STATE OF IDAHO
C. Ben Ross, Governor

IDAHO BUREAU OF MINES AND GEOLOGY
John W. Finch, Director

GOLD-BEARING GRAVEL OF THE
NEZPERCE NATIONAL FOREST, IDAHO COUNTY, IDAHO

By
John C. Reed

Prepared in cooperation with
the United States Geological Survey

University of Idaho
Moscow, Idaho
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FOREWORD

Detailed geologic study has been carried on for three years in the Elk City-Buffalo Hump region of Idaho County by the United States Geological Survey in cooperation with the Idaho Bureau of Mines and Geology. A report embodying the results of this work has now been published as U. S. Geological Survey Circular No. 9, obtainable from the Superintendent of Documents, Washington, D. C.

Deposits of high-level placer gravels were studied and mapped. The revived interest in placer mining, the substantial gold production now coming from this source, and the hundreds of requests for aid in prospecting, prompted additional field work exclusively for the study of placer gravels. Reconnaissance revealed that there are many other deposits of the same kind as those around Elk City scattered over a large area in central Idaho.

As the following report indicates, there are large volumes of low grade gravel that promise to be of commercial value if developed and equipped for large scale operation. The field work is still in progress. Ultimately, it is hoped, a map may be completed showing at least the high-level gravels over all the gold areas of interior Idaho. Meanwhile, this preliminary pamphlet will serve to aid prospectors in the recognition of this earlier group of placers as well as other kinds derived by re-concentration of these older gravels along the modern streams, and those recent deposits formed directly from the erosion of vein outcrops.

John W. Finch  
Director, Idaho Bureau of Mines and Geology

Moscow, Idaho  
June, 1934.
GOLD-BEARING GRAVEL OF THE
NEZPERCE NATIONAL FOREST, IDAHO COUNTY, IDAHO

ABSTRACT

The Clearwater Mountains of north-central Idaho have yielded nearly $50,000,000 in placer gold. The outlook appears favorable for continued production from this region, but most of the gold will probably come from large-scale operation of low-grade deposits.

Unconsolidated sediments are widespread in the Nezperce National Forest and are found on a high, somewhat distorted, erosion surface that was cut across pre-Tertiary igneous and metamorphic rocks, on a lower pediment-like erosion surface, and on benches above and bars along the present deeply incised streams. The largest deposits lie in the several rock-enclosed basins, such as Elk Creek basin, that apparently were formed by faulting and warping after, perhaps in part during, middle Miocene time. The floors of the basins appear to be parts of the pediment-like erosion surface.

The placer deposits include both a high-level and a recent-valley type. Deposits on the higher surface and on the lower pediment-like surface, and some of the deposits in the basins, belong to the first group. Deposits on the steep recent valley sides and along the present streams constitute the second group. Such deposits are ordinarily much smaller but richer than the high-level deposits.

The placer mines are grouped into three districts, Elk City, Tensmile, and Castle Creek, and about 23 properties are briefly described. A few districts in the general area, including Florence and Dixie, are not included in the report.

INTRODUCTION

Field work and acknowledgments

The recent increased interest in gold production led to an investigation, beginning in the summer of 1931, of several nearly inactive mining districts in the Nezperce National Forest in Idaho. This work was part of a cooperative program of the United States Geological Survey and the Idaho Bureau of Mines and Geology, and Mr. F. J. Shanon was placed in charge of it. The writer accompanied Mr. Shanon in the field in 1932 when the project was completed. Much of the emphasis during these two summers was placed on the lodes and the study of the geological conditions relative to them, but considerable information was collected also regarding the large deposits of gold-bearing gravel in the region. These deposits appeared to be of such economic and geologic interest that their systematic investigation was begun as a new project by the writer in the summer of 1933. This report embodies the preliminary results of the field work carried on in 1933, as well as the information gained in 1931 and 1932 in so far as it is applicable to the gravel deposits.

Many of the major problems relating to the gold-bearing gravel are not yet solved, and the solutions to others are as yet tentative only. Much more field work will be required before the complete story is revealed.

The writer is indebted to Mr. Shanon for a great deal of the material here- in contained. Much credit also is due Mr. Roger H. McConnel for his excellent assistance during the seven weeks' field season in 1933. Mr. Reuben McGregor of Elk City was the source of many data, which, but for him, could not have been
gotten. The cooperation and favors of many men of the United States Forest Service are gratefully acknowledged.

Bibliography

The papers on the following list contain material of particular interest regarding the gravel deposits:

LINDGREN, WALDEMAR. The gold and silver veins of Silver City, DeLamar, and other mining districts in Idaho: U. S. Geol. Surv. 20th Ann. Rept., pt. 3, 1900. Contains a generalized geologic map (pl.9) that includes the Florence district; p. 87, describes the Salmon River Canyon; pp. 90-93, describe the Columbia River lava and the surface on which it rests; pp. 238-235, give an account of the situation, history and production, and geology of the Florence district, and describes the Florence placer deposits.

RUSSELL, I. C., Geology and water resources of Nampa County, Idaho: U. S. Geol. Surv. Water-Supply Papers 53 and 54, 1901. Contains excellent accounts of the geology, and particularly the geomorphology of the country lying north and northwest of the area described in this report.

