cutting is done**

well stocked with game as is the interior of Curry county. On two or three days' trips from the main trails great numbers of deer were seen, and many of them were so tame that it is very doubtful if they ever before saw human beings. Black and brown bear and cougar are also fairly plentiful, and two or three elk were sighted. Most of the streams teem with trout; in fact, the region is a sportsman's paradise.

## GEOLOGY AND PETROLOGY

### GEOLOGIC HISTORY

The oldest geologic record left in Curry county is found in the Colebrooke schist, a body of highly schistose rock which was probably originally an argillaceous and sandy sediment laid down under the sea. Crustal movements followed the deposition of this material, crushing, folding, and finally uplifting it above sea-level. The age when this rock was deposited has not been determined, although evidences existing in Curry county prove it to be pre-Jurassic. Diller suggests<sup>1</sup> that it may be pre-Devonian, or Carboniferous, or even later. There is a possibility that it is the equivalent of the Abrams of Hershey.

Following the deformation and uplifting of the Colebrooke beds, occurred a period of erosion in which the waste derived from their disintegration was deposited in the bordering ocean. These clayey and sandy sediments were finally indurated, and now constitute the Dothan shale and sandstone. The period of deposition of these rocks has been placed as Jurassic by Diller, who has described<sup>2</sup> their occurrence in other sections of southwestern Oregon. The deposition of the Dothan beds was followed by another epoch of crustal movements which brought them above sea level and left them, in many places, in a highly tilted position.

Extensive erosion followed the uplifting of the Dothan, and the gravel, mud, and sand derived from the wearing down of the surface was deposited in the adjacent sea, to be later transformed into the Myrtle conglomerate, shale, and sandstone. The alternation of different types of sediments comprising the Myrtle suggests changes in the elevation of the land and the depth of the sea during that epoch.

<sup>1</sup> U. S. Geol. Surv. Bul. 546, p. 14, 1914.

<sup>2</sup> *Idem*, p. 17.



Fig. 10. In camp southwest of the Craggies

Fossils found on the trip, and mentioned later, prove that the Myrtle was deposited during the latter part of the Knoxville or Horsetown epochs of the Comanchean or Lower Cretaceous. Following the deposition of the Myrtle sediments, occurred a third epoch of deformation, which left the Cretaceous strata tilted to angles of 35 degrees or more, and raised them far above sea level. The forces which acted upon these later formed terranes doubtless acted also upon those beneath, hardening, crushing, shearing and folding them. At about the time of this third diastrophic movement and likely coincident with it, masses of igneous rocks, such as pyroxenite, and peridotite, which now may be altered to greenstones, were intruded into the Myrtle and earlier formed strata. This third deformation was the last severe one affecting the region. At its close, the surface was lifted well above sea level, and the streams engaged vigorously in their work of land-sculpture. The resulting products of erosion, consisting of gravel, sand and mud, were carried down into, and deposited in, shallow seas; and were later changed by pressure and cementation to the rocks which make up the Eocene system. Gentle folding of the Eocene beds indicates that slight crustal movements occurred at the close of this period, and this was doubtless accompanied by the elevation of the Eocene beds. Another epoch of erosion ensued, and Miocene beds were formed by the deposition of the waste products

in the sea. If these deposits were once widely distributed, they may have since been removed by erosion. It is not improbable, however, that the greatest part of this deposition occurred along the continental border beyond the present coast line. In any event, the only Miocene known to exist in the county occurs in two narrow strips, one about half a mile north of Blacklock Point, and the other extending south of Cape Blanco for three miles. After the Miocene period, continued erosion resulted in the formation of the gravel terraces of Pleistocene age, the terraces formed being the result of interruptions in the erosion cycle as previously explained. No further changes occurred until comparatively recent times, when the alluvium deposits formed, and still continue to form, bars and benches along the streams, and flats along the coastal plains.

The approximate distribution of the various geologic formations just mentioned, as well as of several types of igneous rocks, is indicated on Fig. 1. The delineation of the areal geology of the Port Orford quadrangle, in the northern half of the county, may be regarded as fairly accurate, since it is simply a generalization of the map prepared by the United States Geological Survey and published in Folio No. 89. Much of the mapping in the rest of the county, is, however, nothing but the roughest kind of an approximation, since the time available for gathering the desired data was too short to permit the running out of a single contact. Where contacts were encountered, the fact was noted on the rough base maps with which the party was provided; and considerable information could sometimes be secured, or guessed at, by observations from high peaks. Occasionally prospectors made statements concerning the nature of the rocks in regions not visited, and, when these appeared sufficiently reliable and definite to make it possible to interpret them in geologic terms with a fair degree of certainty, they were used in preparing the map.

It was found especially difficult to map the igneous rocks with any degree of satisfaction. In fact, nothing definite along this line could have been done without a good large-scale base map and extensive petrographic investigation. This is because of the wide variety of such rocks encountered and the small size of many of the masses. Where the map indicates the presence of a certain type of igneous rock, this should be understood to mean that it is the prevailing species found in the area involved. Where two masses petrol-



ogically identical were noted in areas not too far separated, it was always assumed that the same rock filled the intervening country; and this rule was extended so as to apply to quite widely separated outcrops if they were very extensive. In a geologic map prepared in the manner just outlined, accuracy in details should be expected by no one.

#### PETROLOGY

The petrology of Curry county is very interesting since representatives of each of the three great groups of rocks—sedimentary, igneous, and metamorphic—are to be found, and numerous varieties of each occur. In fact, a decidedly interesting monograph might be written on this subject alone, and such a paper may be prepared at some time in the future. As such a discussion would possess possibly greater theoretical than practical value, and would consume more time in its preparation than it seemed possible to give, it was decided not to include it in this report.

As indicated on Fig. 1, the sedimentary rocks, consisting of many varieties of sandstone, shale, and conglomerate, are prominent in the northern half of the county, along the coast, and in the southeastern corner of the area examined; while the igneous masses, which are almost entirely of intrusive character, outcrop in the northeastern corner along the Rogue river, and extend southward along the eastern border of the county as far as the Oregon-California line, and probably further. In addition, outcrops of igneous rocks, often numerous, and frequently of large size, can be found cutting through the other types of rock in nearly every township. The metamorphic rocks are confined chiefly to an irregularly shaped mass in the central part of the county, which extends from the latitude of Mussel creek and Lake of the Woods southward approximately to Pyramid peak. Another smaller mass of different nature occurs in West Craggy and northward to a point a little beyond Collier creek. Some small masses of metamorphosed sediments lie adjacent to masses of igneous rock. These were formed as a result of the heat and chemically active solutions given off by the cooling igneous mass with which the now metamorphosed material is in contact. The slaty Dothan shale on Mule creek is a fair example of this type of metamorphism. The slaty shale doubtless owes its hardness and other unusual characteristics to the intrusion of the rocks now greenstone with which it is in contact.

In the ensuing descriptions of the various types of rocks, the modes of occurrence, relations to other rocks, textures, and other megascopic features (those which can be determined by examination with a handlens and pocket knife) have been emphasized. In fact, practically all other data have been excluded, since it was felt that such a treatment would be best suited to the needs of those who will be most interested in this report, namely, prospectors and those developing prospects. In a few cases, microscopic examinations were made when the identity of specimens was unusually doubtful and exact data on this point seemed desirable. A full petrologic description of the rocks in the Port Orford quadrangle has been given<sup>1</sup> by Diller, so the information herein offered will refer especially to the rocks of the south half of the county and the strip in the northeastern portion along the Rogue river. While the formations and species there found do not usually differ materially from those to the northwest, some distinctive peculiarities were noticed which will be stated on the following pages.

#### SEDIMENTARY FORMATIONS

*Alluvium.* The alluvium is the loose, heterogeneous mixture of soil, sand and gravel that occurs along the rivers as bars and flood-plain deposits, and along the coast at the mouths of streams. This material varies in size from fine mud or silt to boulders several feet through. The fine-grained alluvium is very fertile, and is in some localities renewed whenever flood conditions prevail. As has already been mentioned, many of the streams flow through rather narrow, steep-walled valleys in which there is no opportunity for the formation of extensive deposits of alluvium. In some places where the rocks are comparatively soft and easily eroded or where other favorable conditions exist, fairly extensive alluvial flood-plains have developed. Notable deposits of this nature occur as bars at varying intervals along the Rogue river from Mule creek to the ocean. Good illustrations of these exist at Big Bend, about six miles up the river from Illahe, and at the mouth of the Illinois river. Others are found at the Fry ranch on the Illinois river, at Collier Bar, a flat covering several acres along the Illinois river a short distance below the mouth of Collier creek, near the head of the south fork of Sixes river, and elsewhere. Remnants of an old bar, now converted to a very hard

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<sup>1</sup> U. S. Geol. Surv. Folio 89, pp. 2-4, 1903.

conglomerate were found several hundred feet above the present stream bed on the northern side of Bald Face creek in the southern part of the county. Most of the other bars examined were less than a hundred feet above the valley bottoms.

Alluvial deposits, some of which cover large areas, occur along the coast at the mouths of all the larger streams, and constitute some of the best agricultural land in the county (see fig. 8, page 16). Although extensive deposits of alluvium along the valley bottoms are the exception rather than the rule, some of this material was found in nearly all the streams visited. This formation is of considerable economic interest since it is the usual source of placer gold, which is being recovered from it at Agness on the Rogue river and at the head of Boulder creek.

*Marine Sands and Gravels.* Sand and gravel deposits in the form of elevated beach terraces occur at many places along the coast where the deposits are more or less indurated, and vary in thickness from a few feet to approximately 80 feet. Good exposures of this material can be seen at Gold Beach in the road-cut just south of Rogue river, also on both sides of the Chetco river near the mouth, and at intervals all along the coast (see fig. 11, page 23).

These sands and gravels are of interest because of the occasional presence of gold and platinum in them. The age of these deposits has been determined as Pleistocene by Diller.<sup>1</sup>

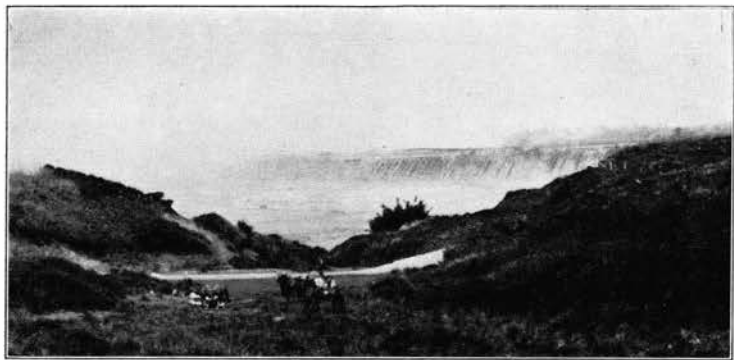
#### MIocene SYSTEM

Only two narrow strips of Miocene rocks occur in Curry county. They lie along the coast in the Port Orford quadrangle, and have been described by Diller in U. S. G. S., Folio No. 89 in the following way:

No rocks of Miocene age were found by our party in the previously unmapped portion of Curry county, and, if they ever had a

<sup>1</sup> U. S. Geol. Surv. Folio 89, p. 3, 1903.

The Empire formation is composed chiefly of sandstone with some conglomerate and shale, and a bed of volcanic dust. \* \* \* The strata are tilted southerly to an angle of 25 degrees, rest directly upon the Myrtle formation, and are overlain unconformably by marine sands of the coastal plain. Fossils are very abundant and, after an examination of a large number of them, Doctor W. H. Dall reports that the strata are Miocene and of the same age as the Empire formation of Coos Bay. Much of the formation has been washed away, but it probably never extended far inland along this portion of the coast. To the north, however, along Coos river and also near the Columbia, it reaches further inland.



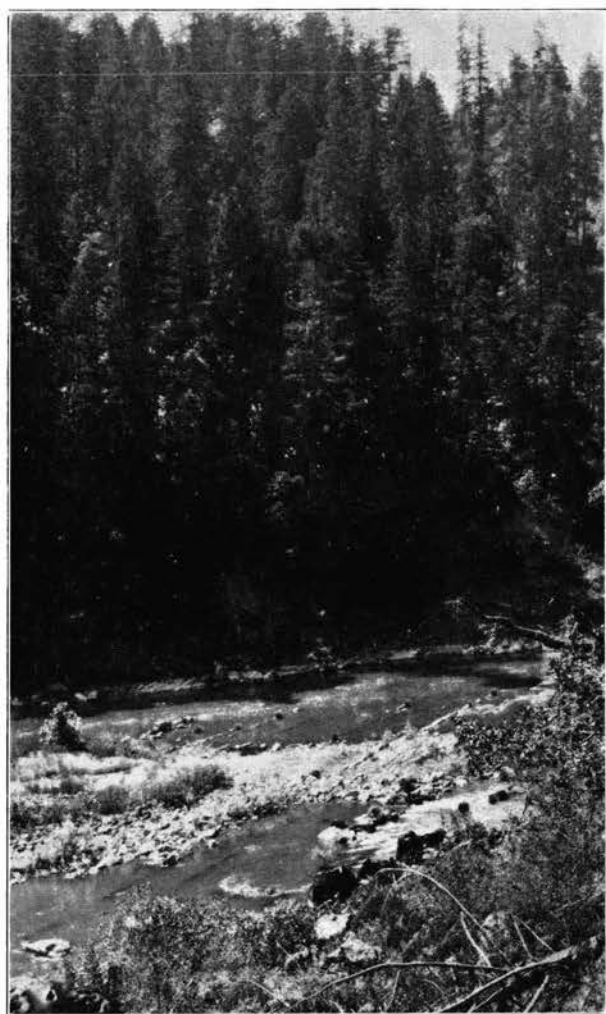
**Fig. 11. Highly inclined Eocene beds overlain by horizontal Pleistocene sands and gravels, between Pistol river and Gold Beach. (The haziness of this picture is due to fog which was blowing in from the ocean.)**

more wide-spread occurrence than noted above, erosion has removed them.

#### **EOCENE SYSTEM**

The Eocene rocks comprise conglomerate, shale, and sandstone. So far as noted, the conglomerate is confined to the base, and consists of pebbles averaging an inch or more in diameter, which are rather strongly cemented together. The thickness varies from nothing to several score feet, while the dip varies from 10 to 25 degrees, and is generally to the southeast or northwest. This bed forms the east wall of the Rogue river at the mouth of Shasta Costa creek, where it rests unconformably on the steeply dipping Myrtle (Lower Cretaceous) shale exposed just below the mouth of Shasta Costa creek in the south bank of the Rogue river, as well as elsewhere in the vicinity (see fig. 12, page 24). This conglomerate is liable to be confused with the Myrtle conglomerate described later, but in general it may be said to differ therefrom in that the pebbles average larger, a much greater proportion of them consists of quartz, and the unweathered conglomerate is somewhat less thoroughly indurated; also, no fossils were found in the basal Eocene conglomerate, while some were taken from the conglomerate at the base of the Myrtle.

The shale has a bluish-black color and is interbedded with sandstone which is gray when unweathered. Both of these rocks alter on exposure to yellowish, brittle, shaly matter, and to soft, crumbly, yellowish or brownish sandstone, respectively. Bedding planes are



**Fig. 12. Steeply inclined Myrtle beds exposed in the bed of Rogue river between Agness and Illahe**

well preserved and indicate dips as high as 35 degrees, but the tilting is generally less than this.

Fine exposures of the sandstone and shale occur on Foster creek from one to two miles above its junction with Rogue river. Here the interbedded character of these two materials is marked. The



beds are relatively thin, the sandstone being the thicker. The strata dip gently to the northwest, and the conglomerate appears below the shale and sandstone as the Rogue is approached. Other fine exposures occur along the Rogue river trail below Illahe where some fragments of leaves were found in the sandstone. The specimens were, however, so fragmental that their age could not be determined with certainty. They resemble closely those found in the shale and sandstone of Eden Ridge which have been classified as Eocene. These same beds outcrop very prominently on the east side of the Rogue river as well and were examined along Shasta Costa creek for a distance of over three miles from the mouth. A number of fossils were found in the sandstone along the trail up Shasta Costa creek about one hundred yards above the bridge, but they proved to have no determinative value. Large areas of Eocene rock, principally sandstone, were also found in the southwestern part of the county. These usually occur fairly close to the ocean, but along the Windchuck river the Eocene sandstone was found several miles inland.

From a body of Eocene sediments examined in the neighborhood of Eckley were secured two excellent specimens of *Venericarida planicosta*, a characteristic Eocene fossil.

The Eocene shales and sandstones are often very difficult to distinguish from the Myrtle (Lower Cretaceous) beds of the same nature unless the rocks are fossiliferous. This is especially true in the Rogue river section and south thereof. Northeast of there Diller<sup>1</sup> describes the Myrtle sandstone as having been generally so crushed as partially or wholly to obscure the bedding planes, and says that the shales are only local thin beds, but these features were not found elsewhere in the county, and could not be used in distinguishing the two horizons. The most distinctive characteristics of the Eocene beds were usually found to be a relatively flat dip and the complete lack of quartz veins or indications of crushing in the sandstone. The geologic position of the beds relative to an identifiable basal conglomerate was also sometimes found a useful criterion. Another peculiarity usable in the field is the usual lack of large igneous intrusions into or through the Eocene strata, while masses of such rocks commonly intersect Myrtle beds.

The Eocene system in Curry county is of special interest as it contains all the coal known to exist there. This feature will be discussed later.

<sup>1</sup> U. S. Geol. Surv. Folio 89, p. 2, 1903.

**LOWER CRETACEOUS (COMANCHEAN) SYSTEM**

Rocks of this age, known as the Myrtle formation, occupy a large portion of Curry county, but due chiefly to erosion and to the presence of igneous intrusions, they are not continuous over very large areas. Like all the sedimentary formations already described, the Myrtle formation comprises conglomerate, sandstone, and shale.

Conglomerate is much more common at or near the base of the formation than elsewhere; in fact, only basal conglomerate was found during the course of the investigation. This material is relatively fine-grained, since the component pebbles average less than an inch in diameter. Notable quantities of quartz and chert are present, and these pebbles are very strongly and compactly cemented together in the unweathered conglomerate. When fresh, the rock is white with a slightly pink tinge, and when disintegrated yields many whitish pebbles about the size of marbles. These often completely cover surfaces underlain by decomposing Myrtle conglomerate, and constitute a very striking and a characteristic feature of such outcrops, as at Pebble Hill, Horse Sign butte, and Bunker Hill.

Diller states<sup>1</sup> that the bivalve *Aucella crassicollis* characterizes the Myrtle conglomerate in the bluffs above the Rogue river below Agness. Although considerable time was spent hunting for fossils there, none were found. In fact, no fossils were found in the Myrtle until Butte creek was reached. This is a small stream rising in Horse Sign butte and flowing into the Illinois river. There, at a point about a mile southwest of Horse Sign butte, sandy layers in the Myrtle conglomerate yielded both *Aucella crassicollis* and *Aucella piochii*. These fossils were so numerous and well preserved that it seems unlikely that an error could have been made in identifying either form, yet the former is supposed to be older than the latter, and they are not reported to occur together elsewhere.

A fine exposure of the Myrtle sandstone occurs in Butte creek near the locality mentioned in the preceding paragraph. Here the rock is a hard, massive, grayish stone containing an appreciable number of quartz and calcite veinlets. Both *Aucella crassicollis* and *Aucella piochii* are found in this sandstone, as in the neighboring conglomerate.

The difficulty of distinguishing this Myrtle sandstone from the Eocene sandstone has already been mentioned, and the peculiar fea-

<sup>1</sup> U. S. Geol. Surv. Folio 89, p. 2, 1903.

tures of each indicated. Perhaps an even greater chance of confusion exists as regards the Myrtle and Dothan (Jurassic) sandstones, but it seems best to defer the discussion of the means used in distinguishing between these two until the later formation is described.

The Myrtle shale is nearly black in color when fresh, but weathers grayish or yellowish. It is very brittle, and sometimes somewhat slaty in structure. Good exposures occur in the fossil locality on Butte creek, but it outcrops even more prominently near the mouth of Lawson creek, on Rogue river in the vicinity of Agness, and below the Eocene conglomerate at the mouth of Shasta Costa creek. The beds are usually thin, and alternations of shale and sandstone similar to those found in the Eocene rocks are common from lower Foster creek southward. Elsewhere in the Port Orford quadrangle the shale is comparatively inconspicuous.

#### JURASSIC SYSTEM

The Jurassic rocks called by Diller<sup>1</sup> the Dothan formation consist, so far as observed, entirely of shale, sandstone, and chert. They are found in the region from Mule creek eastward as far as this survey extended (four miles), also they are very extensively developed in the southeastern corner of the county. In general, the shale seems subordinated to the sandstone so far as quantity is concerned, but in some places the former outcrops prominently. This is true on the east side of the bridge over Mule creek on the Rogue river trail, near the mouth of Miss Latney creek, and elsewhere. In the first mentioned locality, in contact with greenstone the shale has a pronounced slaty structure, and similar effects were noted in other areas where rock now serpentine or greenstone has intruded into the shale. In a few places, as near the mouth of Miss Latney creek, the shaly structure is not very evident, and the rock has been so hardened as to form almost an argillite. Here, also, the rock contains numerous calcite veinlets (see fig. 13, p. 28). The fresh shale is black in color, but becomes somewhat grayish or brownish on weathering; and surfaces where it outcrops are often covered with numerous, small, shiny plates or flakes.

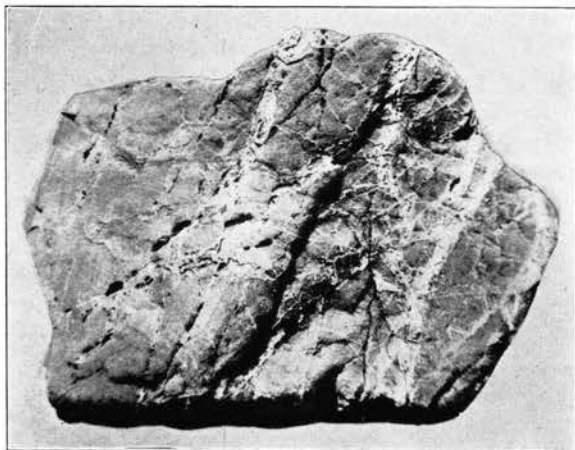
In general, it appears that the Dothan shale differs from the Myrtle shale in that it is apt to occur in thicker beds, to be harder (either slaty or argillitic), or, occasionally, to contain calcite veinlets.

<sup>1</sup> U. S. Geol. Surv. Bul. 546, p. 17, 1914.

The Dothan sandstone is extremely plentiful in many districts. Good exposures are found along the trail to Johnson butte via Cedar and Windy camps, and at a number of points south and west of there. This rock is also encountered on the Marial trail about two miles east of Mule creek where it occurs in fairly thick beds from which the large pieces now standing close to the trail have been broken.

The sandstone in the locality last named is very hard, and exposed surfaces have a grayish color. On fresh fractures the color is a darker shade of gray. Some fragments of black shale are present in this sandstone, but this is not characteristic of the Dothan material since the Myrtle sandstone often shows this feature also.

In the southern part of the county the color of the rock is usually gray on fresh surfaces, but brownish where exposed to the weather: and there it is frequently full of quartz veinlets. Some of this venation was noted east of Mule creek, but it is not nearly as common a feature as is the case further south. It is decidedly difficult to distinguish between hand specimens of Dothan and Myrtle sandstones. In the field, however, the following features were found to be useful criteria. First, the Dothan sandstone is apt to be more plentifully veined with quartz than is the Myrtle, although locally the latter may show as close venation as the average Dothan. Second, the Dothan sandstone is usually associated with less shale than the



**Fig. 13. Black Dothan argillite containing calcite veinlets from near the mouth of Miss Latney creek**

Myrtle, especially south and east of Rogue river. Where shale does occur in the Dothan it differs from the Myrtle shale in the manner already outlined. Third, south and east of Rogue river no chert was found associated with the Myrtle sandstone, although Diller says that very thin lenses of this material are found in many places in the Myrtle formation of the Port Orford quadrangle. Fourth, no conglomerate was noted in association with the Dothan sandstone, while this rock is not uncommon in the Myrtle formation, especially near the base.

The Dothan chert is a very hard, compact, fine-grained, flinty rock of red, green, white, yellow, or intermediate tints, that is composed almost entirely of quartz. When examined under a compound microscope the chert is seen to be made up of the remains of minute organisms such as now live in the ocean. This rock occurs in lens-like masses sometimes one hundred feet or more long and a score or more of feet thick, which outcrop very prominently due to the fact that they resist weathering better than the adjacent rocks. Splendid illustrations of this material occur at the so-called Marble Ledge a mile east of Marial, on the ridge west of Cedar camp, and elsewhere. This Dothan chert differs from the Myrtle chert occurring north

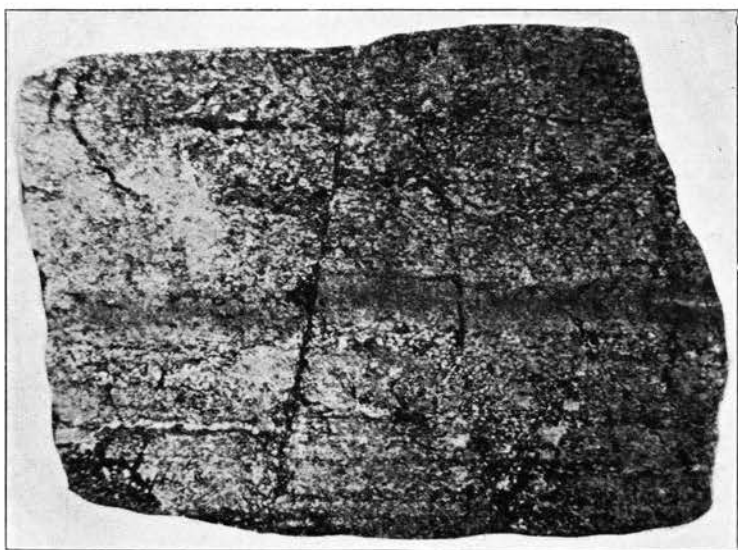


Fig. 14. Dothan sandstone showing a small fault, from the ridge east of Sugar Loaf mountain

of Elk river as described<sup>1</sup> by Diller in that it occurs in very large masses instead of in thin layers interbanded with other materials. The writer had no opportunity to examine these so-called Myrtle cherts, however, and cannot forbear suggesting the possibility that they are of Dothan age and that this may also be true of other portions of the Myrtle formations as mapped in the Port Orford quadrangle, a possibility which Diller himself suggests.<sup>2</sup>

The age of the Dothan formation has been placed by Diller<sup>3</sup> as Jurassic, and it is believed that it lies at about the same horizon as do the Mariposa slates of the California Mother Lode region. Diller recognizes two formations, the Dothan and the Galice, of the same age, which are separated by a mass of igneous rocks, but it was impossible to extend this two-fold classification to the region under consideration.

#### IGNEOUS ROCKS

*Greenstone.* The term greenstone as here used covers a rather extensive and varied series of rocks occurring usually, if not always, as intrusive masses. It seems almost certain that in a given area they are differentiation products of a single rock magma. By differentiation is meant the development of two or more kinds of material, differing more or less from each other, in a magma reservoir originally filled, perhaps, with homogeneous molten matter. The cause of this segregation of more or less unlike matter in different portions of the reservoir cannot be discussed here, but it is evident that, the process once having taken place, molten material issuing from different parts of the reservoir, or from the same part at different periods, may solidify as rocks of unlike, although in some respects allied, character.

In general, the greenstones are fine-grained. In fact it is customary to confine the use of this term to rocks so fine-grained that their constituents cannot be recognized without the use of thin sections. However, in this report, as well as in Diller's<sup>3</sup> covering adjacent areas, the term has been extended so as to include rocks of fairly coarse grain to which other terms might probably be ascribed. This was done because of the small size of many of the masses, and the frequent variation in texture found in large masses. These features make it impossible to map the igneous rocks under more

<sup>1</sup> U. S. Geol. Surv. Folio 89, p. 2, 1903.

<sup>2</sup> Idem.

<sup>3</sup> U. S. Geol. Surv. Bul. 546, p. 17, 1914.



specific names unless this can be done on a very large scale map and after detailed investigation. In Diller's report on the Port Orford quadrangle, the rock here designated greenstone is called gabbro.

As the term is commonly employed, greenstone refers, as is to be expected, to a rock with a greenish tinge due to the presence of chlorite or other greenish constituents; but the varieties herein included under this term vary from black to almost white in color. The species grouped under the name greenstone in this report include, then, diorite, gabbro, porphyrite, diabase, basalt, and perhaps others.

A large and important body of this rock occurs in the Mule creek district between Dothan shale and serpentine on the east, and Myrtle sandstone and serpentine on the west. An idealized section through this mass is shown in Figure 15, the material now exposed

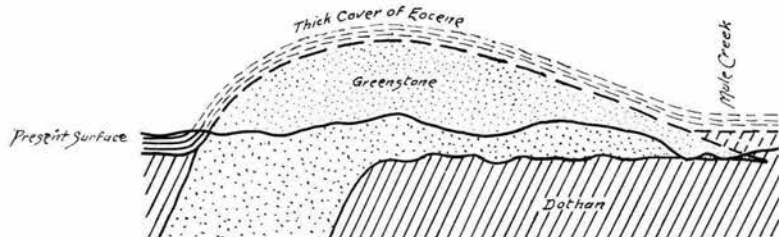
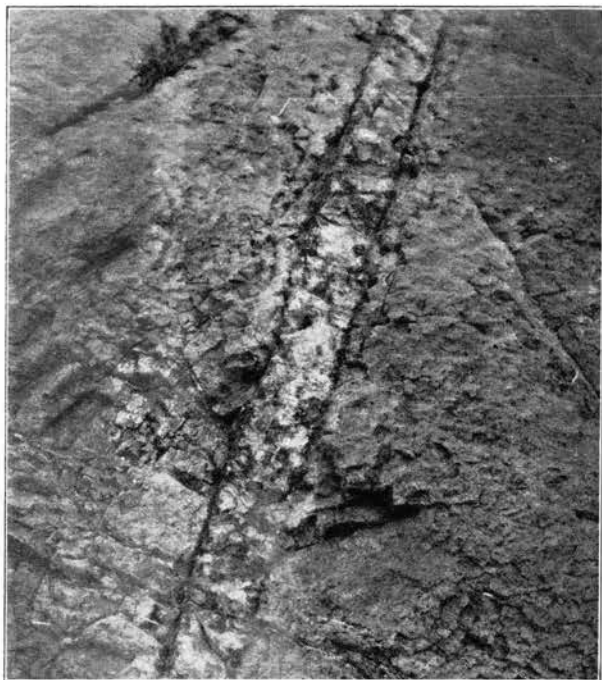


Fig. 15. Suggested section (idealized) through the greenstone intrusion west of Mule creek

being shown by solid lines, while the probable original conditions are indicated by broken lines. An intrusion of this type is known as a laccolith. Near the boundaries of this mass of greenstone, the material cooled rapidly and is fine-grained; while the rate of cooling in the interior was slower and this resulted in the formation of decidedly coarse-grained rocks. In some places, notably on the trail to the upper workings of the Mule mountain group of claims, the rock has been squeezed while still plastic and shows a decided gneissoid or layered structure. This large mass of greenstone is of especial interest because of the presence of gold-bearing quartz veins in it. Many other areas of greenstone occur in the county, as is indicated on Fig. 1. The common presence of gold veins in this rock in the Mule creek region and in Jackson county suggest the advisability of prospecting all such areas with care.

The age of the greenstone is certainly later than Lower Creta-



**Fig 16. Ten-inch vein of platy enstatite in peridotite on ridge west of Collier creek**

ceous, for it was found cutting the lower beds of the Myrtle formation two miles east of Horse Sign butte, and elsewhere.

*Peridotite.* Peridotite is a rather heavy, coarse-grained rock composed chiefly of olivine and pyroxene. In some places the former may be almost entirely lacking, and then the rock may, with greater propriety, be called pyroxenite. Occasionally some hornblende is present, and grains of chromite and magnetite are usually visible. The pyroxene is commonly either diallage or the orthorhombic variety known as bronzite or enstatite. It weathers much more slowly than the rest of the rock and occurs as scattered, dark-brown grains with a platy structure, which project from a lighter brown matrix. This makes the weathered surface very rough, and such material is known locally as "buck skin" rock. In some specimens of similar appearance, the projecting grains are made up of olivine instead of pyroxene. When freshly broken, these have a greenish color, an oily lustre, and are not platy in structure. This last described variety is also called

"buck skin" rock. It is really peridotite or peridotite-porphry, while the type first described should be called, at least in many cases, pyroxenite or pyroxenite-porphry.

Exposures of the "buck skin" rock are numerous in many parts of the county and are especially plentiful in the serpentine areas later mentioned. So common is this material, in fact, that it is difficult to select any one exposure as especially typical, but splendid illustrations of the features described are found all over the ridge between Smith river and Bald Face creek in the southern part of the county.

In some places the pyroxenite is cut by numerous veins of practically pure platy enstatite. These are usually only a fraction of an inch wide, but occasionally reach a thickness of as much as eight or ten inches. Figure 16 shows a good illustration of such a vein on the ridge west of Collier creek. The age of these rocks, so far as can be determined, is the same as that of the greenstone previously discussed.

*Dacite-Porphry.* This rock occurs, so far as noted, invariably in dikes, and is decidedly porphyritic, that is, it contains numerous fairly large and well formed crystals imbedded in a much finer grained groundmass. In this case, the crystals are mostly white plagioclase feldspar, although the hexagonal outlines of a few glassy quartz crystals are usually visible in a hand specimen. The groundmass is compact, of white or grayish color, and is so fine-grained that the constituents are unrecognizable with the unaided eye.

The largest outcrop of this rock noted occurs near the head of Rock creek in Coos county, near John R. Smith's property. Here, however, the porphyritic character is not nearly so plainly developed as elsewhere. As the dacite-porphry is here much harder than the surrounding rock, it has more strongly resisted erosion and outcrops in masses with dimensions running up to several scores of feet. Figure 17 shows one of these outcrops.

Two typical dikes of this rock were crossed on the trail from Sourdough mountain to Bunker hill, one about a mile south of Sourdough mountain, and the other one-half a mile north of Bunker hill. Another such dike or sill lies below the Myrtle conglomerate on the north side of Pebble hill. Several dikes of this material occur in the Collier creek district also, and Collier butte is capped with dacite-porphry. A few other occurrences were noted, but in general



**Fig. 17. Outcrop of dacite-porphyry west of Rock creek, Coos county**

it may be said that this rock is considerably scarcer than the other types already described.

The dacite-porphyry is younger than the serpentine and peridotite, since the dike a mile south of Sourdough mountain intersects both of these rocks. This dike dips  $70^{\circ}$  N. W. and strikes N.  $75^{\circ}$  E.

*Diorite.* Diorite has the general appearance of granite, but is composed largely of plagioclase, instead of orthoclase feldspar, contains little or no visible quartz, and the prominent dark colored mineral is hornblende. The feldspar occurs in slender, lath-shaped

grains which often show numerous parallel lines on fresh cleavage surfaces.

Although this is a comparatively rare rock in the area studied, good examples were found at the base of Collier butte, and in the Mule creek greenstone area; and a similar rock (called gabbro by Diller<sup>1</sup>) makes up most of Granite peak, a mile west of the Gold Slug placer claim on Boulder creek in the Port Orford quadrangle. This rock differs from that just described in that it contains considerable quartz visible to the unaided eye, which makes it more properly a quartz diorite. The diorite is probably of the same age as the greenstone discussed previously.

*Syenite porphyry.* This rock also looks considerably like granite. It contains much orthoclase feldspar and hornblende in grains of such size as to be plainly visible to the unaided eye. In fact, some of the rectangular orthoclase sections are over three-quarters of an inch long and an eighth of an inch wide. These, together with some large hornblende crystals, are imbedded in a fine-grained groundmass composed of hornblende and feldspar. This gives the rock a porphyritic texture. The lack of visible quartz is what distinguishes the syenite-porphyry from a granite or a granite-porphyry. The only occurrence of this rock noted is on Mount Emily, east of Harbor. There the rock under consideration is closely associated with a body of rhyolite. Considerable detailed field work will be required to determine the exact relation of these two species, but the impression gained in a hasty examination of the region was that the rhyolite occurs as a flow, while the syenite seems to have the form of a dike below the rhyolite flow.

*Rhyolite.* The rhyolite found in Curry county shows numerous, small, fairly well formed quartz crystals and a few small crystals of glassy orthoclase imbedded in an extremely fine-grained groundmass. The color varies from nearly white to gray, the last named tint being most commonly shown by weathered specimens.

Only four areas of this rock were noted, one being on Mount Emily, where the material has the appearance of a flow, as already mentioned under the discussion of syenite-porphyry. Other areas exist one mile north of Brookings, four miles north of that town, and about half way between Brookings and Pistol river along the main highway up the coast. The rock in the first of these areas is some-

<sup>1</sup> U. S. Geol. Surv. Folio 89, 1903.

what grayer than the Mount Emily rhyolite and contains flakes of graphite. It outcrops prominently as "stacks," which appear to be the eroded remnants of a fairly large northwesterly striking dike cutting through Eocene sediments. The second area just mentioned is similar to the first, but no graphite was noted in the rock. The third occurrence appears to be more extensive than the others, but it was impossible, because of limited time, to determine the geologic relationships of this mass. On exposed surfaces it alters readily to soft white material that has been used with indifferent success as road metal on the main highway for a distance of five or six miles.

In all the occurrences described, fairly well formed doubly-terminated quartz crystals are plentiful, and the existence of other points of resemblance leaves no room for doubt that the rock is the same in all the areas mentioned, even though they are somewhat widely separated.

The fact that the rhyolite is found cutting Eocene sediments in at least two localities along the coast makes it possible to fix its age as post-Eocene.

*Basalt.* A dark colored, fine-grained, unaltered rock was found along the trail from Frank Berry's cabin to Horse Sign butte. It occurs as a dike, and was classified in the field as basalt. The later examination of a thin section showed it to be composed chiefly of plagioclase feldspar and pyroxene, proving the correctness of the field classification. Other occurrences of this kind of rock in the northern part of the county are mentioned by Diller who states<sup>1</sup> that it becomes more and more numerous as the northern boundary of the county is approached, and that there the outcrops form "stack-like" ledges rising considerably above the general level. He also says that the mode of occurrence strongly suggests that these rock stacks are volcanic necks connected with larger masses of gabbro below. The age of the basalt is probably the same as that of the greenstone already discussed.

#### METAMORPHIC ROCKS

*Colebrooke schist.* This rock is fine-grained and has a decidedly schistose or platy structure. Muscovite (white mica) and quartz are the most plentiful constituents, and in most localities the material is a typical quartz-mica schist. Frequently, quantities of very fine-grained white mica (sericite) are present, giving the parting sur-

<sup>1</sup> U. S. Geol. Surv. Folio 89, p. 4, 1903.



faces a silky appearance. In some sections subordinate amounts of rock of a more or less slaty character are interbedded with the mica schist, but this is more plentiful in the northern than in the southern half of the county. Everywhere the formation is decidedly folded and is often crumpled or contorted; and it has not infrequently been subjected to considerable crushing. Numerous small quartz veins are present in some localities, although these are totally lacking in others.

The largest area covered by this rock extends from Mussel creek on the west and Lake of the Woods on the east southward to the vicinity of Pyramid peak, and has somewhat the shape of a triangle with the angles at each of the three points mentioned. Another occurrence of considerable size surrounds White and Summit mountains in the northern part of the county, while several small outcrops are found between the last mentioned area and Mussel creek. Splendid exposures are shown along the Rogue river from the mouth of Lobster creek eastward for about twelve miles, and on Wake-Up-Riley ridge. In the last named locality the formation appears first as slaty material about one-half mile south of Seven Mile peak, but this soon gives place to the quartz-mica schist already described.

Although there are evidences that the material forming the Colebrooke schist was originally largely or entirely of sedimentary character, no fossils have been found therein, so its age is more or less uncertain. It is certainly unconformable with the Jurassic (Dothan) rocks which overlie it, so it is at least pre-Jurassic. It may be pre-Devonian.<sup>1</sup>

*Craggy gneiss.* West Craggy is made up of a metamorphic rock which is different from any other found in the southern part of the county. Diller has described a similar rock under the name of amphibole schist as occurring in small masses in the northern part of the county, and states that they are more numerous north of the Sixes river than south thereof. He considers this material to be a metamorphosed phase of the Myrtle formation, and a description of these masses has been incorporated in the discussion of the Myrtle formation included in this report. As the writer had no opportunity to examine these northern exposures, he is uncertain whether they are identical with what is here designated the Craggy gneiss. The published descriptions vary, however, in several particulars from

<sup>1</sup> U. S. Geol. Surv. Folio 89, pp. 1 and 2, 1903.

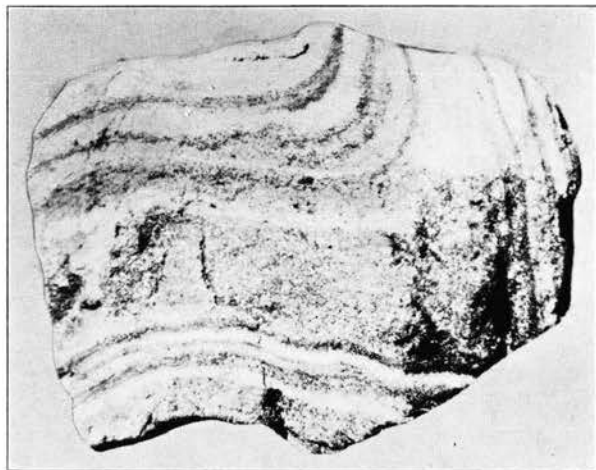


Fig. 18.—Specimen from west Craggy peak showing folding in craggy gneiss. (Dark material is largely hornblende, while the white is orthoclase and quartz)

those applicable to the southern area, so it seems best to give the material in the southern district the name herein used.

The Craggy gneiss consists chiefly of hornblende, feldspar, and quartz, with minor quantities of biotite (black mica). A very little epidote was noted in one or two places, but there seems to be much less of this mineral present than is the case in the amphibole schist masses further north. Another point distinguishing the rocks in the northern and southern areas is the lack of actinolite, glaucophane, and garnet in the southern district. At least, these three minerals are not present there in sufficient quantities to be recognized without the use of a compound microscope.

The Craggy gneiss has a decidedly schistose structure, that is, it is made up of layers of the different constituent minerals. In some places the bands of light and dark minerals are drawn around white, eye-like aggregates of quartz and feldspar, giving to the rock a spotted appearance. Such a rock is called augen gneiss. The Craggy gneiss has not generally been subjected to the folding commonly shown by the Colebrooke schist, and close crumpling is absent. Some evidences of folding are present, however, and this is illustrated in Fig. 18.

The time available for the study of this interesting rock was so short that no definite decision as to its origin could be reached, but

it seems likely that it is a metamorphosed phase of the adjacent Dothan sandstone. If later investigation proves it to be the same as the amphibole schist found further north, this will bear out the suggestion already made that at least a portion of the material mapped as Myrtle in the Port Orford quadrangle is of Dothan age.

*Serpentine.* Serpentine is one of the commonest rocks exposed in Curry county, and is especially plentiful in the southeastern part, where it constitutes all, or a major portion of, whole mountain ridges and peaks. This rock is formed as a result of the alteration of peridotites and pyroxenites, and all gradations are encountered from the unaltered igneous rocks, in which all the ingredients are plainly recognizable, to homogeneous serpentine. When the alteration process has been completed, the product is a soft, soapy-feeling mass which usually breaks out in irregular fragments bounded by smoothly polished faces which frequently have a somewhat oily lustre. The color is, in the great majority of cases, some shade of green, although yellow and red tints are sometimes found, and flakes or stringers of white material are not uncommon. Where the alteration process has not been carried to completion most of the rock is apt to consist of a rather dull-lustered, compact, dark-green or nearly black substance upon which a knife-blade leaves white scratches. In this may be embedded still recognizable crystals of enstatite, diallage, or other primary constituents. In several localities the serpentine masses seem to be made up of smoothly rounded boulders imbedded in a matrix of softer material. This peculiarity is probably the result of the presence of numerous joints in the original rocks, which broke it up into more or less cubical blocks. The alteration proceeded from these joints in toward the center of the blocks, and the boulder-like masses represent kernels of still relatively unaltered material. In a few places the more massive material is traversed by veins of somewhat fibrous serpentine, but nothing was found on this trip which could properly be termed chrysotile, the most valuable variety of commercial asbestos.

The weathered slopes of hills composed of serpentine have a brick-red color due to the oxidation of the iron in the decomposing material. Vegetation is scanty on such slopes and is confined to scrub pines and short brush. Even on comparatively level tracts underlain with serpentine where there has been an opportunity for wind-blown or alluvial material to accumulate, trees other than

"bull" pines are rarely found. These localities often constitute good grazing land, however.

The rock is of such a soapy, slippery nature and is so sheared that it does not stand long on steep slopes, especially after these have been saturated with water. This leads to the development of numerous landslides where streams cut through serpentine belts, and such slides form a noticeable feature of the topography in these areas (see fig. 6, p. 14). In most instances the serpentine occurs in the form of wide dikes which can sometimes be traced for many miles. In fact, it seems likely that all the occurrences of this rock have a dike-like character, although in the southeastern part of the county the masses are so wide that it would lead one to believe they are of some other form of intrusion.

As serpentine dikes are found cutting the Myrtle formation, but have not been found traversing the Eocene strata, intrusions of the rocks of which the serpentine is the alteration product must have occurred sometime toward the close of the Cretaceous period.

#### GOLD RESOURCES

Gold is known to occur in a number of localities in the county. The deposits are of three types, namely, veins, stream placers, and beach placers. The most important characteristic of each of these will be outlined in the order given.

##### VEINS

A vein is a deposit of more or less tabular shape, containing varying proportions of ore and worthless minerals (known as gangue), which have been deposited from solutions in pre-existing openings produced as the result of earth movements. The openings mentioned may take the form of a single crack or fissure, a great number of small, more or less parallel cracks, or a large number of branching, inter-lacing, non-parallel cracks. In the two cases last mentioned the broken ground usually occupies a long, narrow zone to which, after mineralization has occurred, miners commonly assign the term vein. Strictly speaking, however, in these cases a very large number of small, narrow veins are involved rather than one large one. Each of the three types of so-called veins mentioned has its own peculiarities and these will be briefly discussed.

*Simple and fault fissure veins.* The mineralization of a single crack or fissure in the earth's crust results in the formation of what

is known as a simple fissure vein; and, if movement (faulting), of the rocks on one or both sides of the fissure has occurred parallel to the plane of the fissure, and previous to the introduction of the mineral contained therein, the deposit formed is called a fault fissure vein. Either constitutes the so-called "true fissure vein" so popular with miners. This popularity is probably due to the known fact that such deposits are usually fairly extensive both horizontally and vertically, and are not apt to be of as "pockety" a character as are many of the other types of ore deposits. The simple fissure veins do not average as long as do the fault fissure veins, but their width is more uniform. In fact, fault fissures are frequently characterized by the presence of more or less numerous wide portions known as "swells" separated from each other by very narrow stringers called "pinches." Such veins may be distinguished by the presence of soft clay or talc-like gouge along one or both walls; by the presence of more or less polished and grooved walls which are said to be slickensided; or by evidences of considerable crushing of the wall rocks. Faulting parallel to the plane of the vein not infrequently occurs after the deposition of the mineral, in which case slickensiding, gouge, or crushed material may be formed within the vein itself.

The walls of simple or fault fissure veins are usually sharply defined, and may contain little or no valuable material even though the vein itself is rich. Sometimes, however, the mineralizing solutions penetrate the wall rocks and impregnate them with valuable minerals or even cause them to be dissolved and replaced by ore. In such cases, there may be a gradual transition from high grade vein matter to valueless wall rock. Off-shooting stringers from either type of vein are not uncommon, but are probably more numerous in the case of the second type mentioned.

*Persistence of simple and fault fissure veins at depth.* The features exhibited by the simple and fault fissure veins examined in Curry county are such as lead to the belief that they were formed at considerable, although not abysmal, depths; that, in other words, the outcrops now found were originally covered by several thousand feet of earth material subsequently removed by erosion. Such deposits are apt to be persistent with depth, that is, there is no reason to expect that ore-shoots will become much less numerous or valuable with deep development than they are near the surface, but below the ground-water level. That there has been abundant time for the

removal of enormous quantities of the rocks containing the original upper portions of the veins will be appreciated when it is known that the majority of the fissure veins were probably formed at the close of the Jurassic or the beginning of the Cretaceous period.

*Oxidation of outcrops.* Prospectors should not expect to find that the mineral filling of veins is the same at the outcrops as at greater depths unless erosion is taking place very rapidly. The portion of a vein above ground-water level is usually quite different in appearance, and often in value, from that below the ground-water. This is due to the fact that most sulphides are readily attacked by the constituents of the atmosphere and are converted to oxides, carbonates, or, less commonly, silicates. Since iron or copper-iron sulphides are the commonest in many veins, and since these are readily converted into limonite (yellow or brown hydrous oxide of iron) on exposure to atmosphere ingredients, it follows that the outcrops of many veins are notably stained with iron-oxide and have a rusty appearance.

*Secondary enrichment.* Sometimes the reactions accompanying the oxidation process just discussed result in the total or partial leaching out of one or more metals, leaving the outcrop more or less barren of elements which constituted a considerable portion of the original vein. This is especially apt to occur in the cases of copper and zinc. Occasionally the metals thus leached from the outcrop are carried downward and deposited at or near the ground-water level. This process is known as secondary enrichment, and results in the formation of a mass of very high-grade ore between the leached outcrop and the lower grade, primary ore beneath.

It is the fact that such high-grade deposits have not infrequently been located comparatively close to the surface beneath low-grade outcrops, that has lead many prospectors to believe that ore always gets richer with depth. After finding such an enrichment they have trouble with water, and usually dispose of their prospects to operating companies financially able to take care of the water. They are then unfamiliar with the future history of the property and never learn that beneath the enrichment the low-grade ore is again encountered.

In view of the facts just outlined, and of the presence of numerous leached, iron-stained vein outcrops in Curry county, it becomes important to discuss the probability of the occurrence of secondary enrichments there.



As regards gold, it can be said that in practically every case the oxidizing of the vein, while resulting in the removal of some of the ingredients leaves the gold unattacked, so the oxidized outcrop is often richer than was the original vein. Not only is the ore there of higher grade, but it is wholly or partially free from sulphides. It is then said to constitute "free milling" ore, and the gold is much more cheaply recovered than when enclosed in sulphides.

When decomposing sulphides and oxides of manganese occur in a gold-bearing vein free from calcite, the gold may be taken into solution, carried downward, and precipitated as an enrichment near the ground-water level. Such conditions were noted in no vein in Curry county, however.

It is, of course, true that irregular shoots of high-grade ore are apt to occur anywhere in a vein, but these are usually even more numerous horizontally than vertically; so an outcrop exposed for a considerable distance yet containing no gold ore worth mining, is hardly worth investigation below. Before leaving the subject of fissure veins it should be pointed out that not all of those in Curry county are gold-bearing. Some seem absolutely barren, while others contain metals other than gold, and will be discussed under the proper head later.

*Shear-zones.* Strictly speaking a shear-zone is a more or less tabular mass of earth material traversed by numerous, small, closely spaced, approximately parallel cracks, but miners use the same term for the ore body formed when such cracks have been filled with ore and gangue minerals. Not infrequently, one or more simple or fault fissure veins are included within such shear-zones, and these partake of all the peculiarities of such veins already discussed. Shear-zones are in general more pockety than simple or fault fissure veins, but average considerably wider, and sometimes reach thicknesses measurable in tens of feet.

The filling of such a zone is usually largely country rock, but sometimes the solutions which have caused the formation of the accompanying veinlets have impregnated or replaced this rock so that the whole zone is made up of ore. When this is not the case, some form of concentration is usually necessary in order to separate the valuable material in the veinlets from the gangue and the accompanying worthless rock.

Some shear zones have sharply defined walls, which are usually

plainly fault surfaces, while, in other cases, the little cracks become less and less numerous as the side of the deposit is approached, and finally disappear altogether. Shear-zones frequently contain more or less slickensiding and gouge, which indicates that they commonly mark the location of fault movements. Whether faulting results in one clean-cut fissure or in a number of closely spaced cracks is probably dependent both upon the depth and the nature of the rocks involved.

While most of the shear-zones observed in Curry county traverse the country rocks without apparent regard to their structure or position, it has been noted elsewhere that they are especially common in dikes of igneous rocks and parallel to the walls thereof.

*Persistence of shear-zones at depth.* It is likely that, other conditions being equal, a fault in earth material is more apt to take the form of a shear-zone when comparatively near the surface than when occurring at considerable depths; and a relatively rapid decrease of the grade of the ore contained therein is to be expected when the upper portions of such zones are still uneroded, as appears to be the case on Mount Emily. That shear-zones do, however, extend to considerable depths is indisputable. In such cases the ore minerals present are apt to be confined largely to pyrite and, less frequently, chalcopyrite, which may or may not be gold-bearing. The grade of such deposits may be expected to persist with little change to considerable depths.

All that has been said previously regarding oxidation of outcrops and secondary enrichments of fissure veins applies in equal degree to shear-zones.

*Stringer lodes.* A zone of shattered rock cemented together by a network of small, non-parallel veins is called a stringer lode or a stringer lead. The fragments of country rock involved usually lie with their greatest dimensions parallel to the plane of the zone or lode, but are still so thick and irregular that the veinlets between them depart too far from parallelism to make it possible to call the deposit a shear-zone. In case the fragments are extremely irregular in shape, and are not oriented in any definite fashion relative to the trend of the shattered zone, we have the conditions which lead to the formation of brecciated veins, after mineralization has taken place.

All that has been said relative to oxidation of outcrops and secondary enrichment of fissure veins applies with equal truth to stringer lodes and brecciated veins.

*Source of the gold-bearing solutions.* It appears highly probable that the gold now contained in the various types of veins already discussed was deposited in its present position from solutions that have worked upward from unknown, though doubtless great, depths. The frequent association of igneous rocks with such veins suggests that they may be genetically related. It is likely, indeed, that both the mineralizing solutions and the molten magma (which formed igneous rocks after solidification) came from a common source, and that the former are either the result of the process of differentiation already described, or else they represent gases and vapors expelled from magmas during solidification.

#### STREAM PLACERS

A placer is a deposit of rock waste, composed either of angular or rounded fragments, which contains grains or nuggets of valuable substances that were deposited contemporaneously with the material surrounding them; and stream placers are such deposits which have accumulated along the banks of, or as bars in, creeks or rivers.

*Nature of the deposits and source of the valuable contents.* Such deposits will naturally vary greatly, not only in thickness and extent, but also in the nature of the waste material of which it is composed, and the distribution and quantity of the valuable material contained therein. In general, however, since the contents represent waste derived by erosion from the sides and head of the stream valley, it is possible, unless erosion has removed all traces of such outcrops, to find the source of all the materials present in a placer at some point in the surrounding valley. This statement applies with equal truth to both valueless rocks and valuable minerals. It is not always possible, however, to trace a valuable constituent, such as gold, back to its source, for the reason that it may not have come from a single vein or group of large veins. In fact, it seems to be often true that in southern Oregon the source of the placer gold is frequently the tiny veinlets of the Colebrooke, Dothan, or Myrtle formations, which are not themselves worthy of exploitation. The gold may, in other cases, have been distributed originally in small quantities in the sediments themselves, where it may still exist in amounts too small to attract attention. Some idea of the distance which the placer gold has come may be derived from its appearance. If smoothly rounded or flattened, it has probably come a long way; while if rough and angular with projecting points and indications

of crystallization, its source is likely to be near at hand. If coarse, it may be expected that the gold in the source will be visible to the naked eye; while, if very fine, it may be almost or quite invisible when in its original position. It should be remembered, however, that coarse placer gold does not always indicate that the gold at its source will be also coarse, for it has been repeatedly proven that some placer gold particles grow by precipitation from solution after deposition in the placer itself.

The great weight of gold, as well as of other valuable minerals frequently found in placer deposits, gives them a tendency to work to the bottom of the bed, and such deposits are frequently, although not always, richest along the bed-rock. Sometimes, where impervious layers exist above bed-rock, the valuable material may be concentrated on top of these, which then constitute false bedrocks.

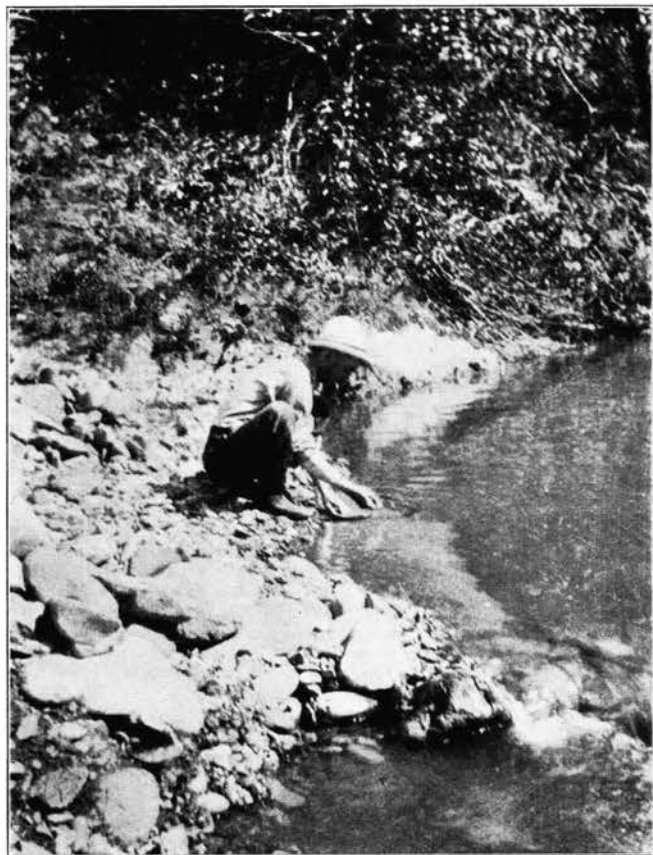
*Placers of the first cycle of erosion.* Diller recognizes<sup>1</sup> three cycles of erosion each of which was marked by the formation of placer deposits. The first of these resulted in the formation of the Klamath peneplain already mentioned (see p. 11). Streams flowing across this surface deposited placers which were probably once numerous and extensive, but which have now, in most cases, been completely carried away, and the constituents deposited elsewhere. The few remaining examples of such placers are said to belong to the first cycle of erosion, and are represented in Curry county by those in Gold Basin.

*Placers of the second cycle of erosion.* Following the uplift of the Klamath peneplain, the streams started to wear their channels deeper; and broad, gently sloping valleys developed on both sides. This constituted the second cycle of erosion, and the resulting placer deposits differ in no way from those first mentioned except that they lie well down toward the bases of the mountain slopes. No undoubted examples of such placers were found in Curry county, although they are known to exist in Josephine county to the east.

*Placers of the third cycle of erosion.* Another uplift of the region followed the second cycle of erosion, and the rejuvenated streams cut steep-walled valleys or gorges in the bottoms of the broad valleys previously eroded. Some localities show indications of still a fourth uplift and period of gorge or valley making, but no attempt has been made to distinguish between the placers resulting from the

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<sup>1</sup> U. S. Geol. Surv. Bul. 546, pp. 95, 97-98 and 102, 1914.



**Fig. 19. Panning third erosion cycle gravels on Rogue river**

two last mentioned cycles. Both together are considered as belonging to the third cycle of erosion. Although these are probably less extensive than those originally formed during either of the two earlier cycles, they have not been subjected to degradational agencies for so long a period, so are comparatively common and extensive, and constitute the most important placers in the county. They are closely related to all the modern streams, along which they formed terraces or bars. The highest beds lie about 500 feet above the present stream levels, but those extensively mined are usually within 100 feet of the water. The bars, of course, lie under the streams them-

selves, at least during times of high water. Although the gravel and sand deposits in or along most of the streams in the county probably contain more or less gold, the most important deposits are along Rogue river, Sixes river, and Boulder creek. Similar important deposits lie along Rock and Johnson creeks in Coos county, not far from the Curry county boundary.

Further descriptive matter relating to the placer deposits of Curry county will be found in the discussion of the individual placer mines on later pages.

*Gold-bearing nature of the Cretaceous conglomerate.* It is deserving of mention that south and west of Curry county the Cretaceous (Myrtle?) conglomerate has been found<sup>1</sup> to be gold-bearing, and in some places it has been proven to be quite rich. Not only has this conglomerate been mined by placer methods where disintegrated by exposure to the atmosphere, but it has also doubtless furnished some of the gold now present in placers of the third and, possibly, second cycles of erosion. In view of the richness of this conglomerate elsewhere, the numerous outcrops in Curry county should be carefully investigated.

*Effect of landslides on placer operation.* The very severe weather of the spring of 1890 caused numerous landslides, which in many places covered placer ground that had previously been mined with profit. Whether erosion will ever remove this material is problematic; it will certainly be many years before several such buried placers can again be worked.

#### BEACH PLACERS

Diller states in U. S. G. S. Folio No. 89 that:

Gold was first discovered along the beach at Gold Beach, Port Orford, and the mouth of Whisky Run, where work was commenced in 1852; \* \* and work on the elevated beaches at the eastern edge of the coastal plain, the Blanco and Sixes mines, followed in 1871. The beach mines were very rich in places and were extensively mined, but within the last few years they have received little attention.

The last successful attempt on any considerable scale to catch the gold on copper plates was made by Mr. Ed. Yates near Gold Beach about thirty-nine years ago. Some sixteen or seventeen years later, San Francisco people installed a "gold machine" near Gold Beach. They intended to fill the hopper by means of horse-drawn scrapers, but tried out their apparatus with material delivered from wheel-

<sup>1</sup> U. S. Geol. Surv. Bul. 546, pp. 88-95, 1914.





**Fig. 20.—Camp on the beach at the Lone ranch, 5½ miles north of Brookings**

barrows; and, as the sand never came out of the machine, the operators at once left for San Francisco "to get more machinery with which to improve the machine." They never returned, and the boilers and other equipment on the beach were sold on attachments.

Seven years ago Mr. W. H. Williamson of Gold Beach, and associates, made a serious attempt to save the gold by concentrating it on tables and cyaniding the concentrates. Mr. Williamson is convinced that the failure of this process was due to the dishonesty of an employee, who, he believes, precipitated and cleaned up the values at night, and left camp suddenly with the proceeds. Mr. Williamson states that by the process of concentration used, they lost 56 per cent of the values in the sand, but succeeded in gathering 182 tons of concentrates which averaged \$4.40 per ton.

During the summer of 1914 a number of attempts were made to use the centrifugal concentrating machines manufactured by Sweet Bros., of Marshfield. This machine is designed to save both gold and platinum values. Experience has shown that it does good work when the conditions are favorable. Attempts to use the apparatus along the Curry county coast met with little success, however, due apparently to no fault of the machine. Efforts to work the beach near Cape Blanco proved unsuccessful because the wind blew so strongly and continuously that pits dug to the pay-streaks could not be

kept open. During the comparatively short time that the machine was in actual operation, considerable amounts of both gold and platinum were saved, however. Another attempt to use this machine about three miles north of Brookings met with negative success due, apparently, solely to the fact that the sand was not of pay grade at that point. Careful panning of the tailings revealed only one or two minute colors of gold and no platinum. It is reported that parties operating the machine a short distance south of the Oregon-California line cleaned up several thousand dollars during the same season.

Diller reports<sup>1</sup> that the Eccleston tension concentrator was used with apparent success on the Meeks mine, near Port Orford, as well as in the Bandon region. At the time of the examination upon which this report is based, the use of this apparatus had apparently been abandoned along the Curry county coast. Canvas or burlap covered tables have been much used for the recovery of the gold and platinum present in the beach sand. Although they appear to have given a considerable degree of satisfaction, and are doubtless the cheapest form of apparatus that can be used, it is doubtful if the percentage of recovery is as high as could be wished.

Mr. Henry E. Wood, of Denver, Colorado, has done a great deal of work on the problem of extracting the valuable materials from the beach sands. He is so well and favorably known to mining men that some extracts from a personal letter to the writer will doubtless prove interesting. He says:

Many years ago, after fully investigating the recovery of the platinum associated with the free gold of the Pacific coast beach deposits and also the platinum which came in the placer cleanups, I built a small mill at Grants Pass, Oregon. The plan adopted was dependent upon the use of the Wilfley table for a reconcentration of all sluice-box or other black sand concentrates we could secure. We found that there was practically no gold in the black sand particles themselves, so over 90 per cent of it was cut out and discarded, as it rarely assayed more than a trace. Our high-grade concentrate was then re-cleaned on a Wetherill magnetic separator. Frequently we found and separated other rare minerals, such as monazite, rubies, garnets, nickel, etc. Our final concentrate, containing the platinum, osmiridium, and gold, we found could be treated by a certain amalgamation process so as to separate the gold. The platinum scales were then separated at a high current from the osmiridium. \* \* \* Mr. Gordon Land was then, and is still, associated with me. We are now trying to finance a small plant on the coast, as we have great faith that our views can all be proven to be right. Mr. Land has since developed a practical demonstration of my claims upon a ton sample from the a system of simple classification directly from the sluice-boxes. After

<sup>1</sup> U. S. Geol. Surv. Bul. 546, p. 128, 1914.

Camp Carson mine in Oregon, Mr. Land installed the plant at that mine. I refer you to descriptions and photographs in the Engineering and Mining Journal, September, 1915. \* \* \*

*Origin and nature of the deposits.* The disintegration of land surfaces under the action of atmospheric agents releases the gold, platinum, and a number of other valuable and rather unalterable substances that may be contained in the rocks and various types of ore deposits originally outcropping on such surfaces. The valuable minerals, together with other valueless materials, are washed by rain water into the beds of streams; and under favorable conditions eventually find their way into the ocean. There they may work outward and form a part of the sedimentary deposits accumulated beneath the surface of the sea; or they may be driven by the action of waves and wind up onto the beach, where the action of the waves tends to concentrate the heavier material at the highest point reached by the water. This is not so much because heavy substances are more likely to be carried there than is lighter matter, but is rather due to the fact that the lighter material is more easily washed oceanward by the water retreating down the beach. In this way a mass of mixed heavy and light sand, hurled high upon the beach by the waves, will eventually be "panned down" until little or no light material remains. A portion of the valuable contents of the beach placers may also be derived from sedimentary rocks which have been disintegrated by wave action.

As is to be expected, the particles of heavy minerals concentrated in the manner described are apt to be small. In fact, the pieces of precious metals contained therein are often so minute as to float readily on water when dry. It is in fact the "floury" condition of this gold that presents the principal difficulty in its recovery.

The material concentrated in the fashion outlined consists principally of the magnetic black oxide of iron called magnetite. In fact, the prevalence of this mineral is responsible for the term "black sand" so frequently applied to the purer deposits. When smaller proportions of this substance are present the name gray sand is often used. Many other minerals have been found along the Oregon coast, some of which have considerable value. Among these are monazite, garnet, zircon, chromite, gold, platinum, osmiridium, and other minerals of the platinum group.

The beds of black or gray sand formed in the manner just described

may be as much as several miles long, but their width varies from a few score to a few hundred feet, and their thickness from less than an inch up to ten feet or more, the thickest beds being usually the widest. They are interstratified with thick or thin layers of sand usually of much lighter color, which contains little or no valuable material. In some localities several black or gray beds are present within short vertical distances of each other. In most cases, the highest values are found near the contact of a black sand layer with a relatively hard impervious bed-rock. This bed-rock may be an old erosion surface formed by the wearing down of hard sedimentary or other rocks, or it may be a layer of beach sand hardened by cementation with oxide of iron or other material.

The beach placers are not confined to the present beach, although they are certainly being formed there at the present time; but are also found in connection with the elevated beaches already mentioned (see p. 13). In such cases the beds of black or gray sand are often covered with varying, but sometimes great thicknesses of unworkable material; and such deposits must often be developed by means of adits in a fashion similar to that used when mining coal seams or flat veins. The grade of these old beach deposits is, however, not often high enough to warrant the use of such methods.

The elevated beach deposits occur up to altitudes of nearly one thousand feet above sea level, but the most profitable beds have been found to lie between one hundred and two hundred feet above the present beach.

The modern beach placers are in beds which have a gentle slope toward the water, but the dip of the black sand layers in the elevated beaches is sometimes away from the water. The amount of inclination varies, although it is usually less than 15 degrees from the horizontal.

*Grade of the beach placers.* Mr. W. H. Williamson, of Gold Beach, states in a letter to the writer that he is convinced that the sand upon which he operated seven years ago is worth, on an average, about \$1.00 a ton in gold and platinum. He says that he has secured this information as the result of about three hundred assays, and has found that the platinum values occur principally in the four feet of sand directly above the bedrock.

Mr. A. H. Gauntlett, of Gold Beach, states that black sand running

at least \$10.00 a ton exists near the mouth of Hunters creek, but is buried under from ten to twelve feet of gray sand.

Mr. John R. Smith claims that a bed 12 to 14 feet thick on South Slough, in Coos county, runs from 40 cents to \$13.60 a ton in the precious metals. He states that this bed lies about 60 feet above the level of the slough, and that another bed, 10 to 20 feet above the one first mentioned, is 30 inches to 7 feet thick, and runs from \$3.57 to \$130 a ton in gold and platinum. The second bed is covered by from 4 to 20 feet of overburden. He further claims that each of 5 samples selected from the smaller beds yielded assays of better than \$70 a ton.

Mr. A. M. Collins, of Agness, states that he took some 200 samples from bore-holes, and that he was employed to do this by Mr. Henry E. Wood, of Denver, whose opinion of the commercial possibilities of the black sand deposits has already been quoted. Although no figures as to the result of Mr. Collin's work were obtainable, the fact that Mr. Wood is willing, and even anxious, to develop these deposits seems sufficient proof that the grade of the material was found to be thoroughly satisfactory.

Some additional details concerning the nature and grade of the beach placers will be found in the descriptions of the mines and prospects of Curry county, which constitutes the last section of this paper (p. 130).

#### COPPER RESOURCES

It has long been known that Curry county contains deposits of copper ore, and many extremely rich specimens, including chunks of native copper weighing many pounds, have found their way into collections. Little or nothing was known, however, as to the quantity available in other localities than those along the eastern border of the county, some of which were described briefly by Diller in U. S. G. S. Bul. 546. The desire to obtain information concerning the copper resources of the county was, indeed, one of the principal considerations that led to the investigation which yielded the data included in this report.

Mr. E. G. Hurt, of Agness, was interviewed upon the arrival of the party at that point. He claimed that Dr. T. R. Hines took 45 tons of copper ore from Hurt's copper properties near Collier creek, and shipped it to San Francisco in 1908. The ore is said to have been brought to Agness on pack-horses, carried to Gold Beach

in small boats, and then shipped by water to San Francisco. No information concerning the outcome of this venture was obtainable as Dr. Hines was never heard from after taking out the ore. It is claimed, however, that 2,700 pounds of the ore, which happened to be left in Agness, was shipped by Mr. Ed. Miller in order to secure reimbursement for packing expenses incurred; and that it paid the cost of shipment and treatment, and yielded a net profit of \$45. It is said that this ore consisted chiefly of bornite, but contained some native copper.

These reports, as well as others which reached the writers, naturally aroused considerable curiosity and interest; and led to a rather careful investigation as to the nature of the deposits from which the ore just mentioned came. As a result of this examination, as well as of work done elsewhere in the county, it can be stated that the copper deposits of Curry county are of the three types discussed in the next section.

#### NATURE OF THE DEPOSITS

*Veins in rocks other than serpentine.* Several of the veins in the Mule creek district, as well as elsewhere, contain more or less chalcopyrite and low-grade cupriferous pyrite. It is likely, however, that the copper values will prove decidedly subordinate to the gold values; and it is certain that none of these veins will ever be worked primarily as copper mines. As the characteristics of these deposits have been described in the preceding chapter, it is unnecessary to discuss them further here.

*"Boulder" or float deposits.* These constitute the most interesting and, probably the most important deposits of copper in Curry county, and are so unusual in many of their features as to deserve somewhat extended description. This is especially true since this type of deposits seems rarely to have been described in the scientific press. Oscar H. Hershey, has given, in the Mining and Scientific Press of March 28th, 1908, an account of seemingly almost identical deposits which occur in Del Norte and Humboldt counties, California. Although the deposits he describes seem to differ in some minor particulars from those in Curry county, there is no doubt of their essential identity. J. S. Diller<sup>1</sup> and G. F. Kay<sup>2</sup>, also, have briefly described Josephine county deposits which are evidently like those under consideration.

<sup>1</sup> U. S. Geol. Surv. Bul. 546, pp. 81-85, 1914.

<sup>2</sup> U. S. Geol. Surv. Bul. 380, pp. 76-78, 1909.



The first peculiarity to be noted is that the deposits are confined to serpentine, or to peridotites or allied ultra-basic rocks which have been almost completely altered to serpentine. While copper deposits in such materials are not unknown they are so rare as to make this association in itself a feature of rather unusual interest.

The second point worthy of consideration is the unusual mode of occurrence of the ore, as it is found in more or less boulder-like or lenticular masses which are usually unsystematically distributed throughout the serpentine. These individual masses vary from a few ounces to several tons in weight, and commonly appear to be absolutely unconnected by stringers or anything else. The ore (described later) resists weathering to a notable degree, although exposed portions are sometimes partially converted to limonite, and often outcrops prominently so as to have the appearance of rounded fragments which have broken off from some higher deposit of great size, and have rolled down to their present position. In fact, practically all the prospectors with whom there was opportunity to talk were of the opinion that these masses are merely float, and that, when the mother lode is discovered, it will be found to be a very large and rich vein of some kind. A little investigation in the field sufficed, however, to prove conclusively that each mass of ore is in place in the serpentine. Although this rock is sometimes more or less sheared and softened around the ore bodies, the ore minerals are usually confined to the nodular masses of ore themselves. In some places these little bodies of ore are comparatively close together, while in others they are widely separated, and often there seems little or no system in their distribution or magnitude.

The third unusual feature shown by these deposits relates to the nature of the minerals found in them. These consist mainly of magnetite (magnetic oxide of iron), which is often rather coarsely crystalline. Cavities frequently show the typical octahedral crystallization of this mineral, but, in at least one locality, the crystals are cubical. Associated with magnetite, are copper minerals of various kinds of which one of the commonest is chalcocite (sulphide of copper). This mineral has an unusually high luster, is notably sectile, and differs from the ordinary type of chalcocite in that the prismatic cleavage is uncommonly distinct.

Other minerals usually present in greater or less abundance are cuprite (red oxide of copper), bornite (a sulphide of copper and iron,

which has a brownish color when untarnished), and native copper which is sometimes present in nodular masses weighing several pounds. Less frequently are found malachite (green carbonate of copper), azurite (blue carbonate of copper), chrysocolla (blue silicate of copper), tenorite ? (black oxide of copper), and erythrite (pinkish hydrous arsenate of cobalt). Occasionally thin crusts or films of a bright green chromium mineral of uncertain nature are also present.

In one or two localities, notably in the McKinley group east of Gold Beach, chalcopyrite (sulphide of iron and copper) and pyrrhotite (mono-sulphide of iron) constitute the bulk of the sulphide minerals. Not infrequently chromite replaces the magnetite to varying extent.

Practically no quartz or calcite, and little or no pyrite or other minerals common in ordinary vein deposits are present. In fact, the only gangue in the ore bodies is magnetite, chromite, or one or more of the other minerals already mentioned.

Mr. Frank Berry, of Agness, who has done considerable work on this material, expressed the conviction that the copper ores are always overlain with the magnetite or chromite. It is hard to explain such an occurrence, although it is true that the relationships seen in the field seem to substantiate this theory. It may be that the magnetite or chromite originally formed a core around which the sulphide minerals were deposited, and that the relative ease with which these may be disintegrated and leached away when exposed on the surface of the ground accounts for the fact that the core of magnetite or chromite is the material usually exposed. Unfortunately, most of the ore bodies examined had been so cut up or so largely removed by mining operations as to make it impossible to prove or disprove this hypothesis without the expenditure of more time and labor than could be given to the problem.

The deposits in question seem to be more closely allied to those at Monte Catini and Libiola in Tuscany and Liguria, Italy, than to any others which have been carefully investigated. Similar deposits are reported to occur in Serbia, Cuba, and elsewhere. In all these localities, the copper ores occur principally in rounded masses and are imbedded in serpentine or other closely related rocks, but there are several notable differences of detail in the Italian districts, such as the presence of calcite, prehnite, datolite, analcite, and laumontite

in the gangue, the occasional occurrence of the several sulphides in concentric inter-growths, and the presence of clay-like crushed serpentine or other basic rock immediately surrounding the masses of ore.

Authorities differ widely as to the origin of the type of deposits under consideration, although all of them seem to have placed this type under the heading "magmatic segregations." On page 45 of Weed's translation of Beck's "The Nature of Ore Deposits," it is stated that "the best authority on these formations, B. Lotti, now regards them as originally segregations," while some masses of chromite certainly originate in this way, and while fewer occurrences of magnetite appear to have been so formed, no proof can be advanced that bodies of mixed oxide and sulphide minerals, such as are those under consideration, have ever thus originated.

E. Reyer considers that the Monte Catini deposits were originally a vein of some kind which has subsequently been much faulted and broken during the swelling incident to the serpentinization of basic rocks. The fact that the masses of ore are so irregularly distributed mitigates against this theory. Several authors, including Lindgren, Hershey, and others, are inclined to the view that the ore minerals were originally distributed throughout the igneous rocks, but have been segregated in the positions now found during the changes accompanying the serpentinization of the containing rocks. Such a process is believed, confidently, to account for the presence of many masses of magnetite in serpentine, and, in all probability, also produces some of the bodies of chromite therein.

The nature of the chemical and physical conditions which would lead to such a concentration of copper, iron, and chromium minerals can hardly be suggested, but Lindgren ventures<sup>1</sup> the assertion that "it is probably safe to say that the present ground waters have had nothing to do with the formation of the ores." Hershey suggests<sup>2</sup> that "perhaps the molten rock came in contact with and absorbed rocks containing copper deposits, thus deriving an unusual copper constituent which was widely disseminated in certain portions of the peridotite and related basic rocks, but during serpentinization became segregated with the iron minerals. However, it remains an open question as to whether the segregation was connected with the solidifi-

<sup>1</sup> Mineral Deposits, p. 411, 1913.

<sup>2</sup> Min. and Sci. Press, Vol. 96, p. 430, 1908.

cation of the magma or with the subsequent serpentinization." The truth of his last statement must be admitted, but authorities exhibit a growing tendency to accept the segregation during serpentinization theory.

Among those who do not admit the validity of the explanation just suggested is G. F. Kay, who, in describing the Queen of Bronze and neighboring mines in the vicinity of Takilma, Josephine county, first makes the statement<sup>1</sup> that the ores (presumably he includes those of the boulder type) are not confined to serpentine, but are also associated with gabbro and peridotite. He then mentions chalcopyrite as the principal unoxidized ore mineral, and states that pyrite and pyrrhotite are associated with it. In this respect, the Josephine county ores evidently resemble those in the Starr (McKinley) group more closely than they do those found elsewhere in Curry county.

In discussing the origin of the Josephine county ores, Kay says:<sup>2</sup>

These ore bodies are apparently the result of precipitation from mineral bearing solutions which entered the rocks after they had been fractured and fissured by earth movements. Whether these solutions were set free from cooling magmas as they solidified to form igneous rocks; or whether they were of meteoric origin it is impossible to determine. Although dikes cutting the peridotite and gabbro were not observed in the vicinity of the mine, their presence in other areas of these rocks would suggest that the solutions may have been associated with the magmas from which the dikes were formed. In places in the serpentine below the zone of oxidation, chalcopyrite with slickensided surfaces has frequently been found. The chalcopyrite appears to have been subjected to all the movements which accompanied the process of serpentinization. This indicates that the ores are older than the serpentine.

As the boulder deposit minerals examined in Curry county showed no evidences of slickensiding, or of having been subjected to movements accompanying serpentinization, and, as all of the ore of this type examined in this county is strictly confined to serpentinized material, the validity of Kay's conclusions seems open to question, at least so far as the Curry county deposits are concerned.

*Shear-zones in serpentine.* In most of the serpentine areas which contain the boulder-like masses of ore already described, there also occur zones of copper-impregnated serpentine, locally called veins. In these the ore minerals are confined to the joints and slips everywhere plentiful in the serpentine, but which appear to be especially numerous at the points where the copper mineralization is most pronounced.

<sup>1</sup> U. S. Geol. Survey Bul. 380, p. 77, 1909.

<sup>2</sup> Idem.

Surface exposures usually show no copper minerals excepting malachite (carbonate of copper) and chrysocolla (hydrous silicate of copper), but the presence of considerable limonite (hydrous oxide of iron) at some points indicates that the original minerals were sulphides of copper and iron.

The ore resulting from such impregnation as just described is very low-grade, at least where oxidized, but these deposits are of interest since they seem to be the loci of an unusually large number of boulder deposits of the type already described. While the latter are not by any means confined to such shear-zones, in some localities they are so closely connected therewith as to make it appear possible that the systematic development of these zones will expose a sufficiently large number of boulder deposits to make mining profitable.

An interesting feature of the type of deposit under consideration is their common presence parallel and in close proximity to dikes of dacite-porphyry. This suggests that the copper-bearing solutions have come directly from the dacite-porphyry after the serpentinization of the basic rocks into which they have been intruded, or that they have risen along the dacite-porphyry contact and spread into the adjacent sheared serpentine. They may have come from the same magma reservoir as did the dacite-porphyry. It has been suggested that the shear-zone deposits represent contact deposits originally of quite different types, which were later changed to their present condition as a result of the serpentinization process. The fact that the fragments of serpentine between the films of copper minerals do not themselves appear to be cupriferous, makes it appear unlikely that any considerable metamorphism has occurred after the introduction of the copper minerals; and the small size of some of the dacite-porphyry dikes mitigates against the theory that the mineralizing solutions were expelled directly from them during solidification. As some decidedly sheared zones of serpentine in the neighborhood of boulder deposits show no copper stains, and as it is difficult to understand how serpentinization could produce two such distinctly different types of deposits as the boulders and shear-zones, it seems most likely that the ore solutions have risen along the dacite-porphyry and spread into the adjacent sheared serpentine.

*Economic importance of the serpentine copper deposits.* Mr. O. H. Hershey, in the article previously quoted does not hesitate to state, in speaking of the boulder deposits, that "none of them is of economic

importance," and, also that "the little ore bodies are not sufficiently plentiful to make it practicable to work any part of the shear-zone as a large low-grade concentrating proposition." Still later he adds when referring to the deposits in Humboldt county "my impression is that nothing of value will be ever found there; that the float boulders have been derived through the weathering of small, hard bodies of ore distributed unsystematically and at wide intervals through the serpentine. There are no seams leading to them, nothing whatever to guide explorations under-ground, and searching for a sufficient number of them to make a mine would be economically futile."

Prospectors in the southern part of Curry county state that the principal mines of the type under consideration in northern California are known as the Cleopatra, Union, and Alta; and, that these are about 6 or 7 miles south of the California-Oregon line. It was reported that they, or some of them, were quite extensively developed when copper was very high, but that, although some high-grade ore has been shipped from them, their operation has resulted in loss rather than profit.

The Curry county deposits are so similar to those in California which have proved non-profitable that it is hard to regard their future optimistically. Mr. Hershey in his description of the California deposits does not mention the presence of mineralized shear-zones connecting some of the boulder deposits, and this feature may be peculiar to Curry county. Whether the boulders connected with such zones are sufficiently numerous to make profitable mining possible is doubtful, however. The boulder ores are so rich and sometimes occur in masses of such size that attempts to find and develop them along shear-zones may be justifiable.

What is really needed is some means of locating the many boulder deposits which doubtless exist, but do not outcrop on the surface. At present there seems to be no practical method of securing such data.

It is unlikely that the copper deposits of Curry county can ever be worked profitably on anything but a comparatively small scale.

#### IRON RESOURCES

In the summer of 1914 considerable excitement was caused in southwestern Oregon by the report that enormous quantities of iron



ore existed on Wake-Up-Riley ridge, southwest of Agness, and that one of the great Lake Superior iron mining companies stood ready to purchase claims located there as soon as they were convinced of the truth of the reports concerning the great quantity of the ore there found. The man responsible for these rumors succeeded in inducing a considerable number of people each to put up a few hundred dollars, for which he agreed to locate iron claims for them. He carried out his agreement so far as locating the claims is concerned, but it later developed that there was little or no basis for his assertions as to the interest of the Lake Superior iron mining company in the region under consideration. At the time this investigation was made his whereabouts was unknown to those interested, and considerable interest was expressed as to the value of the claims he located.

No one doubted that iron ore existed in the county, for several specimens had found their way to the State University or to the Bureau of Mines and Geology. The question at issue was, then, not the existence of iron ore, but the quantity present and the manner of occurrence.

#### NATURE OF THE DEPOSITS

As a result of the investigations on which this report is based, it can be stated that three distinctly different types of iron (?) deposits exist in Curry county, although but one representative of one of these was found. They may be called boulder deposits, bedded deposits, and impregnations. Each will be discussed in the order given.

*Boulder deposits.* The fact that magnetite is frequently found overlying the copper ores forming the so-called boulder copper deposits has already been mentioned, and in some cases, the amount of this mineral developed is considerable. It is also possible that "boulders" or lenses of magnetite unaccompanied by copper minerals occur in the serpentine. In fact, Hershey seems convinced of this, for he says: "Magnetite and chromite \* \* \* are common throughout the serpentine areas; \* \* \* but the association of the copper with the magnetite and chromite is comparatively rare." Whereas it is certainly true that chromite unaccompanied by copper minerals is not uncommon in the serpentine, it is an open question how much magnetite so occurs. Even if later developments show it to be comparatively plentiful it is unbelievable that any con-

siderable iron mining industry involving the use of this ore will ever be developed. It is possible, however, that if a practical means is ever discovered for locating the boulder copper deposits which do not outcrop, considerable magnetic iron ore will be mined as a by-profit. Whether this can ever be shipped profitably will depend upon the presence of transportation facilities much superior to those now in existence.

*Grade of the ore.* Pure magnetite should contain 72.4 per cent iron but the highest iron percentage found in the boulder deposits is 69.23. The sample which yielded this analysis was very slightly oxidized, and this doubtless accounts for the deficiency in iron. Other samples of decidedly magnetic iron ore yielded various percentages of iron down to as low as 56.59. The last mentioned specimen was considerably oxidized and contained 2.43 per cent copper. None of the samples analyzed contained more than a trace of sulphur, phosphorus, arsenic, or titanium, so should make a very good quality of steel.

*Bedded deposits.* The bedded deposits occur in Colebrooke schist, and are of special interest since those on Wake-Up-Riley ridge are of this type.

As no development work has been done on these deposits with the exception of the small, open discovery cuts required for a valid location of the claims, it was found very difficult to secure convincing data as to the form and size of the ore bodies. They have the appearance of lenses in the schist, which lie parallel to the foliation. Most of them appear to be small—only a few feet thick, but in one or two cases the cuts were entirely in ore, indicating a thickness of perhaps 10 feet or more. Mr. A. M. Collins, of Agness, who assisted in the location of the claims, and who acted as guide to the party during the examination of them, states that some of the location work was done by means of a dipping needle, and that in certain localities the needle stood practically vertically over an area of as much as 50 or 60 feet long by a score or more feet wide. This suggests that some of the ore bodies existing in the district are of considerably larger size than any of those exposed in the open cuts.

The iron mineral present is mainly magnetite (magnetic oxide of iron) which is considerably finer-grained and less noticeably crystalline than the same mineral in the boulder iron ores that occur in serpentine. It sometimes has a slightly brownish appearance, possibly

due to hydration. This variety is considerably softer than ordinary magnetite and occasionally shows a slightly brownish streak. Its appearance suggested the presence of psilomelane (impure hydrous oxide of manganese), and two or three fragments of the softer material yielded good bead tests for manganese when tested in the field. Two of the best looking samples, when analyzed, proved to contain respectively 28.29 per cent and 23.47 per cent iron, 12.95 and 7.30 per cent manganese, and a trace of phosphorus, but no titanium, arsenic, sulphur or copper. From these facts, it seems likely that all this ore is manganiferous.

The iron ore is in most cases perfectly transitional into the schist, becoming less and less massive and pure-looking as the edges of the bodies are approached. A few cubes of unaltered pyrite, evidently of a secondary nature, were found in some of the cuts, but most of the ore, including the samples analyzed, contains no sulphides. In one or two cases quartz streaks, parallel to the schistosity of the country rock, occur near the outside of the ore bodies; and in one cut some small, black, radiating crystals of tourmaline are associated with the quartz. The small quartz veins already noted as being common in the Colebrooke formation cut across the masses of iron ore, proving, of course, that the latter were formed before the veins.

The schists in the neighborhood of the deposits, although composed principally of muscovite mica and quartz, are quite granular, have a somewhat sandy texture, and show a slightly greenish tint in some of the cuts. This is due, doubtless, to the presence of some chlorite. They seem to dip at a rather small angle to the southeast; and this is also the direction of dip of the ore lenses or blankets.

The extent of the area over which the ore lenses are distributed is unknown, but the two cuts from which the samples analyzed were taken are both on the east side of the ridge, and are about 600 feet apart. There are several cuts on the west side of the ridge and some of these are probably at least a quarter of a mile from those first mentioned. From reputable authorities it was learned that a very large outcrop of the iron ore occurs in the first gulch southeast of Dry lake, about 7 miles southwest of the locality where the iron claims are located. An earnest effort was made to find this deposit, but no guide being procurable, the search was fruitless. The country rock all around the lake and for at least 2 miles further south is Colebrooke schist, and the presence of a large lens in that vicinity is not unlikely.

It is unknown whether other lenses exist between the outcrop unsuccessfully sought and the main iron locality.

Until more development work has been done on the deposits, it will be a difficult matter to decide with any degree of certainty as to how they originated. There seems little doubt that the enclosing rocks are largely or entirely metamorphosed sediments. This makes it impossible to consider the ores magmatic segregations. Neither have they the characteristics of the Lake Superior iron deposits, which are believed to have been leached from the surrounding rocks and concentrated in their present positions. Most authorities regard iron deposits in schistose rocks as being genetically connected with igneous rocks contained therein, that is, they consider them to be in the nature of metamorphosed contact deposits; but the absence of igneous rocks in the area under consideration makes this theory untenable in the case in question.

In view of the facts outlined, it seemed most likely that these deposits were laid down contemporaneously with the enclosing metamorphosed sediments. They may originally have been deposited as bog iron ore or glauconite, and been changed to their present condition as a result of the dynamo-metamorphism to which the whole formation was subsequently subjected. Their lenticular form is easily explained as due to the squeezing and shearing which accompanied the metamorphic processes.

While the theory just suggested seems, in the present state of our knowledge, to be the most probable one, it is recognized that subsequent more thorough investigations may prove it erroneous. The term "bedded deposits," as applied to the iron ores in the Colebrooke schist, should then be regarded as a tentative one.

*Economic importance of the bedded iron deposits.* It is unlikely that any of the lenses now developed by open cuts could be mined profitably even if transportation facilities were much more favorable than they are. It is not improbable, as already stated, that larger lenses than those already located exist, and they may some time prove valuable. A careful magnetic survey of the region is needed, and, if this should indicate the presence of any considerable amount of ore, the means for transporting it would doubtless be provided, as there is a good market in the northwest for this material.

*Impregnation deposits.* The only iron ore found which can properly be classed as an impregnation deposit occurs on the ridge running

easterly from Horse Sign butte between Horse Sign and Collier creek. The deposit in question is about 2 miles east of the butte proper, at an elevation of about 3,050 feet.

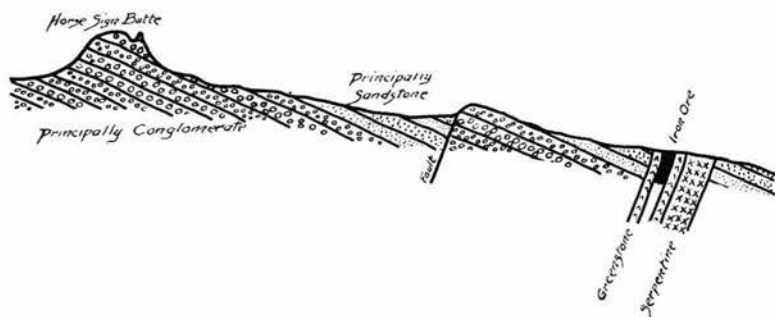


Fig. 21. Generalized section through ridge east of Horse Sign butte, showing the geologic relations of the iron ore in the Oregon prospect

Figure 21 is a generalized section of the ridge above mentioned and shows that the country rock is of Myrtle age, but is intersected by two or more dikes of igneous material, and is faulted at one point. The iron ore is magnetite, and it occurs as an impregnation in Myrtle sandstone between two greenstone dikes. The contacts of the sandstone and igneous rocks are not well exposed so it is impossible to ascertain the width of the impregnated sandstone; but little pits scattered here and there over the surface indicate that it may be as much as 50 to 100 feet wide, and that it runs for some distance down both sides of the ridge. There seems no doubt that a large body of ore could be developed here. The beds appear to strike about N. 20° E., and to dip 51° to the northwest.

The weathered ore looks like a highly jointed brown sandstone, but its great weight at once suggests the presence of metallic material; and the use of a hand-lens shows that the pores between the sand grains are completely filled with magnetite. So thoroughly impregnated is the sandstone that an average sample proved to contain 51.45 per cent of iron. Phosphorous, sulphur, titanium, arsenic and copper are entirely absent.

It seems likely that this deposit originated by deposition from solutions developed in the neighboring serpentine during the serpentinization process. Such solutions would normally have led to the formation of one or more masses of the boulder type of iron deposits in the serpentine itself, but accidentally finding their way

to the border of the serpentine, they worked outward through the greenstone, and impregnated the neighboring sandstone.

*Economic importance of the impregnation deposit of iron.* Although the iron ore as mined would be of rather low grade, it could readily be concentrated magnetically so as materially to increase its purity. As there is almost unlimited water power at no great distance this would not be an expensive operation.

The absence of detrimental elements, the apparently large size of the ore body, and the comparative ease with which it could be mined combine to make this deposit well worthy of a careful investigation, and of exploitation if transportation difficulties can be overcome.

### MISCELLANEOUS MINERAL RESOURCES

#### CHROMITE

Reports of the presence of chromite in Curry county have been in circulation for many years, and many fine specimens have been brought in by prospectors. It was, then, a matter of no surprise to find the mineral rather widely distributed and present in masses which were not infrequently of considerable size.

The chromite of Curry county always occurs in serpentine or basic rocks in the process of alteration to serpentine. This association is the normal one, not only in Curry county, but all over the world. In fact, workable deposits of this mineral are not known to occur in other rock.

Lindgren states<sup>1</sup> that "late investigations, particularly those of Vogt, have shown that chromite in large masses mainly represents purely magmatic separations in peridotite magmas." He prefaces this statement, however, by expressing the opinion that "in part the ore may have a secondary origin, being developed together with magnetite during the process of serpentinization from primary chromite, picotite, chromium-diopside, etc." It seems probable that both processes have been active in the production of the Curry county chromite deposits, for some of them occur in connection with the boulder copper deposits which were probably formed by the method last mentioned, while others are entirely free from copper ores, though in a district where the boulder copper deposits abound.

Most of the masses have more or less boulder-like or lenticular forms, but some are quite irregular in shape, and a few have the ap-

<sup>1</sup> Mineral Deposits, p. 747, 1913.



pearance of veins in the serpentine. In size, the single masses probably average larger than do the magnetite or copper-magnetite boulder deposits. In fact, solid chunks of chromite float were found which measured, roughly, about 5 by 10 by 10 feet.

The chromite varies considerably in appearance, as in some occurrences it is very fine-grained and rather dull-lustered, while in others it is coarse and decidedly metallic in aspect. Although sometimes slightly magnetic, it is never as noticeably so as is the magnetite, and can always be distinguished from the latter by the fact that it has a brown streak or powder, whereas the magnetite streak is black. The octahedral crystallization of the mineral is sometimes apparent, although not as commonly shown as is the case with the magnetite.

Two specimens from widely separated localities were analyzed and proved to have the following compositions:

Chromic oxide 45.99 and 48.09 percent, iron 20.41 and 16.44 per cent, silica 21.33 and 19.78 per cent, alumina 2.14 and 8.12 per cent, no magnesia in either sample, and a trace of titanium in the second sample.

These analyses indicate that the ore is of fair grade so far as the chromium content is concerned, but that it is of unusual character in two particulars. The first of these is the total absence of magnesia, and the second is the unusually high percentage of silica. No effort was made to determine what effect the presence of the high percentage of silica would have upon the physical or chemical properties of the ore.

#### **METALS OF THE PLATINUM GROUP**

For many years it has been known that the stream and beach placers of southwestern Oregon not infrequently contain platinum, osmiridium (iridosmine), iridium and, sometimes, other members of the platinum group; and for a number of years that part of the state has been credited with a yearly production of a few thousand dollars' worth of these metals. In fact, southwestern Oregon has, with the exception of northern California, been the only steady producer of platinum in the United States; and it is likely that the two localities mentioned have yielded more platinum than all the rest of the country put together.

The platinum metals are, like gold, very heavy, and occur in stream and beach placers in exactly the same way as does gold. Unlike gold, however, the individual grains are practically always very small

and difficult to save, so do not attract attention as quickly as does the gold. In the early days when the value of platinum was not appreciated, it, together with other rarer substances in the so-called black sand, was thrown away, and large quantities have doubtless been lost in this way. At present it is eagerly sought, however, but is always mined as a by-product in the production of placer gold.

The platinum found in Curry county has a bright metallic luster and is usually steel gray in color, although lighter tints are sometimes found, and silver white platinum is not unknown. It usually occurs in tiny scales which are malleable (can be pounded out into thin sheets) and sectile (can be cut with a knife). Some of the metal is magnetic, although this is not always the case. In fact the Curry county platinum rarely appears to be as magnetic as is the magnetite with which it is associated, and magnetic methods may frequently be used to separate the two.

The osmiridium (iridosmine) differs from the platinum in being considerably harder (will scratch glass), rather brittle, silver-white (usually) in color, and in its tendency to occur in hexagonal scales.

The iridium is as hard as the osmiridium, and, like it, is rather brittle. Fractured surfaces are, however, apt to be gray, although the color on the outside is usually silver-white with a slight yellowish tint. It is more apt to occur in angular grains than in scales.

Other members of the platinum group which may be present cannot be recognized with any degree of certainty without chemical tests.

The platinum is usually the most plentiful of the minerals just described, but Diller mentions<sup>1</sup> one locality on the Sixes river where osmiridium was detected without any accompanying platinum. The ratio of gold to platinum group metals varies widely in different localities. It is claimed that at the Blanco mine the ratio of these two substances is as twenty is to one, while at one Sixes river locality these two substances occur in the ratio of about seven to one. Not a few very productive gold placers contain no platinum whatever.

As to the source of the platinum, little that is definite can be stated. Diller says<sup>2</sup> that "where it (platinum) has been traced to its source in other regions it has been found in serpentine, and in Oregon it probably has the same association." Mr. Frank Berry, of Agness, makes the positive assertion that in each of many cases that he has investigated it has always been possible to trace the platinum back to

<sup>1</sup> U. S. Geol. Surv. Folio 89, p. 6, 1903.

<sup>2</sup> *Idem*.

a serpentine area. He also believes that all the serpentine areas in the county contain platinum. Several prospectors in Curry county described deposits of platinum in serpentine. In some cases they claimed to have found extremely thin veinlets of the metal, while in others it was stated that the serpentine when crushed and panned yielded scales of platinum. It was, however, impossible to substantiate any of these rumors. Recent investigations of the subject indicate that this metal is considerably more widely distributed, especially in connection with deposits of copper-ores than has been thought probable. It is not at all unlikely that it occurs in Curry county as a decidedly minor constituent of the boulder or other types of copper deposits in serpentine; and that considerable primary segregations of the pure metal do not exist. Prospectors should, however, always keep this metal in mind, especially when investigating the placer deposits of streams draining serpentine areas.

#### COAL

Coal has been found in the Eocene beds of Curry county at a number of points. The two most promising regions are in the vicinity of Eckley and near the mouth of Shasta Costa creek. Diller describes<sup>1</sup> the former occurrences as follows:

Within the Arago (Eocene) formation of the Eckley area coal is known only close to its base where it comes in contact with the Myrtle formation, and the most important outcrops yet found are along the southern border near the head of the Middle Fork of the Sixes, and two miles nearly west of Eckley, on the eastern slope of Sugar Loaf mountain.

Near the southern line of Sec. 14, T. 32 S., R. 13 W., a number of tunnels and open cuts have been run in various directions into a mass of coal and coaly shale that varies greatly in structure and composition. Much of it is crushed and slickensided, but other portions appear to be good coal with bright luster on fresh fractures.

A short distance further south at an elevation of over 2,000 feet above the larger mass an outcrop of coal and coaly shale similar to that already noted occurs in place, and is penetrated by a tunnel running almost directly east and parallel to the strike of the bedding. The total thickness of the coal and associated carbonaceous shale is not well exposed, but may be nearly fifty feet.

Another outcrop which has been developed is in section 35 at the eastern part of Sugar Loaf mountain, close to the contact of the Arago beds with the underlying rocks. Here the coal-bearing beds at the base of the series have a thickness of not much over fifty feet and are overlain by nearly one hundred feet of firm sandstone. The coal-bearing series are shales and soft sandstones, and contain two beds of coal, one of which is so much crushed that its thickness (said to be twenty feet) cannot be definitely measured. Near it are a few feet of sandstones and shales, and then a five-foot bed of the best looking coal seen in the

<sup>1</sup> U. S. Geol. Surv. Folio 89, pp. 4-5, 1903.

region. \* \* \* A number of other outcrops occur on the small streams tributary to the main stream flowing through section 35 and along the North Fork within a mile below Eckley, but the best coal cannot be identified at any other point.

The coal beds vary greatly and abruptly indicating that they are not of great extent. Aside from the difficulty of transportation it is not believed that there is sufficient coal in that country to warrant the expectation of profitable mines.

The Shasta Costa coal beds are well exposed and are on the right hand bank of Shasta Costa creek near its mouth. The material there is mostly bone and shale. In fact, no seam of pure coal over one inch wide was found. Mr. Harry Hillis claims that he has made attempts to burn this coal in camp-fires, and, that although it did burn under these conditons, the chunks retained their shape and were approximately the same size after burning as when put in the fire. Diller states<sup>1</sup> that

An attempt to mine the coal has not proved successful. It has a thickness of not over four to six feet, and looks on the whole to be of poor quality, but in composition it is remarkable, resembling in some respects the pitch coal, and in others the normal lignite of the Coos Bay coal field. \* \* \* It contains a remarkably low percentage of water, and, when heated, partially fuses like pitch coal; but, like the normal lignite, it contains a larger percentage of ash and a much more nearly equal amount of volatile matter and fixed carbon. It appears to coke well, but the large amount of non-combustible ash in the coke reduces its value. Where exposed on Shasta Costa creek the coal shale has a thickness of ten feet.

The coal shale is overlain by sandstone containing Eocene fossils, while beneath it is a heavy bed of conglomerate. These strata dip gently in an easterly direction, and are underlain unconformably by highly tilted and crushed shale, and other Myrtle sediments. These last are well exposed along the bank of the Rogue river.

Coal is also reported to occur in the Eocene sediments along the coast in the southern part of the county, but the reports which reached the field party were of so indefinite and unpromising a nature that the occurrences were not investigated. It is claimed, however, that outcrops of small beds exist at several points along the north fork of the Chetco, and that Jeffries and Aikens have opened a 10-foot bed in the bluff above Thomas creek at its mouth. Still other outcrops are said to occur along the creek next north of Thomas creek.

*Probable economic importance of the coal beds.* From all the data available the conclusion is inevitable that known occurrences of coal in Curry county are hardly of sufficient importance to compete

<sup>1</sup> U. S. Geol. Surv. Folio 89, p. 5, 1903.

successfully with the more extensive deposits of the Coos Bay region. As the widespread use of the cheap California crude oil has made it impossible to work many of the last mentioned beds profitably, it is unlikely that any of the Curry county deposits will prove valuable until the purer coals more plentiful elsewhere have been exhausted.

#### BORAX

Priceite is believed to represent a massive and not entirely pure variety of colemanite, which is the principal substance from which borax is manufactured. It is a hydrated borate of lime, that occurs in soft, loosely adherent, somewhat chalky, snow-white masses. Dana's "System of Mineralogy" speaks of it in the following terms on page 884:

Priceite is from Curry county Oregon, five miles north of Chetco, where it occurs in a hard, compact form in layers between a bed of slate above, the cavities and fissures of which it fills, and blue steatite below; also, it occurs in boulders or rounded masses completely imbedded in the steatite. Many of these masses weigh two hundred pounds each. Others are smaller, from twenty pounds down to small pellets the size of a pea. Named after Mr. Thomas Price, of San Francisco.

The description of the material in the extract just quoted would seem to apply better to the variety known as pandermite than to material now commonly called priceite, since the former is firm and compact rather than friable and chalky. The question of nomenclature is not a matter of much moment, however.

The Borax mine, as it is known throughout Curry county, is on the Lone Ranch owned by Moore Brothers. It lies along the coast, 5 and one-half miles north of Brookings, and at least 8 and one-half miles northwest of the hamlet of Chetco, instead of 5 miles as stated in the paragraph quoted. The country rock containing the borax is entirely serpentine of the type common throughout Curry county. Not the slightest trace of slate or talc (steatite) was found. The serpentine is typical in every respect, and bears little superficial resemblance to the other substances mentioned.

It is claimed that considerable material was mined here many years ago and was shipped to San Francisco, but that "no one could reduce it" and that the property has lain idle since. It is reported that the Pacific Borax Company now controls the deposit. The property was evidently developed by means of a number of open cuts and short tunnels, but all of these have caved with the exception of one tunnel which is 75 or more feet long, but which was so full of water

as to make an examination of the material exposed a difficult and unpleasant proceeding. A few streaks and lenses of soft, white material are present, however, and samples from these yielded reactions for boron, as did also a few badly weathered fragments picked up on the old dumps.

From the testimony of men who have worked on the property, there seems no doubt of the essential correctness of the description of the manner of occurrence given by Dana. It was utterly impossible, however, to secure any information as to the frequency with which the large boulder-like masses were encountered, but residents of the locality say they were not plentiful. Little is known of the extent of the area over which they are scattered, although one man stated that one or more similar masses were found while building a bridge across the creek a mile south of the so-called Borax mine.

So far as known, this occurrence of borax minerals is unique, and it is unfortunate that it could not have been carefully studied and described at the time the various cuts and tunnels were made. With the scanty information at hand it would be idle to attempt any explanation of the manner in which this deposit originated, but it is interesting to note that the general manner of occurrence is identical with that of the copper deposits in serpentine, namely, boulder-like masses and shear-zones.

#### MERCURY

Nuggets of the heavy, red mercuric sulphide (cinnabar) are occasionally found in the southwestern Oregon placer deposits, and one or two deposits of this mineral in place have been located. None of these were found during the field work in Curry county, however, and only one report of the existence of cinnabar in this county reached us. This rumor was to the effect that the mineral occurred in place north of the Moore ranch on the east side of the Cheteo river, near the point where this stream changes its course from an easterly to a southerly direction. Nothing was learned concerning the nature of these deposits, as no one could be found who would guide the party to them, and no indications of their presence were seen while passing through that district.

#### LEAD AND ZINC

The only zinc ore found in Curry county occurs in the Florence prospect near the summit of Mount Emily, and this occurrence will be described in later pages.



No lead ores of any kind were seen, although it was reported that during the Indian wars lead ores were mined and converted near the mine into metallic lead which was used as bullets. It was further stated that a hollow stump was used as a blast-furnace in this operation, and that particles of metallic lead and slag can still be found in the vicinity. The locality where these operations were conducted could not be learned, however.

#### DIAMONDS

It has long been known that diamonds have occasionally been found in the placers of northern California. Kunz states<sup>1</sup> that they are very likely to be found in the flumes and sluices not only there, but "in the vicinity of Coos Bay in Oregon." Whether any have ever been found in Curry county could not be ascertained, but the geologic conditions there are identical with those existing in the diamond localities of northern California, and their possible presence should always be borne in mind by placer miners. Any transparent, light colored mineral of such a weight as to tend to collect in sluice-boxes should be carefully investigated, especially if it is unusually hard and occurs in octahedral or rounded crystals or grains.

The source of the diamonds found in this part of the country has never been ascertained, but many of the basic rocks existing in this region are very similar in composition to the material containing diamonds in South Africa and Arkansas. This is true of the peridotites, especially; and diamantiferous masses of these rocks may sometime be found. Whether the gems will be sufficiently plentiful therein to make the deposits profitable is a question on which it is useless to speculate.

#### LODE MINES AND PROSPECTS

No pretense is made of furnishing a complete directory of the lode mines and prospects of Curry county. There are doubtless many of these, some of which have considerable merit, that are not mentioned herein. Those included are the ones examined during the course of the investigation, or concerning which apparently reliable data could be secured from other sources. The various properties are numbered consecutively according to their locations, beginning in the northern and western part of the county and progressing to the southern and

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<sup>1</sup> Gems and Precious Stones of N. Amer., pp. 28-29, 1890.

eastern portion. The approximate locations of the deposits described are indicated on the map which constitutes Figure 1.

#### **SOUTH FORK SIXES RIVER DISTRICT**

The presence of workable gold placers along the south fork of Sixes river and along the main stream, especially below the forks, has lead to considerable prospecting for the lodes from which the gold came. These efforts have in the main been unsuccessful, and this has led Diller to state<sup>1</sup> that "the original source of the gold is in the quartz veins of the Myrtle formation." Whether he is correct in this conclusion is a matter that must remain undecided until the region has been developed to a considerably greater extent than at present. A few well defined veins not in the Myrtle formation have already been discovered, and it is not unlikely that diligent search will reveal others. The two prospects described below both lie largely or entirely within a mass of greenstone (called gabbro by Diller). Observations elsewhere in the county have shown that this rock is apt to contain veins some of which are rich, and this indicates the advisability of prospecting thoroughly the occurrences under consideration.

*Lode 1, P. L. Wallis' quartz claim.* This property is located on the South Fork of Sixes river between the fork and Rusty creek. It was discovered May 1st, 1915, and was being developed on August 21st, at the time the examination was made. An open cut with a 20-foot face then exposed a quartz seam varying from 1 to 4 feet in width, which was considerably iron-stained and showed no sulphide minerals. The prospect was not sampled, and no information concerning the grade of the vein matter was procurable.

*Lode 2, Harrison property on Rusty butte.* Diller describes<sup>2</sup> the deposits at this point as follows:

Greater success has attended the efforts of prospectors on Rusty Butte, where the Harrison's and others have discovered some promising but small ore bodies, which occur partly in sedimentary but mostly in igneous rocks.

The first discovery was made at St. Patrick's, nearly 1,000 feet below the summit of Rusty Butte, on the southern slope, in slaty rocks, but not far below the contact with the overlying igneous rock which has altered the slates. Both walls are of slate, and strike N. 45° E., with a dip of 65° N. W. The ore in the small irregular vein is usually quartz full of pyrite, which by its decomposition liberates the free gold, stains the rock with oxide of iron, and softens the mass. Other portions contain calcite instead of quartz, and associated with the pyrite are small quantities

<sup>1</sup> U. S. Geol. Surv. Folio 89, p. 5, 1903.

<sup>2</sup> U. S. Geol. Surv. Folio 89, p. 6, 1903.

of bluish-gray mineral which from its cubical cleavage is regarded as galena. Tellurium is said to be present, but a test by Dr. W. F. Hillebrand for that element in the most promising specimens the writer obtained at the mine showed no trace of it. Instead, however, Dr. Hillebrand found considerable arsenic and some lead, indicating that part of what looks like pyrite is arsenopyrite, and that the gray mineral is galena.

The Golden Fleece and other openings near the summit of Rusty Butte are wholly within igneous rock, which where best displayed is an altered gabbro composed of plagioclase feldspar and a greenish hornblende. In places near the mines the rock is decidedly porphyritic with dark crystals of augite which are changing to hornblende. Quartz is not one of the original constituents of the rock here, but it is permeated with small veinlets of quartz of secondary origin.

These minute veins are altogether irregular as to size, direction, and distribution. The deepest openings examined were at the Mountain Daisy and Golden Fleece, where the open cut and shaft reach fifteen feet into the decomposed gabbro. Small irregular cavities occur in it without order, here and there containing black to reddish-brown powdery material which is generally rich in fine gold. Much of the gold is wiry and cross-striated in various directions, as if from contact with striated quartz crystals, with which it is associated in the seams. The powdery material is a mixture of black oxide of manganese and reddish-brown oxide of iron resulting from the alteration of the pyrite.

At the face of the Golden Fleece tunnel the gabbro is rotten, with a belt of little seams nearly a foot in width. The seams are irregular, but more or less lenticular and approximately horizontal. They contain the auriferous black and red oxides of iron, but are not persistent. The crushing of the Cretaceous rocks near the close of that period was extensive, leaving a multitude of small fissures, and the fissures were filled with quartz and locally with calcite. They contain chiefly pyrite, a little galena, and perhaps some other ores which on alteration and concentration yielded the little pockets now sought for.

From the Mountain Daisy, which was discovered in 1899,  $7\frac{1}{2}$  ounces of gold were taken out in a very short time. The gold, containing considerable silver, is low-grade. The pay seam in this claim was nearly vertical and soon ran out below. It is pockets and seams of this character chiefly that have supplied the placer gold of the stream and beach gravels. Their small size, irregularity, and lack of persistence are not encouraging features.

#### ELK RIVER DISTRICT

The gravel deposits along the Elk river have not proven to be very auriferous, and Diller's map in U. S. G. S. Folio No. 89 shows no placer or quartz mines along this stream. Men who have prospected this district claim, however, that rich bars exist at certain practically inaccessible parts of the canyon below the mouth of Bald Mountain creek, and it is known that Chinese recovered a considerable amount of gold from a bar less than half a mile below the mouth of that stream.

It is noteworthy that the two prospects mentioned below are in or very close to greenstone (gabbro), as were those along the South

Fork of the Sixes river, and that no prospects in the surrounding sedimentary rocks were brought to the attention of the field party.

*Lode 3. Moss Rose group (Axtell Mine).* At the time the field party was in the vicinity of this property Mr. Geo. W. Axtell, the owner, was away and no one could be found to act as guide to the various prospects in the district. After considerable search, however, one of the main veins was located, and was found to consist of a series of quartz veins in greenstone, which strike N. 60° E. and dip 53° N. W. They are exposed in an open cut which reveals perhaps half a dozen veins varying in width from a foot down, and forming a mineralized zone with a total width of something over 12 feet. Faulting has occurred along both sides of this zone. The quartz veins seem to be slender over-lapping lenses, are very compact, and contain no visible ore minerals except chalcopyrite which is fairly plentiful, but is segregated in bunches here and there through the quartz. Pyrite is present in the greenstone near the quartz veins.

Samples were taken across the whole mineralized zone and of the sulphides and quartz separately. These were mailed to Corvallis, but were, unfortunately, never delivered. A sample across the whole mineralized zone was sent in subsequently by Mr. Axtell, which yielded on assaying a trace of gold and 0.4 of an ounce of silver. It is only fair to state, however, that this sample was nine-tenths country rock, and even the vein matter included was comparatively free from sulphides. It would be interesting to know how well the pure sulphides, such as could be obtained by concentration, would run.

Mr. Axtell has opened three other ledges all within 800 feet of each other, but these could not be found. At least one other group of claims has been located by other parties in the vicinity of the Moss Rose ground. Samples from these, as well as from Mr. Axtell's other unexamined claims assayed from nothing to a trace of gold.

*Lode 4. Free gold claim.* This property was located by Mr. C. W. Curl on June 21st, 1915, the discovery cut being almost at the water's edge on Elk river a few hundred yards below the mouth of Bald Mountain creek. At this point a vertical dike of dacite-porphry which strikes about S. 10° W. cuts through a mass of Colebrooke schist near the contact of the latter with greenstone. It is about side. There, along the contact, it is practically pure quartz and is said 75 feet wide, and becomes more and more siliceous toward the western to have yielded ore in which free gold was visible. None of this

metal was seen during the hurried examination made, and, as samples taken were lost in the mail, the grade of the material remains uncertain. It is an interesting fact that the Chinese who worked the placer already mentioned recovered gold from a bar just below this dacite-porphry dike, but could find none above it.

#### MULE CREEK DISTRICT

The mines of the Mule creek district, in the northeastern corner of the county, are all in a mass of greenstone whose nature has already been discussed (see page 30).

The first work in this locality was done in 1891 by John Billings, and the son, G. W. Billings, is still mining here. Attention was first given to the placers along Rogue river, especially the one on Red river bar, half a mile below the mouth of Mule creek; but the search for the sources of the placer gold soon resulted in the discovery of a number of veins, and it is upon these that most of the work was being done at the time the examination was made.

In general, it may be said that two classes of lode deposits occur in this district. One of these takes the form of rather narrow, considerably faulted, high-grade quartz veins containing more or less free gold. Important examples of these are the Lucky Boy (Tina H), Paradise, and Big Devil's Stairs veins. While some of the deposits of this type have been profitably mined, their small size, faulted condition, and irregularly distributed values are factors which mitigate against their profitable development. The ore contained therein is sometimes so rich, however, that numerous attempts to mine them have been made, and doubtless will be made in the future, regardless of the difficulties and discouraging features already mentioned.

The second type of deposit found in the area under consideration consists of mineralized shear-zones of considerable width and of relatively low grade. Good examples of these are the so-called "Iron Dike" of the Red River Mining Company and the Excelsior vein on the south side of Rogue river. These are wider than the deposits first mentioned, and have not been subjected to much faulting, so are decidedly easier to mine. The ore is comparatively low grade, and much of it is in the form of sulphides, so the shear-zones have not received the attention that has been accorded to the small quartz veins. It is believed, however, that if mined on a sufficiently large scale, they may prove remunerative, and they certainly seem deserving of careful investigation.

*Lode 5. Paradise.* The Paradise mine, in which G. W. Billings owns a two-thirds interest which he purchased from J. J. Kenney in 1905, is situated on the west face of the southern peak of Saddle Mountain near the top, about six miles by trail from the mouth of Mule creek. The elevation, as determined by means of a barometer, is 3,220 feet. About one-half of the work has been done under lease and bond, and 1,000 pounds of selected ore are said to have been shipped from the property. A map of the workings and vein is given on figure 22.

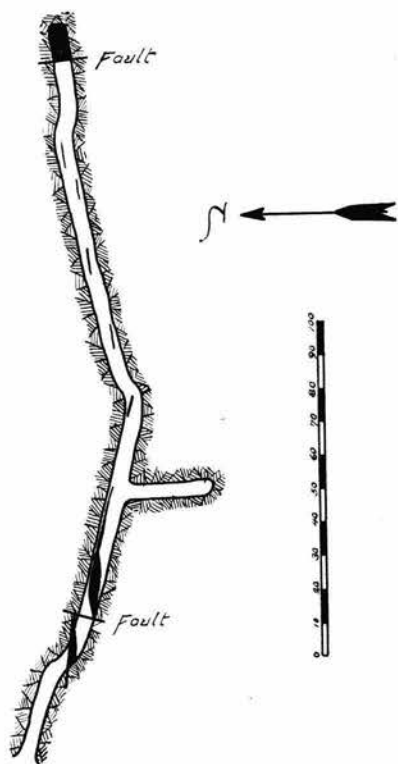


Fig. 22. Paradise workings. Vein matter shown in solid black

At the mouth of the adit no vein matter is shown, but about 34 feet from the portal ore which strikes N. 84° W. and dips 62° S. W. is seen. There it consists of 3 or 4 feet of vein matter which is mostly quartz. This pinches out along the left wall 12 feet further in; and 4 feet further toward the face, a fault perpendicular to the



line of the tunnel brings the vein into the workings. Where first shown it is narrow, but gradually widens until the mineralized zone is 3 feet in width. This condition persists for about 18 feet. Then the quartz in the vein suddenly pinches out along the left wall; but 12 inches of soft sheared material is exposed for a distance of about 12 feet along that wall, after which quartz reappears in the same line as the sheared zone. This quartz vein is only 2 inches wide at first, but gradually widens to 6 inches and finally disappears 91 feet from the portal. At a point about 111 feet from the mouth a quartz vein dipping 70 degrees to the south comes in along the left wall. It varies from 2 to 8 inches in width and disappears about 119 feet from the mouth of the tunnel. Only occasional narrow stringers of quartz show for the next 80 feet, and no quartz is visible after this until a point 10 feet from the breast is reached. There a fault-plane is cut beyond which is a wide mineralized zone clear to the face. The face is entirely in vein matter, although only about one-half is quartz, and the vein at that point dips 74 degrees to the south.

The only ore mineral recognizable is free gold, although numerous unrecognizable gray stains appear in the quartz and are reported to be tellurides. A qualitative test for tellurium made upon them revealed no trace of that metal. It would be easy to select samples which would run several hundred dollars a ton, but the vein matter as mined is said to run about 10 dollars per ton.

The great irregularity of this deposit is typical of the small quartz veins of the district. Not only are they themselves fault fissure veins and are therefore subject to variations in width, but cross faulting has further magnified this irregularity, although the slips appear to be comparatively small.

*Lode 6. Lucky Boy (Tina H).* This property was located in 1902 or 1903 and was formerly called the Tina H. It is at present held by Charles Tucker who relocated it in 1910, the title of the former owners having been allowed to lapse. The former owners put in a two-stamp mill to which Mr. Tucker has added a cyanide plant. He owns two claims (end to end) along the main Lucky Boy vein and another north-south claim on a vein said to run under the bunk-house. The property is located about two and one-quarter miles from the mouth of Mule creek on the west side of the west fork of that stream not far from where the trail crosses the creek. The

mouth of the tunnel is at an elevation of 1,000 feet as determined by means of the aneroid barometer.

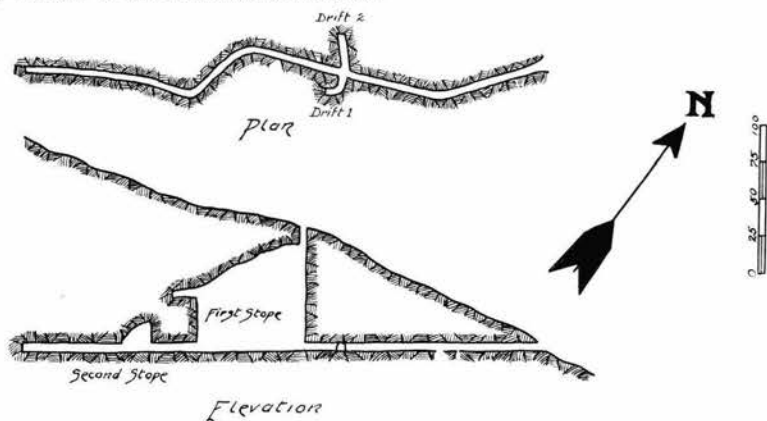
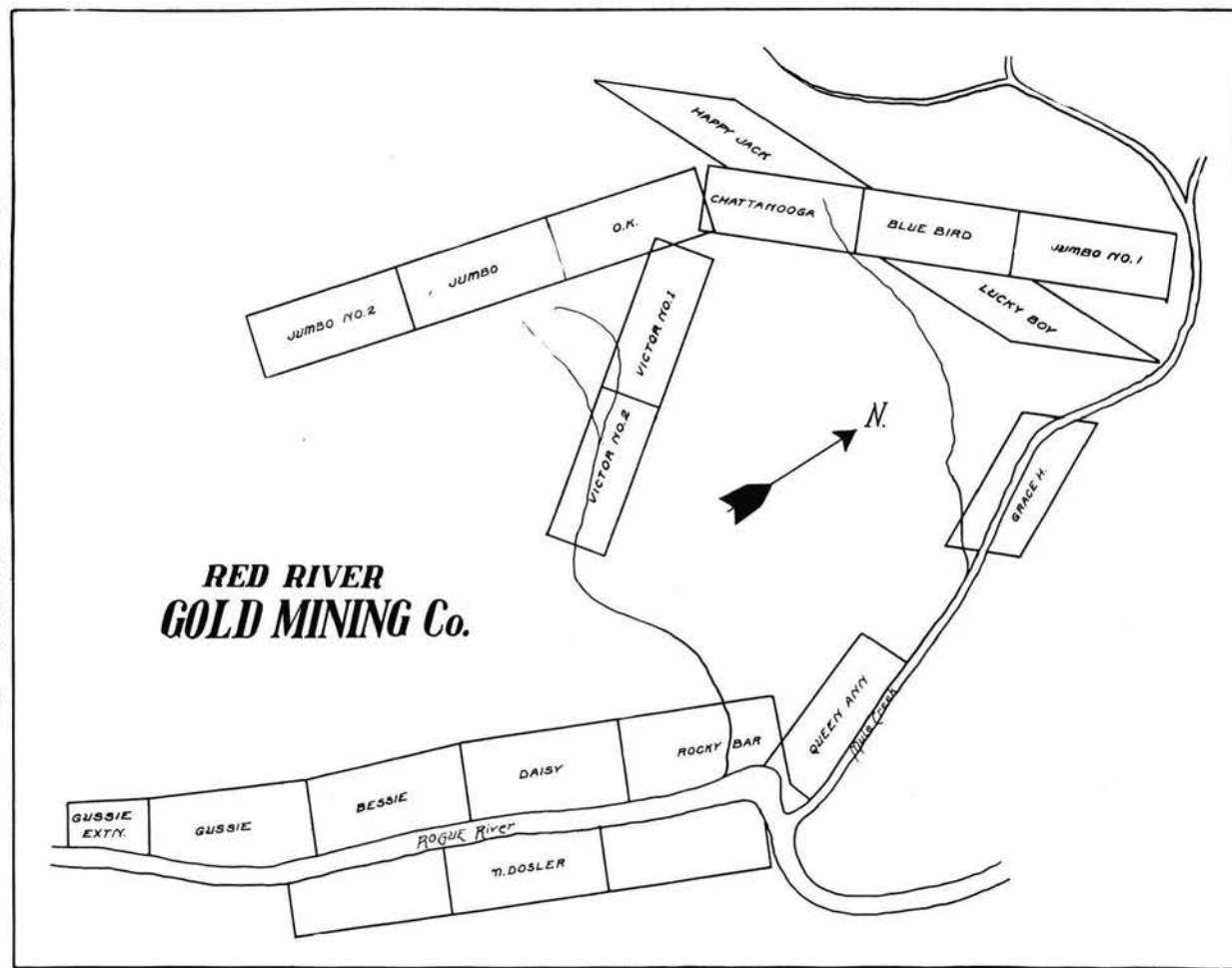


Fig. 23. Lucky Boy (Tina H.) workings

G. W. Billings is said to have taken out over \$48,000 of ore from the first large stope during the time he acted as superintendent of the mine. The present owner had mined only about 30 tons at the time the examination was made, but it was his intention to start a new tunnel for the purpose of tapping the ore shoot at about 75 feet below the present workings. He tried to sink a winze on the ore-shoot but found it impossible to handle the water. Figure 23 shows a sketch map of the workings.

The tunnel was driven on a quartz vein which varies considerably in width and splits at some points into a number of stringers separated by country rock and containing more or less chloritic material. One of these stringers is usually much larger than the rest, however, and may be designated the main vein. Drift 1 follows a small off-shoot from the main vein, and between the entrances of drifts 1 and 2 the vein is badly broken up and faulted to the northwest, which doubtless accounts for the opening of drift 2. One prominent fault in drift 2 is nearly vertical and strikes approximately north and south. Many other such north-south faults are shown at other points in the property. These are usually of the normal type with small slips. A few feet beyond the entrances of drifts 1 and 2 the vein is again encountered in the main tunnel, and can be followed there without difficulty until the face is reached. At that point the mineralized zone is at least 3 feet wide, but only a comparatively

Fig. 24. Property of Red River Gold Mining Company



small portion of this is quartz. In general, it may be said that the width of the main quartz vein varies from an inch or two to over a foot, and that it dips to the northwest at angles varying between 49 and 68 degrees.

Most of the ore produced has come from the first stope, but some still remains in the second stope, and Mr. Tucker claims that it will run \$27 in gold. He also states that the ore at the face will assay only \$5; and claims that it is impossible to distinguish visually between good and poor ore.

The ore minerals visible are free gold and a little chalcopryrite. Some green stains, due to the presence of carbonate of copper also occur. The gold is very yellow and the particles are minute, but it is plentiful in patches in the quartz which is itself very compact and "tight." Gray stains often show in the quartz around patches of free gold. These suggest the presence of tellurides, but qualitative tests for tellurium resulted negatively.

Another opening on the main vein, which is considerably above and some distance south of the first, shows one foot of perpendicular quartz striking S. 30° W. Near the end of the cut the vein is offset a foot to the southeast by a fault striking N. 39° W. and dipping 72 degrees S. W.

The mill, which is run by water power, is so arranged that the ore first goes over a one-inch wooden grizzly. The over-size is crushed in a 6-inch jaw crusher and is then, together with the material that is passed through the grizzly, fed into a 2-stamp mill, after which the tailing is cyanided. It is claimed that 40 per cent of the gold in the ore is caught on the plates of the stamp mill.

*Lode 7. Red River Gold Mining Company.* In June, 1906, this corporation purchased from R. A. Mattoon six lode claims and nine placer claims. The former are on Mule Mountain, north of Rogue river and west of Mule creek, while the latter lie along Rogue river and Mule creek. The location of the various claims is shown on figure 24. Subsequently, four lode claims and one placer claim were located by the Red River Gold Mining Company. These are the Victor No. 2, Happy Jack, Lucky Boy, Jumbo No. 1, and Grace H.

The company stopped work in April, 1912; and George M. Cheney, of Indianapolis, Indiana, and W. H. Corwin, of Marial, Oregon, are now the sole active bond holders. Cheney owns most of the bonds but Corwin is developing the property under an option from

the former. He began work September 20th, 1914, and at the time this examination was made had done little but prospect. The lode claims have not been developed except by such open cuts and short tunnels as constitute the annual assessment work. In all, however, there are about 250 feet of tunnels on the property.

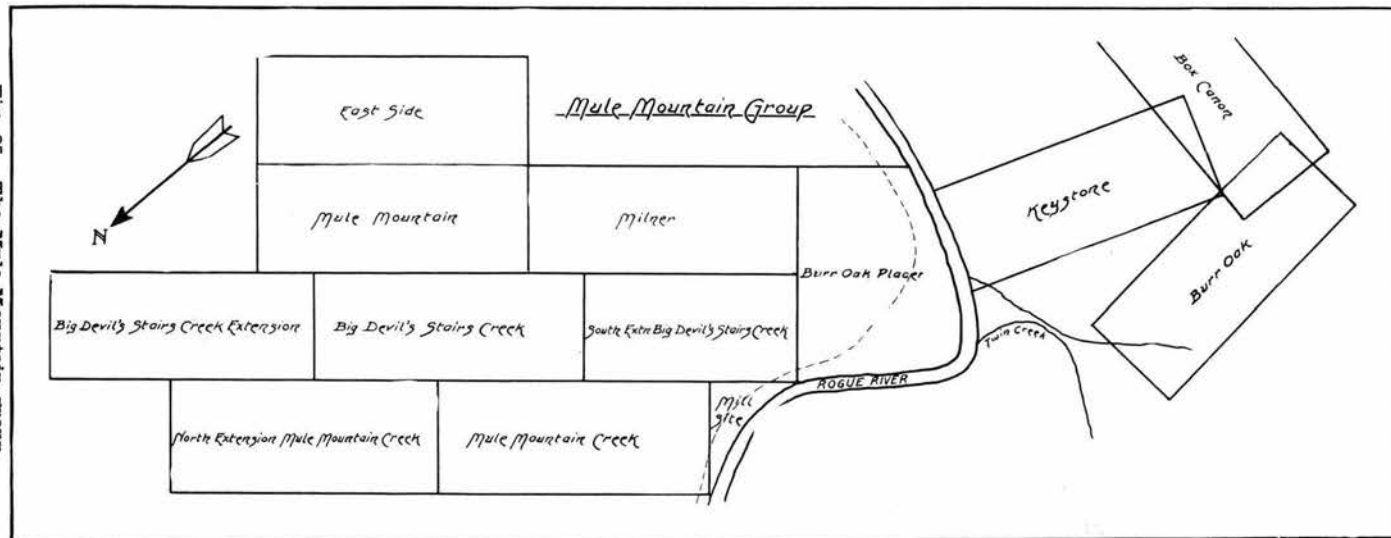
The principal vein owned by the company is the so-called "Iron Dike" which traverses the Jumbo No. 2, Jumbo O. K., Chattanooga, Blue Bird, and Jumbo No. 1 claims. It is said that this deposit may be traced many miles, but no attempt was made to substantiate this claim. The deposit is essentially a shear-zone in greenstone, containing numerous narrow quartz stringers. It varies from 10 to 50 feet in width, and averages about 20 feet. The visible ore minerals are chalcopyrite, which is sometimes plentiful, and lesser amounts of pyrite. The zone does not appear to have undergone much cross faulting and it usually stands nearly vertically. Samples are said to run between \$2.50 and \$4.50 in gold, with a probable average of about \$3. Picked samples from the Blue Bird claim, where the mineralized zone averages 10 to 15 feet, are said to run as high as \$300 a ton in gold.

The vein on the Victor No. 1 claim is a narrow quartz vein in greenstone, very similar to that found in the Lucky Boy (Lode 6) already described. It is more or less broken up by cross faults, and varies in width from an inch or so up to a maximum of a foot; the average is probably about 4 inches. Like Tucker's Lucky Boy it contains free gold. It is, in fact, in nearly all respects except width, a replica of that vein.

*Lode 8. Mule Mountain Mines.* This property consists of one placer and eleven lode claims as shown on figure 25. These were all located between 1896 and 1898 by George W. Billings and J. T. Milner, now dead. Mr. Billings now owns and is developing the group which lies about 3 miles below the mouth of Mule creek on both sides of Rogue river. While Mr. Billings feels confident that many veins traverse the group, 3 are much more prominent and have been more extensively developed than the others, so these only were examined. They are the Mule Mountain, the Big Devil's Stairs creek, and the Keystone veins. These will be described in some detail.

The principal workings on the Mule Mountain vein lie at an elevation of about 1,940 feet, as determined by means of a barometer. They consist of an open cut about 25 feet long with a maximum

Fig. 25. The Mule Mountain group





width of 12 feet, an 86 foot shaft a short distance southwest of this cut, and several smaller cuts farther to the southwest. In these exposures the vein strikes about N. 60° E., and dips 58° S. E.

The country rock of all the veins in this group is greenstone, which is at some points on the mountain so coarse-grained as to constitute a typical diorite. Elsewhere it is decidedly porphyritic, and, in at least one locality, quite gneissoid in appearance.

The Mule Mountain vein, as exposed in the shaft and cuts to the southwest thereof, consists of about one foot of rather solid quartz, which is white as a rule, but contains brown patches that doubtless represent oxidized sulphides. In this quartz are several streaks of country rock, and narrower streaks of quartz parallel to the main vein on both sides, making the deposit a combination shear-zone and fissure vein. On the northeastern face of the open cut the conditions are as sketched in figure 26. The country rock is more or less sheared

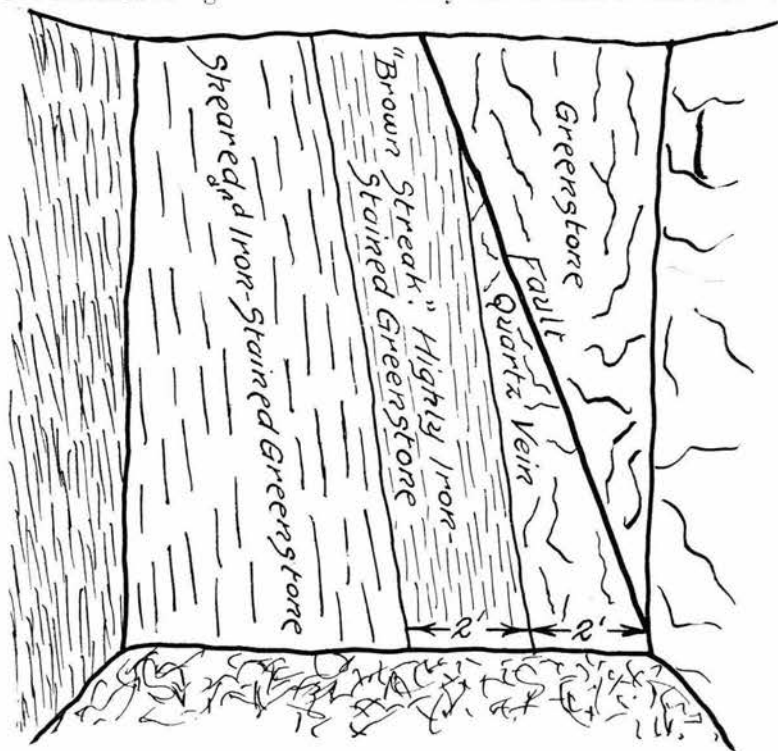


Fig. 26. Sketch of northeastern face of open cut on Mule Mountain vein

and iron-stained for a distance of 15 feet northwest of the main quartz vein, but the 2 feet nearest the quartz is so homogeneous and highly impregnated with iron as to constitute a separate streak. Mr. Billings reports that the 18 inches of this brown streak nearest the quartz runs from \$400 to \$500 a ton in gold, but a sample of the material taken during the course of this investigation yielded but a trace of gold.

The quartz is itself considerably sheared and broken. No free gold could be found therein, but it is said to occur in the iron-stained patches and along the joints, which are often filled with what appears to be a combination of manganese and iron oxides.

Mr. Billings states that this vein was opened in 1898, and that 45 tons of ore have been shipped from the bottom of the shaft. He claims that there it ran \$15 a ton as mined, but was hand sorted so as to yield \$75 a ton.

At the time of the examination the 2-stamp mill and cyanide plant on the property were running on ore from the open cut, which included all of the quartz exposed therein and 18 inches of the brown material adjacent thereto. Considerable amalgam was evidently collecting on the plates, but the results of this run were not learned. Mr. Billings said that about 50 per cent of the values are caught on the plates.

Mr. Judson C. Hubbard, who has examined this property, reports that four samples taken near the shaft on this vein yielded as follows:

(1) Sectional sample through shaft dump: gold, \$9.50; silver, 50 cents.

(2) Average of 12, 14 and 16 inch cross sections of vein near shaft: gold, \$11.10; silver, 45 cents.

(2a) 20 inches footwall gouge adjoining (2): gold, \$4.00; silver, 30 cents.

This gives about 34 inches of vein matter that averages about \$7.28 per ton.

Another small quartz vein parallels the Mule Mountain vein about 15 feet to the northwest thereof. It is exposed in several cuts. It was sampled by Hubbard who reported upon it as follows:

(3) 6 inches of quartz and gouge; gold, \$5.00; silver, 57 cents.

*Big Devil's Stairs creek vein.* The main workings on this vein are some distance (500 or 600 feet) to the northwest, and about 340 feet below the Mule Mountain shaft with which they are connected

by a small wire-rope tramway. A larger wire-rope tramway is used to transfer the ore to the mill, which is perhaps 1,000 feet below, near Rogue river.

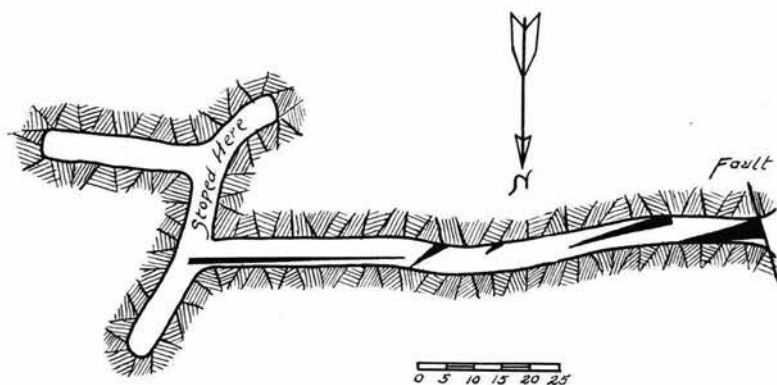


Fig. 27. Big Devils' Stairs creek workings. Vein matter shown in solid black

The vein has here been developed by means of a tunnel 100 feet long from which three diverging drifts have been driven at the end. At the mouth of this tunnel is a fault striking S. 70° W. and dipping 66° S. E. East of this the vein shows as a badly jointed quartz streak about 4 feet wide. Sixteen feet from the portal it disappears along the left wall and is faulted to the right so that it shows along the right wall as a one foot streak. This streak pinches out about 35 feet from the mouth of the tunnel and does not show again except as a small 6-inch lens until a point 56 feet from the mouth of the tunnel is reached. From here the vein persists as a 4 to 6-inch streak of quartz until the end of the main tunnel is reached when it appears to have been faulted almost at right angles, and is then so broken and crushed that its extension has not been found. The vein changes strike and dip frequently, and the walls are often slickensided. The longest portion shown in the tunnel strikes N. 85° E., but in other places the strike is as much as 10 to 15 degrees further to the north. The dip varies from 54 to 64 degrees S. E. The variation in strike and the badly faulted condition of the vein is indicated on a sketch map of the workings which constitute figure 27.

The vein is more or less iron-stained, but shows some pyrite and chalcopyrite. Although no free gold was seen, the whole deposit

bears a very close resemblance to the high grade Lucky Boy and Paradise veins already discussed. This deposit differs, however, from those just mentioned in that, in the main stope which runs up for scores of feet, the single quartz vein splits into a mineralized zone about 4 feet wide which consists of many small veins separated by country rock. Above this point the deposit fans out into a broad zone 15 feet or more wide, which contains 4 or 5 quartz veins, each nearly a foot in width, with many smaller ones between. Of these, the southeastern most large quartz vein has been most extensively stoped.

A man sent down by the Merrills of San Francisco spent 40 days on the ground and sampled the ore in the tunnel and stope carefully. He ran this ore through the mill and claimed to recover an average of \$26.80 from each ton milled. Mr. Billings milled 42 tons of the same ore last winter and recovered values at the rate of \$18 a ton. He explains the discrepancy by stating that Merrill's man used an agitator when cyaniding, while he (Billings) used none. Mr. Hubbart reports the following figures from samples taken on this vein.

(5) 4 feet of quartz in the Devil's Stairs creek vein: gold, \$14.00; silver, 32 cents.

(5a) 40 inches quartz and gangue forming east wall adjacent to (5): gold, \$5.00; silver, 62 cents.

Samples (5) and (5a) average \$10.37 a ton over a width of 7 feet 4 inches.

(6) 5 feet of quartz 10 feet from the portal of the tunnel: gold, \$2.50; silver, 58 cents.

(7) 20 inches of quartz near the end of the tunnel: gold, \$38.00; silver, \$1.30.

(7a) 30 inches of gangue and quartz stringers east of and beside (7): gold, \$3.00; silver, \$1.17.

(7b) 6 feet of gangue and quartz west of and beside (7): gold, \$8.00; silver, 25 cents.

Samples (7), (7a) and (7b) together constitute 9 feet, 2 inches of ore which has an average value of \$13.67.

(8) From sack of ore on dump: gold, \$42.00; silver, \$1.30.

Amalgamation and cyanide tests were made by Mr. Hubbart on samples (5), (7) and (8). On (5) amalgamation showed a saving of 22.8 per cent and cyanidation a saving of 71 per cent, making a total saving of 93.8 per cent by both processes. On sample (7)

amalgamation showed a saving of 14 per cent and cyanidation a saving of 66.6 per cent, making a total saving of 80.6 per cent. On sample (8) amalgamation showed a saving of 39.5 per cent and cyanidation a saving of 43.81 per cent, making a total saving of 83.31 per cent.

Mr. Hubbard notes that samples (7) and (8) contained some chalcopyrite and believes the relatively low saving by the cyanidation process to be due to the presence of copper.

Mr. Hubbard further reports that tests made upon sample (7) resulted in a concentration of 78 into 1, so far as weight is concerned, but that the concentrates assayed only \$108.90 per ton instead of \$2,635.62 as would have been the case if all the values in the ore

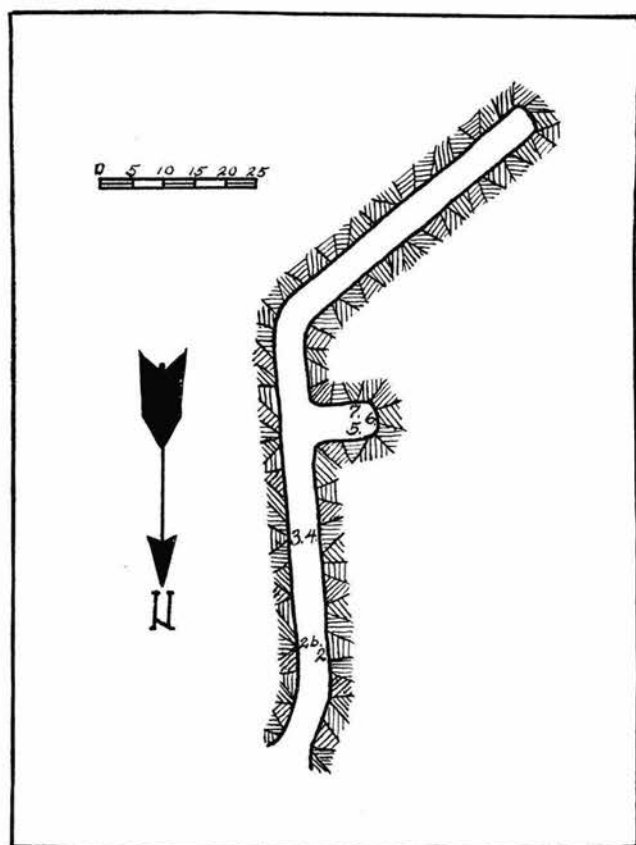


Fig. 28. Keystone tunnel, showing location of samples referred to in text

could have been thrown into the concentrates. The low percentage of values present in the concentrates indicates that the valuable metals are in a very finely divided condition and that a portion, at least, is probably included within, or firmly attached to, the quartz, even after this has been finely crushed.

The Keystone vein is on the south side of Rogue river, and may be an extension of the Mule Mountain vein. It differs sufficiently from that vein in character, however, to make its continuity with the Mule Mountain vein doubtful. It is first exposed about 400 feet above the river, and above this point it outcrops in a number of places, and has been opened at other points by means of open cuts and tunnels. The deposit is essentially a shear-zone striking about S. 25° E., and dipping 76° E. As is the case with the other prospects in this neighborhood, the country rock is greenstone.

The shear-zone contains one or more quartz veins varying considerably in width, and a considerable amount of gouge is also present in some places. A soft, greenish mineral, which is probably chlorite, is also present. The total width of the mineralized zone varies from a few inches up to 20 feet or more, but it is not certain that the smaller measurements were taken on the same zone as were the larger ones. It seems likely that development work will show the presence of one large vein accompanied by one or more smaller, parallel veins. If this is the case, some of the openings now on the property must have been made in the narrower and some in the wider of these zones. It seems hard to explain the variable width of the vein exposures on any other assumption, as no indication of sudden widening or pinching was observed in any of the tunnels or open cuts.

Mr. Hubbart sampled the Keystone vein at a number of points and reports the following results:

(1) 25 inches of quartz below the main tunnel: gold, \$5.00; silver, 47 cents.

(2) 30 inches of vein matter 8 feet from the portal of Keystone tunnel: gold, \$2.00; silver, 50 cents.

(2b) Decomposed wall-rock near (2): gold, \$4.00; silver, 35 cents.

Mr. Hubbart points out that patches in this rock were discolored by a brownish material resembling oxide of manganese, and states that in his experience in this district such material has always yielded assays for gold.



(3) 7 inches of quartz along the west wall of the Keystone tunnel, 33 feet from the portal: gold, \$6.00; silver, 72 cents.

(4) 12 inches of quartz along east wall of Keystone tunnel, 30 feet from the portal: gold, \$5.00; silver, 27 cents.

(5) 30 inches of gangue and quartz along north wall of drift from Keystone tunnel: gold, \$9.00; silver, 37 cents.

(6) 12 inches of quartz at end of drift from Keystone tunnel: gold, \$96.00; silver, \$1.15.

(7) 24 inches of gangue along south wall of drift from Keystone tunnel: gold, \$3.00; silver, 50 cents.

Figure 28 shows a plan of the main Keystone tunnel and indicates the locations of samples (2) to (7) inclusive. Mr. Hubbard points out that samples (5), (6) and (7) were taken from a point west of the others, and mentions that the material exposed in the drift is of a different nature from that in the main tunnel between the drift and the mouth. He further states that the material exposed at the end of the tunnel is of the same character as samples 5 and 7. It seems, therefore, likely that here we have exposed one of the smaller quartz veins which parallel the main Keystone shear-zone.

Other samples taken by Mr. Hubbard at points on the vein above the main tunnel assayed as follows:

(8) 7 feet of quartz along east wall of Keystone vein above tunnel: gold, \$2.60; silver, 38 cents.

(9) 5 feet of quartz and gangue west of and adjacent to (8): gold, \$6.00; silver, 75 cents.

(10) 32 inches of vein matter in an upper tunnel: gold, \$3.00; silver, 42 cents.

Amalgamation and cyanide tests made on samples (2b), (6) and (9) resulted as follows:

(2b) 60 per cent of the values were extracted by amalgamation and  $27\frac{1}{2}$  per cent by cyanidation, making a total saving of  $87\frac{1}{2}$  per cent.

(6) 2.69 per cent of the values were extracted by amalgamation and 96.25 per cent by cyanidation, making a total saving of 98.94 per cent.

(9) 17 per cent of the values were extracted by amalgamation and 75.5 per cent by cyanidation, making a total saving of 92.5 per cent.

Tests conducted upon the amalgamation tailing of sample (6)

resulted in a concentration of 91 into 1. The concentrates thus produced contained 35.75 oz. of gold per ton valued at \$715, and 34.1 oz. of silver per ton valued at \$17.50. This gives them a total of \$732.05 a ton, instead of \$8,628.62 a ton which would have been their grade if all the values in the ore could have been included in the concentrates. Mr. Hubbart does not state in his report what methods of concentration were employed.

Mr. Hubbart concludes his report on this group by stating that he considers "that the property should offer very favorable inducements for the careful expenditure of capital."

#### ROCK CREEK DISTRICT

Rock creek is in Coos county, but John R. Smith's property on this stream is situated so near the Curry county boundary and has aroused so much interest within the past year that it was visited and examined.

The area is a complex of Myrtle sandstone, dioritic greenstone, and serpentine. West of and approximately parallel to the creek is an enormous dike of apparently very acid dacite-porphphyry. This outcrops in masses as large as big buildings, and one such outcrop is shown in figure 17. Some of the greenstone is heavily impregnated with pyrite.

The finding of a rich deposit of placer gold in Rock creek during the fall and winter of 1914-15 attracted much attention to the district and led to an extended search for the source of the gold. Mr. Smith has exposed contacts of serpentine and diorite with Myrtle sandstone, and also a water-course in diorite. He is inclined to think that at least some of the gold has come from these sources, but although the water-course in diorite is much softened and iron-stained, and the contacts mentioned have evidently served as water channels to some extent, it seems highly improbable that any considerable proportion of the placer gold could have come therefrom. In fact, Mr. Smith himself is inclined to think from the panning he has done that most of the gold has come from a hill west of the creek which is underlain with Myrtle sandstone. This sandstone contains many small quartz veins such as are common in the formation at several points, and which Diller has suggested as the probable source of much placer gold. Mr. Smith claims that this quartz pans satisfactorily and has yielded one scale of gold worth \$1.85. He states that the placer gold

often has quartz and dark green chlorite material, such as is common in the Myrtle quartz veins adhering to it. He hopes to find a large vein of this character some place on the hill mentioned, but there is not sufficient grounds for predicting whether or not his hope will be realized.

*Lode 9. Copper King No. 1.* One-fourth of a mile west of Mr. John R. Smith's placer ground on Rock creek is a thick lens of quartz included within serpentine, and which itself encloses small quantities of the latter. It contains considerable chalcopyrite and the upper portion is seamed with veinlets of malachite and some azurite. A mass of this material measuring about 30 feet long and 20 feet thick is exposed by open cuts. Several prospectors who have examined this deposit consider it a boulder or a large chunk of float which has rolled down from some higher point. There is no doubt, however, that it is in place in the serpentine and represents a "boulder copper deposit" allied to those found further south in Curry county, but differing notably therefrom in the large quantity of quartz present. This deposit lies about 100 feet east of a big outcrop of dacite-porphry and may be genetically connected therewith. A general sample taken from all the exposures proved to contain 2.23 per cent copper, .05 oz. gold, and .08 oz. silver. Concentration would doubtless produce a fairly high grade ore, but the decidedly lenticular form of the ore body makes it improbable that the deposit can ever be mined profitably.

#### BOULDER CREEK DISTRICT

Boulder creek, a tributary of Lobster creek, has yielded, and is still yielding considerable placer gold; and, following the excitement attendant upon the discovery of gold in Rock creek, this area was extensively prospected for veins. Nothing promising was found, however, although a number of claims were located. The only one of these examined is mentioned in the following paragraph.

*Lode 10. Alta.* This claim, which is owned by Mr. Charles D. Lash, is situated on Ophir Mountain about half a mile above Ink and Barr's placer claims. The open cut exposes a contact between basalt and shale (Myrtle?). Faulting has evidently taken place along this contact and an inch or two of soft gouge separates the two rocks, which are themselves somewhat crushed and softened near the contact. The deposit appeared so unpromising that it was not sampled.

**SHASTA COSTA COPPER DISTRICT**

The Shasta Costa Copper district is situated about 3 miles from the mouth of Shasta Costa creek. Although an attempt was made to examine the few properties that have been opened there, no guide to them could be secured and they could not be located. It is known that the copper ores are similar to, and occur in the same way, as do those in the Collier creek region elsewhere described in detail. Since they lie in the same belt of serpentine as do those further south, it is likely that the conclusions reached relative to the southerly deposits apply equally to those on Shasta Costa creek.

**PINE FLAT COPPER DISTRICT**

The Pine Flat Copper district is situated about four miles southwesterly from Agness on the ridge which farther to the south is known as Wake-Up-Riley ridge and is composed largely of Colebrooke schist. Along the eastern edge of Pine Flat there is a body of serpentine overlain by dacite-porphry the latter underlying Myrtle conglomerate. Pebble Hill, a prominent topographic feature, is made up of this last rock.

*Lode 11. Pine Flat mine.* The copper occurs as thin seams and stains of malachite in jointed and sheared serpentine, near and below the dacite-porphry. The latter strikes N. 80° E., and dips 32° S. E. Two short tunnels have been driven along the serpentine-dacite-porphry contact, and several open cuts have also been made along the same horizon.

The whole occurrence bears a strong resemblance to the shear-zone deposits in the Collier creek district. Whether any high grade ore was found is unknown. A general sample of the ore on various dumps yielded 9.87 per cent of copper and traces of gold and silver.

**DISTRICT SOUTHEAST OF AGNESS**

Comparatively little work has been done in this area, and only two properties were examined.

A large mass of serpentine crosses the Illinois river at the mouth of Indigo creek, and then runs a little east of north through the Shasta Costa copper district, and on to Mule creek. West of this serpentine dike, between it and the sediments along Illinois river, is a mass of greenstone. The two prospects described are largely or entirely in greenstone.

*Lode 12. Night Hawk.* This prospect, which is owned by Frank

Fry and C. W. Sinniger, occurs at an elevation of about 1,750 feet as determined by the barometer, about 4 miles southeast of Agness on the ridge between the Illinois river and Indigo creek.

The deposit is a sheared and brecciated zone in a very basic greenstone which is partially altered to serpentine at some points. The ore consists principally of pyrite which occurs in kidneys or nodules irregularly distributed throughout the zone. These rounded masses are very hard and solid, and some of them are a foot or more in diameter. Attention was first attracted to the deposit by a bluish-green efflorescence which appears on the surface of the rock in wet weather. No free gold has been found in this prospect, and an assay of one of the nodules of solid pyrite yielded not a trace of that metal.

*Lode 13. Stephens and Stear.* This property, which is owned by a Mr. Stephens and Charles Stear, is situated about 3,000 feet north of the Night Hawk. It has been developed by means of a tunnel which is said to be over 300 feet long, but was locked at the time the examination was made. The dump is of such size as to indicate that considerable development work has been done. From material on the dump, it seems probable that the deposit consists of relatively narrow white quartz stringers through a sheared or brecciated zone, which is said to be more than 20 feet wide in some places. The country rock is mostly greenstone, but there is some serpentine on the dump, and it is evident that both rocks are penetrated by the workings. There is so much wash on the surface that the relationship of these could not be determined. Some calcite and a little pectolite and red hematite are present on the dump, but it is evident that these are not common. The quartz is said to occasionally show free gold, and it is also claimed that gold can be panned from it at many points. It is reported that this property was last worked in the spring of 1915.

#### WAKE-UP-RILEY RIDGE IRON DISTRICT

The general geologic conditions in this district, and the character of the iron deposits have already been described in the chapter on the iron resources of the county.

*Lode 15. Iron Hill group.* This group includes all the claims on the ridge. The deposits exposed are so similar in appearance that only two were sampled. These are called the Iron Hill No. 3 and the Iron Hill No. 4. Each is developed by an open cut, the former being about 600 feet south of the latter. The Iron Hill No. 4 is a

typical small lens of manganiferous magnetite which analyzes 28.43 per cent iron, 12.95 per cent manganese, 0.72 per cent phosphorous, and no titanium, arsenic, copper, or sulphur.

The Iron Hill No. 5 was the best looking deposit examined. An open cut 5 feet wide, 8 feet long, and 5 feet deep at the face was entirely in ore, although the manganiferous magnetite is traversed by numerous quartz seams. A sample from this prospect analyzed 22.87 per cent iron, 7.30 per cent manganese, and 0.56 per cent phosphorous, and no titanium, arsenic, copper or sulphur.

#### **DISTRICT BETWEEN LAWSON AND HORSE SIGN CREEKS**

The highest point on the ridge between Horse Sign and Lawson creek is capped with serpentine. To the northwestward lies Colebrooke schist, and southeastward greenstone. One or more dikes of dacite-porphry cut through all of these rocks. A prominent one is said to run from Mr. Berry's house northwestward to Lawson creek. Mr. Frank Berry owns a house on this ridge and has done some prospecting in the vicinity. Two deposits located by him were examined by the field party.

*Lode 16. Name unknown.* One-eighth of a mile west of Frank Berry's house, about 4 miles from the end of the divide between Horse Sign and Lawson creeks, is a sheared zone in serpentine or greenstone altering to serpentine. It has not been developed, but the outcrop shows a heavily iron-stained porous mass of gossan which is said to pan gold. However, a sample of this material assayed not a trace of gold.

*Lode 17. Name unknown.* About 100 feet down the Lawson creek slope of the ridge above Frank Berry's house below a saddle in this ridge occur numerous good sized chunks of chromite. This material is associated with serpentine near the contact with greenstone. No work has been done upon this deposit, but from the quantity of float present it seems likely that a considerable amount of ore may occur here. Analyses of a general sample secured from a number of float fragments yielded: 45.99 per cent chromic oxide, 20.41 per cent iron, 21.33 per cent silica, 2.14 per cent alumina, and no magnesia.

#### **COLLIER CREEK DISTRICT**

The general geologic conditions of this district, which includes the entire watershed of Collier creek, is shown on figure 1. The



conditions are not as simple as is there indicated, for it was found impossible to include all the occurrences of igneous rock on a map of the scale used.

Most of the ore deposits are in serpentine or peridotite more or less altered to serpentine, but some of them, while still in serpentine, are adjacent to dacite-porphry dikes. The deposits in the serpentine or serpentinized peridotite are all of the boulder or shear-zone type already fully discussed elsewhere in this report (see page 43).

A large amount of work has been done in this area at one time or another and innumerable openings exist. It was not possible to examine all of these, and at least one large group (the Reed claims) was not visited at all. It is believed, however, from observations made that all the properties are of such similar nature that descriptions of those here given will apply with minor changes to all of them.

*Lode 18. The Collier Creek Copper Company.* This property includes a number of claims running from the neighborhood of Horse Sign butte southward. Mr. Frank Berry, of Agness, is either the sole owner of this property or else possesses a controlling interest. Most of the work on the property was done 20 years ago, and the only openings now accessible consist of open cuts and shallow shafts.

The principal mineralized zones on the property are known as the Collier creek vein, the Eagle vein, and the Mohawk vein. Of these, the first is the most persistent, and is exposed in an open cut about 300 yards somewhat east of south of Burt camp over a low divide, as well as elsewhere. This deposit is of the shear-zone type in serpentine, and contains a number of the boulder-like masses of iron and copper ores which have been already discussed. One hundred feet or less west of the zone, and parallel to it, is a dike of dacite-porphry, while east of the zone lies comparatively unaltered peridotite of the "buck skin" type already described (see page 32). The mineralized zone itself averages about 4 feet wide, and the outcrop consists largely of limonite or limonite-stained serpentine. At many points the gossan is very porous and highly ferruginous, so the zone, which strikes S. 25° W., is easily traceable on the surface. At some points, however, the iron-stain disappears, giving place to a mass of serpentine containing numerous bluish or black veinlets.

Many fragments of good looking copper and iron ore occur in the various dumps along this zone, but most of these have been exposed to the weather so long that a considerable portion of their copper

contents has doubtless been leached out. Analyses running as high as 30 per cent copper are said to have been obtained from the freshly mined ore.

The Mohawk vein appears to be an off-shoot of the Collier creek vein. It leaves the latter in the saddle just south of Burt camp, finally disappears under Horse Sign butte, and strikes about N. 10° E. Like the Collier creek vein, the Mohawk is paralleled to the west by a ledge of dacite-porphry. The two zones are in fact decidedly similar in most respects, but the Mohawk is marked by association with a dark-brown serpentine instead of with the greenish material commonly found in connection with the Collier creek vein.

A fairly fresh sample taken from a small cut on the Mohawk vein was found to consist of magnetite (magnetic oxide of iron), cuprite (red oxide of copper), and malachite (green carbonate of copper); and proved to contain 9.87 per cent copper and traces of gold and silver. Another sample of extremely porous, heavily iron-stained gossan from an outcrop of this vein yielded not a trace of copper, gold, or silver.

The Eagle vein, probably an off-shoot of the Collier creek vein, is best exposed just south of the saddle west of Horse Sign butte. A fairly deep shaft at this point exposes a great deal of copper-stained serpentine. The material now on the dump looks low-grade, but the prospect is said to have produced at least one nugget of native copper weighing 26 pounds.

*Lode 19. Oregon.* This is the impregnation deposit of magnetic iron ore, the location and nature of which have already been fully described on page 64. Mr. Frank Berry, of Agness, is the owner.

*Lode 20. Kessler and Frys' property.* This prospect, which is owned by William Kessler and John, Walter and Marshal Fry, is on the ridge between North Collier and Lawson creeks, about two and one-half miles northwest of Game lake, at an elevation, as determined by the barometer, of 4,200 feet. The country rock here is serpentine, but a dike of quartzite-like dacite-porphry about 100 feet thick occurs a short distance to the east. Beyond this are a few hundred feet of greenstone, then several hundred feet of Colebrooke schist, followed by a succession of serpentine and peridotite masses down almost to the Illinois river. How far to the west of the claim the serpentine runs is unknown, but it undoubtedly eventually gives place to Colebrooke schist in that direction.

A 50-foot tunnel which bears S. 34° W. has been run into the serpentine not far from the dacite-porphyry contact. No ore is exposed in this tunnel, and it was doubtless driven with the intention of cutting a mineralized zone nearby. Some copper-stained material occurs in a wash near the tunnel, and big chunks of good ore are said to have been picked up on the flats below, but their exact source is unknown.

*Lode 21. Bonanza King copper group.* This consists of three claims which are owned by E. G. Hurt, of Agness. He purchased one, the Bonanza King, of W. W. Whitton, in 1898, and another, the Bonanza King extension, from R. J. Canfield, in 1912. He located the third, the Spotted Faun, in 1912. Two tunnels, one 60 and the other 48 feet long, were driven on the property, which was also opened up by means of 8 open cuts and shafts. Although work was done as late as 1914, all of the openings have so badly caved as to make it impossible to secure accurate data concerning the deposits. From what observations it was possible to make, they appeared to be largely of the boulder type, although one or more mineralized shear-zones may also be present. In several cases a little moderately deep development has gone under the ore into seemingly barren serpentine, bearing out the conclusion that most of the deposits are of the boulder type. Hurt claims that it was ore on the various dumps of this group which was taken by Dr. T. R. Hines, heretofore mentioned.

The principal ore mineral is undoubtedly chalcocite or copper glance (sulphide of copper), although considerable cuprite (red oxide of copper) and native copper are also present. Magnetite (magnetic oxide of iron) seems to have been invariably associated with the copper ores, and it is claimed that this mineral itself carries copper in every case. This is borne out by the fact that a specimen of seemingly pure magnetite from the Copper King tunnel on the Collier creek group proved to contain 50.05 per cent iron, 2.43 per cent copper, and no sulphur, phosphorous, titanium, or arsenic.

Where the copper ores outcrop on the surface, they have been oxidized to malachite (green carbonate of copper) and azurite (blue carbonate of copper). Occasionally a little erythrite (pink arsenate of cobalt) is also present. These substances are said to give place to chalcocite, cuprite, and native copper a few feet from the surface in every case. Some of the ore still on the dumps is apparently very rich, and a general sample of such material from a number of

points on the Bonanza King group yielded 20.137 per cent copper, .06 oz. gold, and .12 oz. silver per ton.

Mr. John Rae, of Harbor, Oregon, presented the writer with a chunk of native copper supposed to have come from this group, which, although only a fragment of the original piece, weighs  $3\frac{1}{2}$  pounds. It is coated with malachite and other oxidation products.

*Lode 22. Reid group.* These claims are said to have been located 12 or more years ago and to have been last worked by Frank Alley, of Roseburg, Oregon. They lie about a mile east of the Bonanza King group and are doubtless of similar character. They were not visited, and no definite information concerning them is available.

*Lode 23. Cobalt group.* This group of claims is owned by Frank Berry, of Agness, and is situated at the base of Bald Mountain on the east side of the Illinois river. Here is a serpentine hill about 800 feet high, 2 miles long, and two-thirds of a mile wide. It looks like a slide, but as Bald Mountain is composed of different material, the serpentine is doubtless in place.

The serpentine is practically free from overburden, and great patches of it are heavily iron-stained at the surface. It has been opened by means of numerous cuts and shafts, and it is claimed that all these openings run into sulphides, principally pyrite, at no great depth. It is stated that independent examinations showed that the ore ran on an average about \$10 a ton in gold and silver, and that other elements present, including copper and cobalt, brought the total value to between 15 and \$16 a ton. The quantity of ore available is certainly enormous, and if the figures quoted prove correct, it ought to be possible to develop a mine here. It was impossible, because of limited time, to visit more than a few of the openings. From one of these in which many feet of solid pyrite was exposed, a sample was taken which assayed not a trace of gold. Another sample of the porous, iron-stained gossan yielded the same result. From this, it is evident that all the mineral is not gold-bearing, but there are so many exposures and the mineralization has been so extensive that it is not unlikely large bodies of good ore exist elsewhere on the hill.

#### DISTRICT EAST OF GOLD BEACH

The country rock for at least 6 miles east of Gold Beach is serpentine, but eastward of this belt of solid serpentine some greenstone and several lenses or zones of Colebrooke schist exist; and the Starr or McKinley group, which includes the only important prospects

in the region, lies east of one such lens. The main mass of Colebrooke schist is not far to the eastward of this group.

*Lode 24. Starr (McKinley) group.* This group is located about 7 miles south of east from Gold Beach at an elevation of 3,950 feet, as determined by the barometer. It was originally located as the McKinley group by Col. I. E. Munsey about 1893. He held possession of the property until he died in 1912. The property was re-located in 1915 by Charles Starr, Harriet Starr, R. G. Starr and J. R. Stannard, all of Gold Beach, who now hold 15 claims. It is reported that Col. Munsey was offered \$60,000 for the property, but that he considered it worth \$6,000,000, and would not consider the lower figure.

As previously stated, the country rock is serpentine, but at least



Fig. 29. Primitive dump car running on wooden rails used in driving a tunnel of the Starr (McKinley) group

one lens of Colebrooke schist exists in the vicinity, and some greenstone occurs west of the property. The main mass of Colebrooke schist lies not far to the east.

On the Starr No. 2 claim, above the trail, a cross-cut tunnel 275 feet long has been driven N. 60° E. Figure 29 illustrates the primitive dump car used in driving this tunnel. No ore is shown in this opening. It was undoubtedly put in for the purpose of cutting at depth the deposits outcropping above the mouth of the tunnel.

The first cut above the tunnel measures about 15 by 10 by 6 feet. The deposit is a shear-zone in serpentine and shows considerable copper carbonate or iron-stain in the cracks. A general sample from the dump yielded 8.18 per cent copper and no gold.

North of the last mentioned opening is an open cut 30 or more feet long, 15 feet wide, and 12 feet deep. In this is exposed about 12 feet of sheared serpentine stained in the same way as is the deposit described in the last paragraph. A sample carefully cut from across the whole mass yielded 3.17 per cent copper, 1.61 oz. gold, and .27 oz. of silver per ton. A little chalcopyrite (copper-iron sulphide) was present in this ore, and the amount would doubtless increase at greater depth. The high proportion of gold is an unexpected feature which may lead to interesting developments.

Above the cut just mentioned is the large open cut or pit, 40 feet in diameter, shown in figure 30. In this occurs a highly iron-stained, porous gossan to a depth of about 5 feet. Then comes massive sulphide ore for a foot or two; while beneath this is limonite-stained serpentine. The sulphide ore consists of chalcopyrite and pyrrhotite (monosulphide of iron), which latter has a peculiar fibrous appearance. A sample of the gossan proved to contain no gold, as was also true in the case of the limonite-stained serpentine below the sulphide. The sulphide ore yielded 5.158 per cent copper, but no gold or nickel.

A tunnel has been driven directly beneath the open pit just described. It runs S. 45° E. for 20 feet, then gradually curves to the southward for 55 feet so as to bring the breast directly below the pit and at a depth of no more than 10 or 15 feet beneath the material there exposed. Near the mouth this tunnel cuts a copper-stained sheared zone from which considerable ore has been taken. A conical pile of this material, 4 feet high and 12 feet in diameter, was sampled and proved to contain 1.04 per cent copper and no gold. It is but



fair to state, however, that this ore gave evidence of considerable leaching and it is not unlikely that the grade was considerably higher when it was mined. This material, as well as one or more copper-stained shear-zones, are exposed in a trench 250 feet long north of the tunnel and open pit.

The open pit and tunnel described in the preceding paragraph are of especial interest as here we seem to have pretty conclusive proof of the boulder-like nature of the deposit of copper ore. No one can doubt for a moment that the material is in place, and yet, within a depth of a few feet, an ore running better than 5 per cent copper gives place to fresh, unstained serpentine.

About 100 feet east of south of the big pit is an open cut in which some slightly oxidized magnetite is exposed. This material is of the lodestone variety. That is, it is itself a magnet and will pick up small particles of iron or steel. Analysis proves it to be the highest grade iron ore found on the trip, since it contains 60.13 per cent iron, .36 per cent phosphorous, and no sulphur, arsenic, or titanium.

Numerous other openings exist on this property, and several others were visited, but they appeared so similar to those already described that they were not sampled. Enough time was spent in examining the deposits to prove their essential similarity to those in the Collier creek region, both the boulder and shear-zone types being represented. The principal points of difference are the relative scarcity of mag-



Fig. 30. The large pit on the Starr (McKinley) group

netite, and a substitution of chalcopyrite and pyrrhotite for chalcocite, cuprite, and native copper. It may be that the scarcity of magnetite is due to differences in climatic conditions, since the greater rainfall in the vicinity of the McKinley group may have hastened the decomposition of any magnetite that once existed there.

#### DISTRICT IN THE VICINITY OF COLLIER BUTTE

Two or three prospects are located within a mile or two of Collier butte, but the nature of these is so varied that it would hardly be worth while to discuss the geology of the district as a whole. The descriptions of the prospects which follow include brief discussions of the geologic features surrounding them, and further information on this point may be secured by reference to the map which constitutes figure 1.

*Lode 25. Name unknown.* About a quarter of a mile southeast of Sourdough camp (see figure 31) is a quartz vein in schistose Dothan sandstone. Not enough work has been done upon it to expose it entirely, but indications are that it is 10 or more feet wide. The outcrop is extremely porous, heavily iron-stained and forms a promising looking gossan. A sample of this material assayed only a trace of gold, however.

*Lode 26. Bunker Hill group.* This group is composed of 6 claims situated on and to the northwestward of Bunker Hill. Their owner is Mr. Frank Berry. Only a few small pits have been dug on this property, but these are sufficient to show that the deposits are practically identical in character with those in the Collier creek copper region; that is, they are boulder and shear-zone deposits in serpentine.



Fig. 31. Sourdough mountain from west Craggy

The magnetite associated with the copper ores has, however, crystallized in small, but well formed cubes instead of octahedrons, which type of crystallization of magnetite is so unusual as to seem deserving of mention. Another peculiarity of the Bunker Hill outcrops is the relatively large proportion of erythrite (arsenate of cobalt). Whether sulphides of cobalt are present in any quantity in the ores could not be ascertained.

On the northeastern slope of Bunker Hill occurs a dike of dacite-porphry through which more or less pyrrhotite (monosulphide of iron) is disseminated. This mineral occurs in both irregular grains and as small tabular hexagonal crystals in marolitic cavities. Mr. Frank Berry stated that this material has yielded assays for gold, one return being as high as \$80 to the ton; but a general sample taken from a number of fragments lying on the surface yielded not a trace of gold.

*Lode 27. Name unknown.* On the top of the ridge above Little Meadow camp are numerous fragments of chromite float. They lie on serpentine not far from its contact with Dothan shales, and are sufficiently large and numerous to indicate the existence of one or more ore bodies of considerable size in that vicinity. A general sample taken from a number of fragments proved on analysis to contain 48.09 per cent chromic oxide, 16.44 per cent iron, 19.78 per cent silica, 8.12 per cent alumina, a trace of titanium, and no magnesium.

#### CHINA DIGGINGS DISTRICT

The rocks in this district comprise several varieties of greenstone and a great deal of serpentine. They outcrop in several bands with a general north-south trend.

The gold ores in this area are usually found in the greenstone at no great distances from the serpentine contact. In at least one case, however, the contact itself is mineralized.

*Lode 28. Higgins mine.* This property was not visited, but Diller describes<sup>1</sup> it as follows:

The Higgins mine, at the head of Slide Creek on the Chetco side of the divide, twelve miles on a direct line or twenty miles by trail nearly west of Kerby, has recently attracted much attention. The holdings embrace ten claims taken up, at least in part, by L. G. Higgins in 1903. They extend northeast and southwest along a contact of greenstone and serpentine. The contact has been sluiced at a number of places and most of the gold has been won in this way. The gold is very fine and flaky. It has

<sup>1</sup> U. S. Geol. Surv. Bul. 546, pp 64-5, 1914.

not been transported, but was set free by decomposition of the rocks in place along the contact. The gold does not occur in quartz veins, according to Mr. Higgins, but between the folia of the talcose minerals in the shear zone along the contact.

The latest strike of this mine is in the "Golden Dream" at the head of Slide Creek, at an elevation of about 3,500 feet, and has been sluiced by lessees. The ore was rich but not richer than that obtained by Mr. Higgins years ago on the same contact, three-quarters of a mile further southwest. Mr. Higgins has erected a three-stamp mill with a concentrator to mill the contact rock. A one hundred foot tunnel, somewhat meandering, has been run along the sheared contact to open it up, but there is no evidence to show the relative value of the rock at and beneath the surface. A short distance west of the mine some slaty rocks outcrop which may be of sedimentary origin, but no gold is reported along their border.

The Higgins mine affords one of the best examples of the general character of the pockety lode-gold deposits in southwestern Oregon.

*Lode 29. Empire.* This property lies about a quarter of a mile south of the "Golden Dream" claim mentioned in the preceding section. It is owned by W. G. Cooley and Ben Miller of Harbor. It was not visited, but the deposit is said to consist of quartz stringers in porphyry (greenstone?). It is said to have been worked for at least 14 years, and was being actively developed during the summer of 1915. It is claimed that at least 2 feet of free milling gold ore averaging \$12 a ton is exposed.

*Lode 30. Hustis and Anderson group.* This property was not visited, but is described by Diller as follows:<sup>1</sup>

The Hustis and Anderson claims are on the northwest slope of the Chetco divide on Miller Creek, nearly a mile southwest of the Higgins claims, at an elevation of nearly 2,300 feet. The main contact of serpentine, running N. 20° E., lies just west of the mine which is mainly greenstone. A 100-foot tunnel to the east in greenstone reaches another contact in serpentine.

An old arrastre, now in ruins, gives evidence of milling some years ago. The principle serpentine contact with greenstone extends directly from the Higgins mine to the Hustis and Anderson claims, where it meets another body of serpentine from the east.

*Lode 31. Bacon group; and Lode 32. Miller group.* These groups were not visited, but Diller describes<sup>2</sup> them together as follows:

Recent strikes of the Higgins mine have greatly invigorated prospecting in that region, and numerous claims have been located near the same horizon to the south on Miller creek and Baby Foot creek, tributaries of the Chetco.

The Miller and Bacon prospects are on the ridge between Miller creek and Baby Foot. At the northern foot of this spur, along Miller creek, a mass of serpentine strikes nearly east and west and cuts the volcanic greenstones which form the body of the ridge. The greenstones are well exposed in the great bluffs overlooking Baby Foot, and are

<sup>1</sup> U. S. Geol. Surv. Bul. 546, p. 65, 1914.

<sup>2</sup> Op. Cit., p. 65-6.

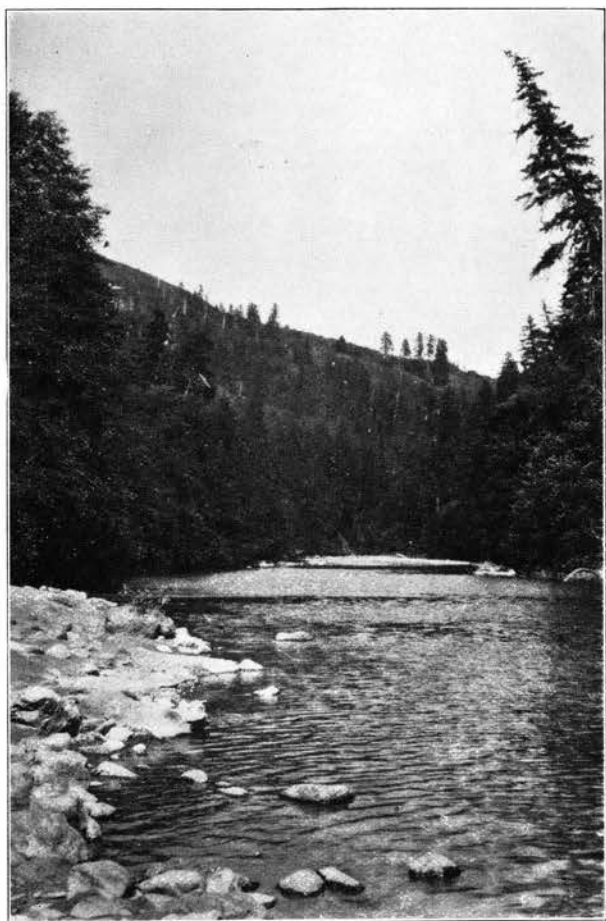


Fig. 32. Chetco river scene, near the mouth of Miss Latney creek

intruded by smaller masses of serpentine, off-shoots of the larger masses which lie at some distances on both sides.

Considerable quartz occurs in irregular veins or bunches in the greenstone, especially near the contact with serpentine, where it is impregnated with chalcopyrite and pyrrhotite. The veins strike in general about N. 60° E. and dip S. E. Their gold content is not evident, though it is said that assays show a considerable amount. The gold at present remains in the decomposed and rotten rock ready to be released by sluicing.

In the Miller Group of ten claims a portion of the contact has been sluiced. A ditch is being opened from Miller creek to the crest of the



Fig. 33. Distant view of Mt. Emily from the northeast

divide at an elevation of about 2,760 feet, for the purpose of sluicing the available auriferous residual material clinging to the slopes on both sides of the spur.

Although Diller does not mention the fact, it is evident from his map that the Bacon group is on the Miller creek side of the divide, while the Miller group is on the Baby Foot slope, about a mile southwest of the Bacon claims.

#### DISTRICT AT HEAD OF THE NORTH FORK OF CARTER CREEK

Near the head of Carter creek just west of the divide at the head of Canyon creek Diller shows<sup>1</sup> two copper prospects. They evidently lie in serpentine, and from his description of them it seems likely that they closely resemble the deposits of the Starr group or those in the Collier creek district.

*Lode 32. Bailey; and Lode 33. Chetco Copper Company groups.* These groups were not visited, and Diller does not mention the former by name although its location is indicated on his map as being perhaps half a mile north of the latter. Diller refers<sup>2</sup> to the property as follows:

The same serpentine belt with which the copper deposits are associated on Fall and Rancherie creeks extends southwest by the head of

<sup>1</sup> U. S. Geol. Surv. Bul 546, Plate VI, 1914

<sup>2</sup> Op. Cit., p. 84.



Canyon creek to Chetco river, where a number of similar deposits occur and have been prospected by the Chetco Copper Company and others, by tunnels aggregating more than 250 feet. The ore appears to be mainly chalcopyrite, but Dixon's prospect has furnished some native copper, and some remarkably beautiful specimens of the bright red oxide of copper, cuprite, in minute cubic crystals. A small amount of ore is said to have been shipped from this locality.

#### MOUNT EMILY DISTRICT

The Mount Emily (or Mount Emory or Emny as it is called by some) district is situated in the neighborhood of Mount Emily (see figure 33), 6 miles northeast of Harbor. The mountain proper rises from the Chetco river to an elevation of about 2,900 feet as determined with a barometer. From the summit a magnificent view of the Pacific Ocean as far south as Crescent City, California, is obtainable. At the top of the western slope where the view is especially good are located a number of Indian structures which take the form of rings of stone. These are uncemented, and some of them have been partially destroyed. Others are still in a good state of repair. They vary from 2 or 3 to 20 feet in diameter, and the better preserved ones are as much as 2 feet deep. The Indians living in the vicinity say that their forefathers used to build fires in the centers of these rings and then sit in a circle around the blaze. The smallest rings are barely large enough to hold one man and a small fire. When asked the purpose of this ceremony, the Indians reply that the rings were alters or open air temples from which their ancestors "talked to God." Figure 34 shows photographs of three of these rings.

Mount Emily is extremely interesting from a geologic point of view. The main mass of the mountain seems to be made up largely of a thick flow of rhyolite which has thrust its way through, and spread over, Dothan sandstone and shale. These latter are exposed on the western slope, and near the top have been metamorphosed until they form hornfels. This metamorphosed Dothan material has been crushed and broken near the contact, after which the broken zone has been invaded by rhyolite which on cooling cemented the fragments together, forming a beautiful breccia of notably unusual type. The fragments of metamorphosed Dothan are decidedly angular and vary from a fraction of an inch to many feet in diameter. Figure 35 shows one of the largest of these. It is entirely surrounded with igneous material and is composed of banded hornfels.

Below the rhyolite cap of the mountain occurs a mass of syenite-porphry which seems to have the form of a dike and may represent



Fig. 34. Remains of stone ceremonial rings constructed by the Indians near the summit of Mt. Emily

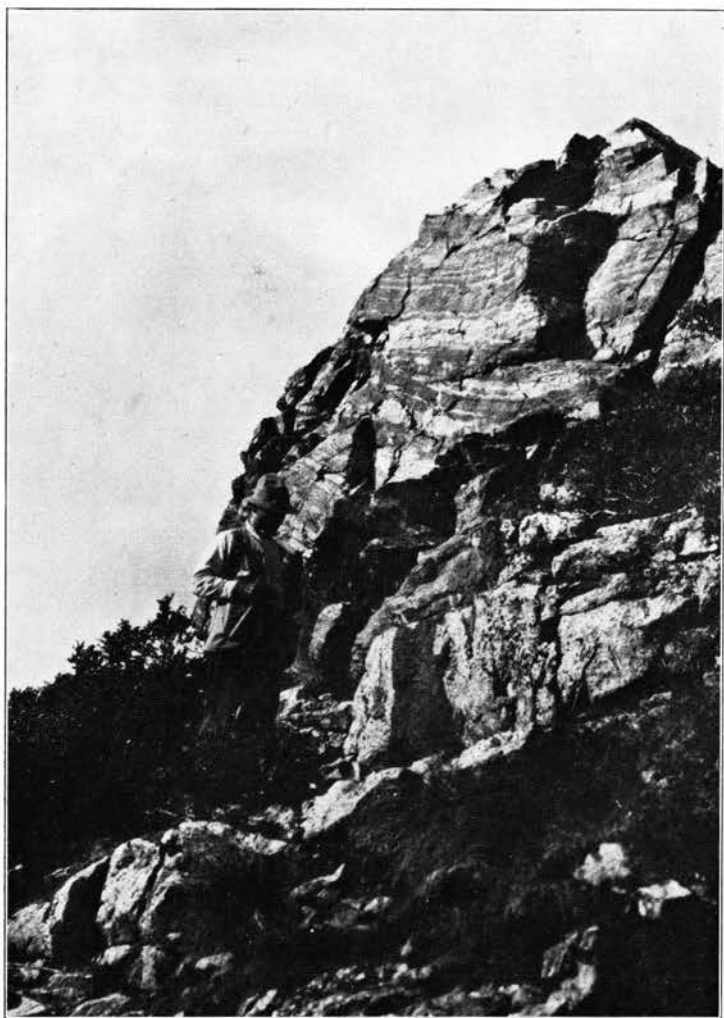
an earlier stage of volcanic activity. Besides the main rhyolite mass, the syenite-porphry and the brecciated metamorphosed sediments, there also occur several dikes of basalt and of a variety of rhyolite which is more porous than the one already described. These cut through the other rocks alluded to and seem to have been formed at a later stage of igneous activity than the main rhyolite flow represents.

The description of the geologic relationships of the various rocks constituting Mount Emily which has just been given, should be regarded as tentative, as the time available for the examination of this area was decidedly insufficient to permit the reaching of positive conclusions. It is believed, however, that conditions existing there are substantially as outlined.

*Lode 34. Florence prospect.* The Florence prospect was located March 4, 1914, and is owned by Charles M. Warren. It is situated just below the crest on the northern slope of Mount Emily. The deposit is along the contact between metamorphosed Dothan sediments and rhyolite. The hornfels resulting from the metamorphosis of the Dothan shale has been crushed, sheared, and silicified at this point, and in the crevices thus formed sphalerite and pyrrhotite have been deposited. The total width of the mineralized zone is about 8 feet; the strike is N. 35° E. and the dip 75 degrees S. W. A sample taken across this mineralized zone proved to contain 3.57 per cent zinc and a trace of gold, while a sample consisting largely of pyrrhotite yielded but a trace of gold. It is certain that this ore would yield a high-grade zinc concentrate, but the only opening on the vein consists of an open cut, and it is decidedly uncertain how extensive the deposit will prove to be. It seems likely, however, that the sulphides will be confined to points along the contact where an unusually great degree of crushing has occurred, and this will tend to give the deposit a "pockety" nature.

An eighth of a mile west of the Florence prospect, across a small gulch, is a cliff the face of which is heavily iron-stained and covered with pot-holes. It proved on examination to consist of a brecciated mass of rhyolite containing rounded cavities and seams filled with pyrite and quartz. A sample of the sulphide yielded not a trace of gold, however.

*Lode 35. Lucky Warren prospect.* This deposit is also owned by Mr. Charles M. Warren and is situated a short distance south of the



**Fig. 35.**—Large fragment of metamorphosed Dothan shale (banded hornfels) included in rhyolite, near summit of Mt. Emily

crest of Mount Emily. The deposit is similar in nature to that on the Florence claim, but the mineralized streak is narrower, and the interstices between the fragments of hornfels contain molybdenite. A sample across the whole ore body yielded on analysis 3.10 per cent molybdenum.

Another peculiarity of this deposit is the presence of considerable hornblende which was not seen in the Florence prospect. The mineralized streak is said to yield high gold values when panned, but a sample proved, when assayed, to contain not a trace of gold.

A number of other prospects exist on Mount Emily, and some of these are reported to be very promising. Lack of time and proper guidance made it impossible to inspect any except those already described, but it should be mentioned that at one point a shallow pit has exposed a veinlet of smaltite (arsenide of cobalt and nickel). This deposit is altogether too small to permit of profitable mining so no samples were taken.

From what has been said it must be evident that Mount Emily exhibits much of interest both to the geologist and the miner. The presence of ores of zinc, molybdenum, cobalt, nickel, and gold, 3 or 4 varieties of igneous rock, and sedimentary material which has been at some points metamorphosed in an unusual fashion form a combination of circumstances so unusual as to seem deserving of much more thorough investigation than it was possible for this party to give. It is hoped that some time in the future a party of geologists may map the district in detail and investigate the mineral deposits carefully. It is impossible to predict whether such an investigation is likely to prove economically profitable, but there is no doubt of the scientific interest and value which the work will have.

#### BALD FACE CREEK DISTRICT

This can hardly be said to constitute a district since very few prospects occur in this region; and only one of these was visited by the field party.

West of Smith river is an extensive occurrence of Dothan shale cut by at least one large north-south trending mass of serpentine. The Dothan shale extends west of Smith river also for about half a mile up Bald Face creek. Here the serpentine comes in once more, and doubtless extends beyond the eastern boundary of the county. This last mentioned serpentine mass is cut at various points by smaller masses of greenstone and dacite-porphry, and what gold has been found here seems most probably to have had its source in one of these two igneous rocks.

*Lode 36. Mark Wood's prospect.* This is situated not far from Spokane creek which enters Bald Face creek from the north about



**Fig. 36. Pit produced by ground sluicing on Mark Wood's prospect near Spokane creek**

6 miles from the mouth of the last named creek. Gold was found here in the loose surface wash which has been ground-sluiced to such an extent as to leave the large pit shown in figure 36. Above this pit numerous trenches have been dug in an endeavor to locate the source of the precious metal. In this way it was found comparatively easy to trace the gold up the hillside to a contact of serpentine and igneous rock which resembles andesite rather closely, but is probably the equivalent of the dacite-porphry found elsewhere in the county. This last named rock is itself in contact with a mass of greenstone which may be more specifically classified as gabbro. Both the dacite-porphry and gabbro are decidedly altered and softened where exposed. It seems possible that they might themselves have been mineralized by solutions working up at the contact between them and the serpentine. Specimens of these rocks were therefore assayed, but neither contained a trace of gold.

While it is possible that the source of the gold beneath the wash has not been discovered, it seems likely that it comes from the contact between the dacite-porphry and the altered gabbro where it occurs in a manner similar to the deposit in the Higgins mine in the China Diggings district about 13 miles north. If this is the case, there seems little likelihood of developing a mine in this region, since the mineralized contact is very narrow, and the ore could hardly be mined profitably unless of very high grade which it shows no indication of being.



### STREAM PLACER MINES AND PROSPECTS

It was found utterly impossible to prepare complete descriptions or even a complete list of all the stream placer mines in Curry county. There are scores of old workings on some of the streams, which have been long abandoned and concerning which no data were obtainable. Diller indicates a number of these in U. S. G. S. Folio No. 89, and describes some of them. Others are not mentioned in the text of the Folio.

The Sixes river placers were examined by Mr. Mitchell. It may be that some of the claims he describes are identical with ones referred to by Diller under different names, and it is quite likely that their relative positions are not accurately shown on the map which constitutes figure 1. It is believed, however, that the information given will serve to indicate the general nature of the stream placers in that part of the county, and will suffice to show how generally gold-bearing are the upper stretches of the Sixes river. Diller in the Folio just mentioned writes as follows concerning the Sixes river district:

Passing westward from the head of Salmon Creek in Coos County, the gold belt enters Curry County on the head waters of the South Fork of Sixes river in the vicinity of Rusty butte, where interesting discoveries have been made recently. Many years ago there was great activity along the Sixes, in mining the benches which rise to about fifty feet above the river. The mines were most abundant from the Forks westward, and are represented by a number of cabins long since deserted. The bed rock is generally Cretaceous conglomerate, sandstone, and shales, and the gravel is composed of pebbles of the same material. At the mouth of Elephant Creek the terrace mined exposes about twenty-five feet of gravel, of which about an acre has been removed. Above the junction of the Middle Fork there has been but little mining, the region being covered largely by Eocene sediments; on the South Fork mining in a small way is still carried on, but is confined to the present stream beds during the low water of summer. Some of the earlier mines were in gravel benches as high as 130 feet above the present stream. \* \* \* The bed of Butcher Gulch, on the northeast slope of Mount Butler, has been washed for a long distance from its mouth. Above the mouth of Rusty Gulch the bed and benches of the South Fork have not been found productive.

For five or six miles below the Forks of the Sixes the placer mines have been idle for many years, but after reaching Edson Creek four active mines are found, one operated by Mr. Corbin and the others by the Messrs. Divelbiss. \* \* \* The Sixes, especially in its lower course, is over-loaded by the large amounts of debris brought in by the great slide of February, 1890. One slide 200 by 150 feet in extent, covered a house and other buildings and killed three persons and twenty-one head of stock. \* \* \*

Beyond the mouth of Edson creek in the Sixes region all the placer mines are in marine deposits.

The stream placer deposits described in this report are con-

secutively numbered according to their locations, beginning in the northern and western part of the county and progressing to the southern and eastern portions. Their approximate locations are indicated on the map which constitutes figure 1.

*Placer 1. The Sixes Mining Company.* This company has an option on a number of claims originally owned and worked by the Divelbiss family. They first gave an option on the property to C. Inman who transferred his interest to the Sixes Mining Company, and now has no interest in the property. Diller describes<sup>1</sup> the claims owned and once operated by N. C. Divelbiss as follows:

The most extensive (of the placer mines then being operated below the Forks of the Sixes), operated by N. C. Divelbiss, is on the left bank in the sharp bend two miles above the mouth of Edson creek, and covers a large part of an acre. The gravel bank, worked by water under pressure, is fifty feet high and rests on Cretaceous sedimentary rocks. Farther west, near the mouth of Edson creek, on the right bank, is an upper terrace of large extent which has been mined on the edge, but with scarcely sufficient success to warrant the fluming necessary to supply the water that is needed to do the work satisfactorily.

Diller also states<sup>2</sup> as follows relative to the platinum content of this ground:

In order to get a clew to the source of the platinum (in the beach placers), if possible, concentrates were obtained from the placer mines at several points along the Sixes. Ascending the river, the first was obtained from Mr. N. C. Divelbiss's mine on the left bank of the stream about three-quarters of a mile above the mouth of Dry creek. The sample submitted contained the concentrates from a clean-up after removing the gold. It weighed about 22.87 grams, of which 5.78 grams (about 25 per cent) were separated by the magnet. Platinum scales were found rather abundant, and non-magnetic, so they remained in the non-magnetic portion. The scales generally were very small, but one well-rounded by attrition weighed .03 gram. The scales are generally malleable and sectile and of steel-gray color, distinguishable from the nearly tin-white and almost brittle scales of iridosmine, which are about one-third as abundant as those of platinum. In the estimates given below the platinum and iridosmine are counted together. The residue was passing through a series of sieves ranging in size from 60 to 100 mesh per inch, separating it into six lots which were then panned out. Nearly all the platinum was caught in the 60, 80 and 100 mesh. The total yield was .384 gram—about .0168 per cent of the total sample examined. A ton of such sand containing the same proportion would have about \$7,500 worth of platinum alone. This material is highly concentrated, and there is no means of determining how many cubic yards of original gravel it represents, so that the value of the platinum per ton of gravel is unknown. Besides magnetite, the other minerals are chiefly chromite and ilmenite, with much zircon, epidote, and garnet and a trace of cinnabar.

Another sample of concentrates from the same mine, weighing 60 ounces, contained platinum at the rate of about \$17.00 a ton, and the gold was about seven times as abundant as the platinum, but in this case as in

<sup>1</sup> U. S. Geol. Surv. Folio 89.

<sup>2</sup> Op. Cit., p. 6.

the first the amount of gravel represented by these concentrates is unknown.

In order to get an idea of the relative values contained in the gravel of the mine, the concentrates from two pans of gravel next the bed rock were obtained from Mr. N. C. Divilbiss. They contained  $32\frac{1}{2}$ c in gold, but no platinum was found. Two pans of gravel from 25 feet above the bed rock contained 3c in gold and no platinum.

Mr. W. A. Bechtel of San Francisco the General Manager of the Sixes Mining Company very kindly furnished the following information about the work being done, under date of May 26, 1916:

**LOCATION:** The Sixes Mining Company is operating on the Sixes River in Curry County, Oregon, about 11 miles from Port Orford and 70 miles south of Marshfield, on what is known as the Divilbiss property, approximately 300 acres.

**WATER RIGHTS:** The water rights of both the Little and Big Edison Creeks have been obtained and their waters are being confined by a dam on the Big Edison, and will be used in mining operations on this property.

**FLUME:** The Sixes Mining Company has constructed a very substantial 3' x 4' flume, four and one-half miles in length, from the above mentioned reservoir. This gives a fall of sixteen feet to the mile, and delivers water into the penstock with a 296' head, measured from bed rock. We avoided construction of ditches on account of the porosity of the soil; in fact, from the very nature and ruggedness of the country traversed by the flume, we decided it would be more economical to build a flume and thus avoid the loss of water which generally occurs in ditch lines, to say nothing of the annoyance and loss of time.

**CHANNELS:** We have three distinct channels traversing this property, but the magnitude of these is not clearly defined as much of the surface is covered by a heavy growth of timber. The first channel, the present bed of the Sixes River, varies in width and depth. We expect to sample and prospect this channel methodically this coming season in an endeavor to determine the value of the gravel. Mining here will be done with dredges which will be operated by electric power developed by the same water as is now being used in washing on the second channel. The second channel is now being washed with water taken from Edison Creek as before mentioned. We have found this channel to be 100' wide from rim rock to back wall, with a depth of 55 feet of gravel and a layer of well packed sand about two feet thick and twenty-five feet above bed rock. We have encountered no heavy boulders, and found it possible to handle this material very satisfactorily. We have found excellent values in the first six feet of blue gravel on the bed rock, with profitable values to the grass roots. The third channel lies above the second channel, but its extent has not been fully ascertained. It has been prospected, however, and seems to carry very good values. In fact, uninterested people maintain that this channel carries better values than either of the other two.

**OPERATIONS:** We have been operating for the past thirty days using one giant with a six inch nozzle. This supplies our present sluice flume with as much material as it will carry with best results. This "run" is in the nature of an experiment to determine the best methods to be employed to save the values existing in our grounds.

**GOLD, PLATINUM AND BLACK SANDS:** We find that our property contains much black sand and platinum; and our earlier prospecting indicates that at least 10% of the values are in platinum. The black sands have received much attention and study from everybody who has

tried to work in this district since it has been found difficult to extract the gold and platinum contained therein. We have devised a method for doing this which, if it proves successful, will be given to the mining world in general, for we realize that the extraction of the values in this material has been a stumbling block to the success of many mining companies. The gold in our property runs better than \$18.00 per oz., as determined by many assayers' reports. It is what is known as fine gold, nothing of nugget size having yet been found. The largest grains are about the size of a kernel of rice and are usually considerably flattened. The superintendent of our property is of the opinion that he will catch most of the gold in the first three or four riffles. We are, however, using undercurrents for additional production.

*Placer 2. Corbin property.* Diller has already been quoted as stating that at the time of his examination 4 placer mines were active between the forks of the Sixes and Edson creek, and that one of these was operated by Mr. Corbin. This property was not in operation during the summer of 1915, and the only information available concerning it is the following statement<sup>1</sup> by Diller relative to the platinum content of the gravel:

On the right bank of the Sixes about a mile above the mouth of Dry Creek, nearly opposite Mr. N. C. Divelbiss's mine is a placer operated by Mr. W. O. Corbin, who informed the writer that one winter he saved \$11.00 worth of platinum from his washings. He sent 44 ozs. of sand from the mine, which was sieved and washed; it yielded .176 gram of gold, less than one hundredth part as much iridosmine, and no platinum. The relation of the concentrates to the gravel being unknown, the value of the gravel per ton cannot be given.

*Placer 3. Hydro Sixes Mining Company.* Mr. C. C. Inman, of Denmark, Oregon, is the owner of 3 claims which were being operated under the above name at the time this investigation was made. Of these 3 claims, one, the Fariar, was acquired by purchase in 1914, while the others, the Tilly B. and Mazie, were located in June, 1914. The building of ditches was begun in August, 1914, and work had progressed steadily on the Tilly B. up to the time of the examination, half a mile of ditch having been finished during the fall of 1914. The claims are said to be located 12 miles from the highway bridge across the Sixes river. Whether this is an air-line distance, or is the length of the trail to the bridge is not stated.

The deposit is an old high bar 30 feet above the present level of the river, and consists of a gravel bed about 20 feet in thickness. The ground has been prospected by means of shafts and pits and it is claimed that it averages about 25 cents a yard. It is further claimed that fine water-worn shot gold occurs scattered throughout

<sup>1</sup> U. S. Geol. Surv. Folio 89, p. 6, 1903.

the gravel bank. Considerable platinum is found with the gold, and the grains of this metal are said to be coarse.

Forty men were employed on this property during the fall of 1914, but only two men were working there at the time the examination was made.

*Placer 4. Byers and Hollenbeck claims.* A. G. Byers and G. H. Hollenbeck own two placer claims on the south side of the South Fork of Sixes river, which they acquired by location in August, 1915. At the time this examination was made they had just begun work, and had panned about 50 pans of gravel which averaged one good color per pan.

The gravel bank is an old bench 15 feet above the present water level, and averages about 10 feet in thickness. The best values are said to exist on the bedrock. When interviewed, the owners were planning to sluice the gravel.

*Placer 5. Wagner claim.* Diller says<sup>1</sup> that at the time of his examination the Wagner claim, about a mile below the mouth of Butcher gulch, was being worked by Mr. J. L. Searle and others from the state of Washington. "The whole stream was dammed to a height of about 5 feet and 2 lines of sluice boxes were suspended on numerous logs felled across the stream. A steam pump and 9 men were employed."

*Placer 6. Way claims.* At the time of this investigation, Mr. C. A. Way was working 3 placer claims, the Rainbow, Robert Harrison fraction, and the Nugget Patch, acquired by purchase in 1912. These have been worked by hydraulicking from the time they were purchased. The property is equipped with 800 feet of flume and 600 feet of pipe. It is claimed that \$700 worth of gold has been taken out of this ground, and that the values are confined largely to a point in the gravel just above the bedrock.

Mr. Mitchell gives the location of this property as being just below the Wallace and Hadley claims next described.

*Placer 7. Wallace and Hadley Claims.* Tom L. Wallace and Oliver C. Hadley own 2 placer claims known as the South Fork Nos. 1 and 2, the relocation of which was recorded January 1st, 1915. This property was originally called Thompson Flat. They began work in March and had 160 feet of pipe on the claim when the examination was made. The first gravel was washed in May, and

<sup>1</sup> U. S. Geol. Surv. Folio 89, p. 5, 1903.

it is claimed that \$165 worth of gold was taken out during the spring of 1915. It is said that the values are confined to within about one foot of the bedrock with the greatest proportion of the gold directly on the bedrock, and that no clay is present to interfere with the saving of the gold. Very little platinum is found in this ground, and no attempt to save it has been made.

*Placer 8. Guerin claim.* The only information obtainable concerning this deposit are the statements<sup>1</sup> of Diller that at the time of his investigation

The Guerin brothers were ground sluicing just above the mouth of Butcher Gulch. \* \* \* From one of the Guerin brothers who works a placer along the South Fork of the Sixes, the writer obtained about 5 ounces of concentrates, to examine for platinum. Nearly 85 per cent of the concentrates was magnetite, and the remainder was chiefly ilmenite or chromite. Numerous scales of gold were present, but no platinum or iridosmine was found."

*Placer 9. Crawford and Fay claims.* Mr. and Mrs. S. B. Crawford and Emmet Fay are the owners of 4 placer claims which they were developing at the time of this investigation. These are the Old High Channel, located in June, 1915, the Dixey purchased for \$500, and the Dixey Extension Nos. 1 and 2, which were located during July, 1915. The first named is an old high river bar, but all the work was being done on the other claims and was confined to sluicing along the creek bed. The owners said they had taken out \$20 worth of gold in 3 days' mining, and that most of the values were found directly on the bedrock.

*Placer 10. Smith and Robinson claims.* M. A. Smith and J. B. Robinson own 3 claims at the mouth of Rusty creek. These are the Big Nugget, located in 1915, and the Big Foot and Nut Wood, located the previous year. The owners were ground-sluicing in the bed of Rusty creek, and they claimed to have recovered \$14.60 in gold at the date the examination was made.

*Placer 11. Old Chinese workings on Elk river.* Just below C. W. Curl's prospect on Elk river is a small bar which the Chinese worked in the early days. Some of their equipment is still on the ground, but no information concerning the property was procurable. It is claimed, however, that a great deal of gold was recovered, and that the values persisted up stream as far as the mineralized zone on Mr. Curl's claim, but that no gold was found above this point.

*Placer 12. Rock Creek claims.* This property, which is owned

<sup>1</sup> U. S. Geol. Surv. Folio 89, pp. 5-6, 1903.



by Mr. John R. Smith, is situated in Coos county, but is so close to the Curry county line, and was the seat of so much excitement during the spring of 1915, that it was deemed worth while to examine the district.

Mr. Smith reached the property in October, 1914, and claims to own by right of relocation 4 placer and 8 lode claims. His title has been disputed by former owners, but he insists he has evidence that no work had been done upon the property for at least 3 years prior to his arrival.

He has made and installed 500 feet of sluice boxes, and has done a great deal of additional productive work. He states that 3 men, working with pick and shovel and often contending with 9 feet of snow, took out \$3,500 worth of gold in two and one-half months during the fall of 1914. He says that he left the property on January 18, 1915, and freely showed the gold he had recovered. This caused two men to go to the property during his absence and to work thereon without permission from him. From what could be learned from Mr. Smith, it seems likely that at least one of these had some title to the property or at least supposed this to be so.

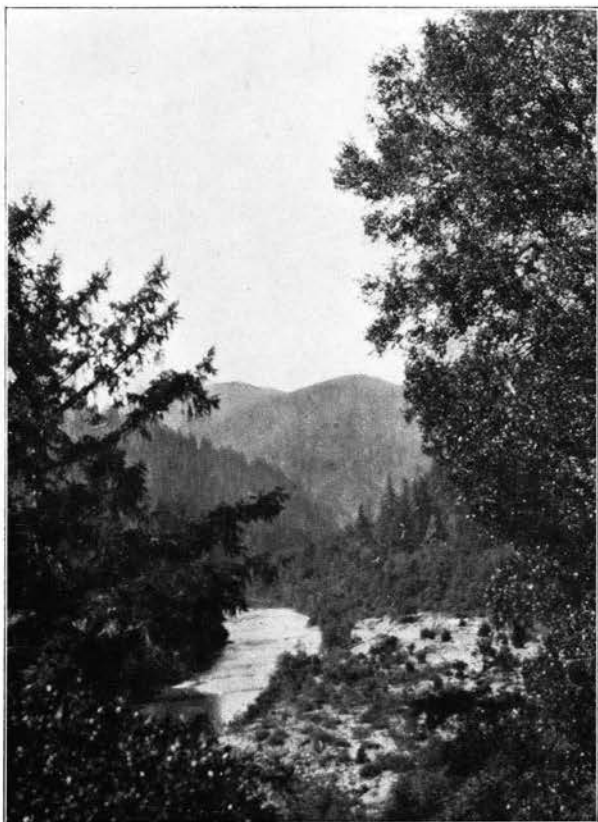
Mr. Smith further claims that he recovered \$2,000 worth of gold after his return to the property in the spring of 1915. At the time of this investigation, he was putting in ditches and laying plans to mine the ground on a large scale. He says that the gold is coarse and unworn, and is very pure, averaging about \$19.50 an ounce in value. He has found that it hugs the bedrock closely.

*Placer 13. Solitude bar, and Placer 14. Paradise bar.* Extensive gravel terraces exist at both Solitude and Paradise bar on the Rogue river, and a great deal of work has evidently been done in these localities in past years. It was found impossible, however, at the time of this investigation, to secure any information concerning these properties.

*Placer 15. Red River Gold Mining Company.* Diller describes<sup>1</sup> the property of this company as follows:

The Red River Gold Mining and Milling Company has eight claims on the low terraces on both banks of Rogue River, just below the mouth of John Mule Creek, about 30 miles below Galice. The slate floor of the mine is 20 feet above the river. It is capped by 30 feet of gravel, which is covered by an overburden of fine material 35 feet in thickness. The overburden is slippery, and is separated from the gravel by a sharp line.

<sup>1</sup> U. S. Geol. Surv. Bul. 546, pp. 115-6, 1914.



**Fig. 37. Placer ground owned by the Red River Gold Mining Company on Rogue river below Mule creek**

The gravel is mostly coarse, the largest boulders being 15 inches in diameter.

The water supply comes from John Mule Creek through  $3\frac{1}{2}$  miles of 4-foot flume and ditch (Figure 38 shows the high trestle over which the flume crosses the western fork of the creek), giving at the mine approximately a 260-foot head for one 9-inch and two 6-inch nozzles.

The gravel is forced up over a grizzly twelve feet wide to a height of 15 feet. (Figure 39 is a photograph of this grizzly). Only about 5 per cent of the material covering the gold goes through the screen of the grizzly to the sluice boxes. The gold is fine and in general hard to save. On the left bank it is said to be coarser.

Much of this property was mined over years ago, and several acres have been mined recently, leaving but a small portion of the original available material.

Statements vary greatly as to the amount of production. The removal of the overburden has been a serious handicap. The present

owners secured the property within the last few years and are making preparations for more extensive work.

Farther down the river, especially at Paradise Bar and Big Bend, a number of other companies have operated more or less extensively, but none of them appear to have been successful.

Mr. W. H. Corwin states that the 8 claims mentioned by Diller, together with another fraction, were purchased in June, 1906, from R. A. Mattoon for the Red River Gold Mining and Milling Company, a corporation, and another claim, the Grace H., has since been acquired. He says further that about a third of the development shown on the property was done by Billings and Marks previous to the purchase of the ground by the Red River Gold Mining Company, and that this company quit work in April, 1912, after taking out between \$8,000 and \$10,000. Mr. Corwin acted as superintendent for the company and he and George M. Cheney of Indianapolis, Indiana, are now the sole active bond holders. Cheney now owns most of the bonds, and Corwin is working the property under an option to purchase given him by Cheney. Corwin began work September 20, 1914, and up to the time of this investigation had done little but prospect.

Corwin claims that the gravel runs about 9 cents per yard, but that the material which passes through the grizzly and into the sluice boxes averages 18 cents. He has found that the upper 8 feet of the bar contains the best average values although the larger particles of gold lie deeper. He says that the available head of water is 180 feet instead of 260 feet as stated by Diller. At the time of the examination he was using four 6-inch giants, but was planning to employ at least 8 giants during the winter. The flume which furnishes water for this property is said to have cost \$80,000.

*Placer 16. Cardwell placer claim.* W. W. Cardwell, of Roseburg, owns a placer claim on the west fork of the west fork of Mule creek. It can be operated only when water conditions are favorable, as the gold is being recovered from the gravel in the present creek bed. No data concerning the success of these operations could be secured, but it is reported that they have been quite profitable.

*Placer 17. Winkle bar.* Diller describes<sup>1</sup> this property as follows:

Nearly a mile below the mouth of Ditch creek and 26 miles below Galice, on the right bank of Rogue river, is a large terrace known as Winkle bar. It contains perhaps 30 acres. The slate bed-rock terrace

<sup>1</sup> U. S. Geol. Surv. Bul. 546, p. 115, 1914.

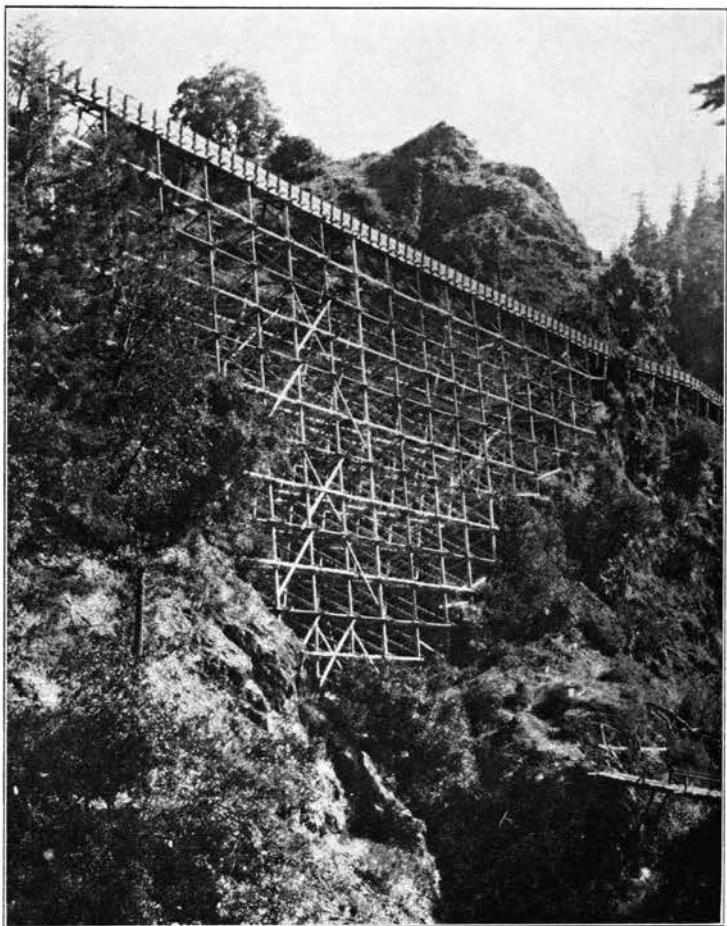


Fig. 38. High trestle on which the \$80,000 flume of the Red River Gold Mining Company crosses Mule creek

rises about fifteen feet above low water in the river, and is capped by 20 to 30 feet of gravel which is generally coarse, half of it consisting of boulders over 5 inches in diameter. A small placer operated here some years ago and a test shaft encourages the Winkle Bar Developing Company to plan for larger operations. Ditch creek, with a few miles of ditch, will supply water with a head of 120 feet. The gold is fine and will require special precaution for its recovery.

*Placer 18. Battle bar.* Diller describes<sup>1</sup> this property as follows:

<sup>1</sup> U. S. Geol. Surv. Bul. 546, p. 115, 1914.



**Fig. 39. Grizzly and flume of the Red River Gold Mining Company. Only the material passing through the grizzly goes through the sluice boxes**

At Battle Bar, on the left bank of Rogue river a little above the mouth of Ditch creek, a terrace 20 to 25 feet above the river is capped by gravel that has been tested by a small placer and said to yield good values. I

saw it only across the river, but the deposit appears to be similar to that of Winkle Bar a mile farther down the river.

*Placer 19. Ink and Barr property.* When this investigation was made, L. G. Ink and Will Barr were working the Old Bonanza claim, now called the Gold Slug, which they purchased from George Curry. They also located on March 10, 1915, three other claims along Boulder creek below the Gold Slug, which they called Iron Mountain, Nugget Bar, and Lilly, making their total holdings a mile in length. \$1,500 worth of gold is said to have been taken from the Gold Slug claim before the present owners purchased it.

The present owners began work in April, and at the time of the examination were sluicing the loose surface soil on the south side of the creek, in which they were finding gold from grass roots to a depth of about a yard. This gold was coarse, the pieces averaging 25 to 50 cents each and including nuggets worth \$6 to \$10 each, and often larger, although the largest they had on hand at the time of the examination was worth something over \$2. They state that Curry secured one nugget worth \$65 from this claim, and that they found another weighing 4 ounces, 9 pennyweights for which the Mint paid them \$93.60. Most of the gold is decidedly worn, but some is so jagged that it could not have come any considerable distance.

One or more old terraces exist on the southern hillside above the present workings, and it seems likely that the gold has slid down from these, although they do not appear to be as rich as is the loose material now being sluiced, of which 250 cubic yards are said to have yielded \$100 in gold. The bedrock beneath the present workings is serpentine, but the contact between this material and Myrtle sandstone crosses the Gold Slug claim.

Below the Gold Slug the stream widens and a decided flat has developed. That gold is present here seems well established, but the nature of the ground is such that it must be worked, if at all, on an extensive scale by means of giants. At the time of the examination two men were prospecting on the lower end of the Lilly claim, but had not done sufficient work to indicate the value of the deposit.

Above the Gold Slug claim is the Blue Bell placer owned by D. Chapin and H. Rowlan; while above this is the Big Nugget claim located by John R. Hurst during the rush to this district occasioned by the Smith discoveries on Rock creek. Practically no work has been done on these claims, and no further data concerning them were obtainable.



*Placer 20. Schulz and Ainsworth claims.* At the time of the investigation, R. Schulz and C. Ainsworth were prospecting on the Great Falls and Tender Foot claims below the Lilly. They were doing the work under an option from Dan Rowlan, the owner.

In the lower end of this property the bedrock is smooth serpentine, and runs down to a V, so that little gold has been caught there, and they had saved almost nothing during the month while they had been at work. A short distance above their present location, however, there is a flat toward which they were working, and where they expected to find gold.

*Placer 21. Boulder Creek Mining Company.* At the junction of boulder creek and the south fork of Lobster creek is an extensive bar known as Old Diggings. The Boulder Creek Mining Company intended to work this property extensively with giants during the winter, and, with this end in view, had ordered 1,000 feet of piping to communicate with a long ditch constructed by A. W. Wilheit. This property was not visited, and no information concerning the success of the undertaking could be secured.

*Placer 22. Gold bar.* This property is located at the old post-office of Illahe, three-quarters of a mile below the present postoffice of the same name. It is on the northwestern side of the Rogue and is owned by T. W. Billings.

Mr. Billings states that the first work on the property was done in 1856, and that the present ditch was started 11 years ago by H. J. Russell who began to mine 7 years ago. The present owner bought the property from Russell's heirs on October 6, 1911, and it has been worked every winter since then. He says he took out \$156 in one month the first year; and that during the second year he cleaned up \$300 in gold dust, and stored seven and a half tons of sand averaging \$272 a ton, which was subsequently washed away. During the third winter, Post and G. P. Murch tried to use a Sweet Gold Machine on the property, but the result was unsatisfactory as there was so much clay in the gravel that the machine became badly clogged.

That portion of the gravel which has been most extensively mined averages 9 feet thick and is covered with about 4 feet of overburden. It is an old high terrace, and the owner claims that at least 2 other such terraces or channels exist on the property. Several engineers have examined the property, and one named Post claimed that the gravel averages 40 cents per yard in gold. Another named G. P.

Murch claimed that it ran only 25 cents per yard. Most of the gold is fairly coarse, and of a flaky nature. The larger pieces are found near bedrock and some of these are worth as much as 25 cents. No attempt to save platinum was made until the winter of 1914-15. During an 80 hours' run made then, a quarter of an ounce of this metal was secured. The bedrock is black Eocene shale together with some sandstone.

A thousand miner's inches of water is brought to the property in a ditch. This gives 180 to 200 feet fall where Mr. Billings has done most of his work, and 100 feet fall to the higher bars.

*Placer 23. Name unknown.* Many have expressed the opinion that there must be much gold in the bed of Rogue river beneath the present channel, and, just as the field party was leaving Agness, it was learned that an attempt was to be made to dam a portion of the stream between Agness and Illahe where it is split into two portions by a low island. It was proposed to divert all the water through the western channel and to mine the eastern channel laid bare by this means. It was stated that a similar attempt in the past had met with failure because the dam could not be made to hold. As the party did not again visit this locality, details concerning the success of this last experiment could not be learned. It was rumored, however, that although the dam held satisfactorily, so much water



Fig. 40. Long Tom operated successfully by A. M. Collins and G. W. Way on the bank of Rogue river at Agness

worked through the gravel beneath the dam that no attempt could be made to extract the gold in the bed of the river.

*Placer 24. Collins and Way prospect.* During the time the field party was in the vicinity of Agness, A. M. Collins and George W. Way were working on the north bank of Rogue river, just below the mouth of the Illinois river. At that time the water in the Rogue was very low, and a considerable stretch of gravel deposited in the stream during high water was exposed along the bank, where it rested on some natural riffles produced by the outcropping of hard bands of Eocene shales and sandstones, which at this point stand almost perpendicularly, and have a strike at nearly right angles to the direction of stream flow. The gravel here varied in thickness from an inch or two up to a foot or more, and the total amount available was comparatively small, but the two men mentioned were making good wages with a very primitive plant consisting principally of the "Long Tom" shown on figure 40. Much of the gold they were securing was fairly coarse (as large as a grain of wheat), but was decidedly flattened and worn, indicating that its source was a long way distant. A considerable, but unknown, amount of platinum was associated with the gold and was being saved.

*Placer 25. Evans prospect.* Mr. Frank Berry is authority for the statement that in 1895 an old man by the name of Evans found a great deal of rough gold, some in nuggets worth \$20 or more, in Blue Slide creek just west of the Craggies (see figure 41), but that he was driven out by a great slide and escaped with nothing but his life. When totally destitute and suffering from privation, he was



Fig. 41. Sugar Loaf and the Craggies from the west

given succor by Mr. Berry, and in gratitude, revealed the exact location of his find. The slide mentioned still covers the gold-bearing gravel, but the source of the gold must be close at hand, and it would seem well worth while to do some careful prospecting in that district.

*Placer 26. Gold Basin.* This locality was visited, but Diller describes<sup>1</sup> the deposits there as follows:

About the head of Tin Cup creek, fifteen miles northwest of Kerby, there is a V-shaped remnant of the Klamath peneplain known as Gold Basin on a large mass of granodiorite. The apex of the V points east, and across its southern arm is a broad, shallow valley filled by an old stream bed running approximately N. 20° W. The surface plain of the stream bed is more than 1,000 feet in width and 2,000 feet in length and is limited at both ends by deep, rugged canyons. The gravel has a thickness of 110 feet where best exposed on the steep southern slope. Near the bottom the gravel, though somewhat decomposed, is more or less firmly cemented, and this condition exists throughout the mass. It has been tunneled on bed-rock for thirty feet. The material is generally coarse, mostly cobblestones up to boulders 4½ feet in diameter mixed with pebbles and sand. There are no layers of sand to afford definite evidence of stratification. The pebbles are well rounded and are for the most part composed of basic eruptive rocks, greenstone, gabbro, peridotite, and pyroxenite, with some of granite. Though generally greenish, they are in places colored reddish by a surface deposit of oxide of iron. The top portion of the deposit is finer, with some fine gravel capped by a reddish soil. Wherever I saw the pebbles in place the course of the stream was not clearly indicated by their position, though they appeared to be inclined southward, and it is believed that the stream came from that direction. The gravel was tested in 1875 or 1876 by sinking a shaft (now filled with water within twenty feet of the surface) and found to contain very little gold. Most that was found is said to have been in the fine material of the surface.

The only available water is snow water, which is obtainable only in small amounts during a short season. It is gathered by a mile or more of ditch, but reaches the mine with scarcely 15 feet of head, and only a small amount of gravel was mined before work was suspended.

### BEACH PLACER MINES AND PROSPECTS

The old high beaches, as well as the present ocean beach, have been worked in scores of places with more or less success, and a book might be written of these attempts if one had the time and inclination to investigate the matter. Considerable data concerning these deposits have already been given (see page 48); and it seems to be most closely in accord with the purpose of this report to add only the descriptions of placers working at the time this investigation was made, together with those of a few others concerning which definite information was obtainable from the reports of others.

*Beach 1. The Sixes mine.* Diller describes<sup>2</sup> this mine as follows:

The Sixes Mine is located about 2½ miles south of Denmark, near the line between Secs. 27 and 34, T. 31 S., R. 15 W., and is operated by

<sup>1</sup> U. S. Geol. Surv. Bul. 546, p. 96, 1914.

<sup>2</sup> U. S. Geol. Surv. Bul. 546, p. 127, 1914.

Mr. W. P. Butler of Lakeport, Cal. Like the Blanco mine, it lies along the eastern border of the coastal plains, at an altitude of nearly 200 feet above sea level. The mine covers about an acre and has a depth below the surface of about 12 feet, exposing along the eastern border the following section:

Section of the Sixes mine,  $2\frac{1}{2}$  miles south of Denmark.

	Feet
Surface material, wind-blown sand and soil.....	5
Gray sand with boulders .....	2
Black sand with boulders .....	$2\frac{1}{2}$

The whole  $9\frac{1}{2}$  feet of material is more or less distinctly stratified and dips gently westward, away from the shore, which is formed of crushed sandstone and shale of Cretaceous age. This bedrock series is well exposed in the eastern portion of the mine and contains rock oyster borings. The decomposed fine sediments yield tough bluish clay, which on the surface for six inches or so is stained reddish and becomes more granular, affording a good bedrock for mining. The gravel is washed into a pool and raised 15 feet by a hydraulic elevator to get drainage for sluicing and tables. Much of the gold is fine and is associated with platinum metals in sufficient quantities to make the saving of them a matter of some importance.

The lack of adequate water supply and good drainage renders mining so expensive as to retard the development of hydraulic mining along this promising old beach. It would seem to be an encouraging locality to test by a modern dredge.

*Beach 2. Cape Blanco ocean beach.* The present ocean beach in the vicinity of Cape Blanco is reported to be unusually rich, and there seems no doubt but that large quantities of gold have been extracted from the sand by means of primitive methods. As has already been mentioned (see page 49), a Sweet gold machine was installed on this beach during the summer of 1915, but while considerable gold and platinum was recovered, it was found impossible to work the sand profitably, as the strong winds which prevail there filled up the cuts as fast as they could be made.

*Beach 3. The Blanco or Madden mine.* Diller describes<sup>2</sup> this mine as follows:

The Blanco Mine is about midway between Port Orford and Langlois, along the inner border of the coastal plain, at the foot of Madden butte, in the N. E.  $\frac{1}{4}$  Sec. 4, T. 32 S., R. 15 W. When last seen it was operated by Mr. Cyrus Madden with about 500 feet of sluices and 7 burlap tables for catching the fine gold which constitutes about one-half the whole product. Platinum metals occur with the gold at this point and are about one-twentieth as abundant. The section exposed in the mine includes about 8 feet of wind-blown material next to the surface, below which lies from 12 to 20 feet of sand with small, black layers and some gravel. Some of the dark layers are coated by oxide of iron, and one of these is used as a bedrock on which to wash the overlying material. The real bedrock, which lies 10 feet below, is Cretaceous shale, but it is too low for drainage across the plain. The working season usually lasts six months, from November to May, and the mine from 1898 to 1900 yielded over \$1,100 annually. The beds of sand and gravel of the ancient beach dip gently ( $10^\circ$ ) westward and over-lap the older rocks at the base of

<sup>2</sup> U. S. Geol. Surv. Bul. 546, p. 126, 1914.

Madden butte. The mine already covers an area of several acres, and there is reason to expect that it will continue profitable farther along the shore, especially at deeper levels, if possible to drain to bedrock.

*Beach 4. Meek's (Eckis) mine.* Diller describes<sup>1</sup> this mine as follows:

On the Meeks mine, near Port Orford, Mr. R. G. Eckis has been running an Eccleston Tension Concentrator twenty-four hours a day for some time. He is using a giant to wash the sand into a sluice box in the bottom of which he has the screen, thus taking the heavy black sand out in an undercurrent. This product is then run over the concentrator. He reports that he is securing 80 per cent of the gold, platinum, and iridosmine, and he says his concentrates run over \$8,000 a ton total value. One machine handles the undercurrent from 150 cubic yards a day.

Mr. Diller does not say whether the Meek's mine is on the present ocean beach or one of the old high beaches, and its exact location is unknown to the writer.

*Beach 5. Kalamazoo ocean beach mine.* No data concerning this property were procurable, but it seemed worth while to mention it since Diller states<sup>2</sup> that at the time he made his last investigation of this region it was reported to be the most productive mine in Curry county. He says that it is located in the Ophir district near Corwin, but as Ophir and Corwin are about 6 miles apart its location (as shown on figure 1) may be erroneous.

*Beach 6. Collins mine.* During the winter of 1914-15, A. M. Collins, of Agness, worked a black sand deposit on ground owned by the Wedderburn Trading Company, about 4 miles north of Wedderburn. He says the deposit is in an old beach about 30 feet above the present water level, and consists of from 12 to 18 inches of nearly pure black sand containing good gold and platinum values, with several feet of lower grade material above, which was separated from the lower streak by 2 to 3 feet of low-grade gray sand. He caught the gold on canvas tables, and, in spite of the fact that he had to pay 30 per cent royalty to the owners of the ground, he succeeded in making good wages throughout the winter.

*Beach 7. Idaho mine.* This property, which is situated on the present ocean beach a mile south of Gold Beach, is the one which Mr. W. H. Williamson of Gold Beach attempted to work 7 years ago. The failure of this attempt, and the reasons which Mr. Williamson assigns for this, have already been mentioned (see page 49). Although a number of deep pits were dug on this property, they have since been so filled with wind-blown sand that it was impossible to examine the gold-bearing beds. From what was seen, however, it seems certain that these are here covered with many feet of worthless or low-grade sand.

<sup>1</sup> U. S. Geol. Surv. Bul. 546, p. 127, 1914.

<sup>2</sup> Idem.



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