LINDGREN, WALDEMAR. A geological reconnaissance across the Bitterroot Range and Clearwater Mountains in Montana and Idaho: U. S. Geol. Surv. Prof. Paper 27, 1904. Page 14, describes the Clearwater Mountains; pp. 24 and 25, describe the Columbia River lava and its contact against the Clearwater Mountains. Points out post-lava folds and suggests that certain marginal portions of the Columbia Plateau may have been elevated; pp. 26-28, geological history. Suggest that the gravel deposits of Elk City are due to damming by Columbia River lava; pp. 59-63, detailed description of the Clearwater Mountains; p. 67, describes origin of Tertiary gravels at Elk City and at Pierce as due to damming by lava; pp. 68-70, description of the topography of the lava plateau bordering the Clearwater Mountains on the west; pp. 70-80, geology of the lava plateau. Describes unconfined pre-lava surface and structural features of the plateau and concludes that it has suffered a general subsidence; pp. 84 and 85, history and production; pp. 91-96, describe placer mines of Elk City district.


BECKWITH, R. H., Geological setting of the Idaho batholith: Pan-American Geologist, vol. 45, no. 5, pp. 359-376, June, 1925. Page 359, a short descriptive paragraph on the Clearwater and Salmon Mountains points out their flat-topped, dissected character; pp. 374-376, describe the pumice plain in the vicinity of Buffalo Hump and briefly discuss its age in relation to the Idaho batholith, the Columbia River lava, and certain dikes.

ANDERSON, ALFRED L., The geology and mineral resources of the region about Orofino, Idaho: Idaho Bureau of Mines and Geology Pamphlet 54, June, 1930. Pages 5 and 6, describe briefly the topography of
the Clearwater Mountains and the lava plateau. Mentions several folds in the lava; pp. 25-27, describe the Columbia River lava and intercalated sediments as well as some post-Miocene gravels. Contains a reconnaissance geologic map of part of the area covered in this report.

HISTORY AND PRODUCTION

According to Thomson and Ballard, 1/ gold was found on Orofino Creek as early as 1859 by Mr. Jack Lessler, a trapper. The discovery of gold in the Clearwater country is ordinarily credited to Captain E. D. Pierce, who, with a small party of about 40 men, founded Pierce City at the mouth of Canal Gulch on Orofino Creek in the fall of 1860.

Pierce City became the center from which in the next few years many prospectors spread over the drainage area of the South Fork of the Clearwater River and even into the Salmon River country farther south. In 1861 placer gold was discovered in Elk Creek basin and along Newsome Creek 2/, and by fall more than 2,000 people had flocked to the new diggings, most of them to Elk City.

Within a few years the richer and more accessible ground was largely worked over, and most of the white miners had left the field to the Chinese who swarmed into the country. The Chinese worked ground left by the white miners and even reworked many of the old tailings dumps. After that, they too departed.

Since 1900 some of the more extensive, low grade placer deposits have been worked by large scale mining methods, and a little small scale work has been carried on continuously. Small scale placer mining greatly in 1931, 1932, and 1933, and there are indications that there will be even more activity in the summer of 1934.

No very satisfactory estimate can be made of the placer gold production from the area now included in the Nezperce Forest because the early records are sketchy and incomplete, and no one will ever know the amount recovered by Chinese miners.

The following table after Thomson and Ballard 3/ represents their estimates for production from central Idaho. The estimates are based on gold at $20.67 an ounce.

<table>
<thead>
<tr>
<th>District</th>
<th>Production</th>
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<tbody>
<tr>
<td>Florence</td>
<td>$22,500,000</td>
</tr>
<tr>
<td>Elk City</td>
<td>18,500,000</td>
</tr>
<tr>
<td>Pierce City (north of</td>
<td>10,000,000</td>
</tr>
<tr>
<td>the Nezperce Forest)</td>
<td></td>
</tr>
<tr>
<td>Newcombe</td>
<td>2,000,000</td>
</tr>
<tr>
<td>Dixie</td>
<td>1,500,000</td>
</tr>
<tr>
<td>Other districts</td>
<td>2,500,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$57,000,000</strong></td>
</tr>
</tbody>
</table>

These figures are somewhat higher than some other estimates, for instance,

Lindgren says that the total production for the Elk City district up to 1902 was probably between $5,000,000 and $10,000,000.

Mr. C. M. Gerry of the United States Bureau of Mines has furnished a compilation of production figures for Idaho County from which is abstracted the following table of placer gold production. It must be borne in mind that most of the placer production was before 1900.

<table>
<thead>
<tr>
<th>Interval</th>
<th>Oz. placer gold</th>
</tr>
</thead>
<tbody>
<tr>
<td>1901-1910</td>
<td>21544.84</td>
</tr>
<tr>
<td>1911-1920</td>
<td>7832.60</td>
</tr>
<tr>
<td>1921-1930</td>
<td>3413.60</td>
</tr>
<tr>
<td>1931-1932</td>
<td>11444.06</td>
</tr>
<tr>
<td>1901-1932</td>
<td>44037.00 Total</td>
</tr>
</tbody>
</table>

**GEOGRAPHY**

**Location and settlements**

The area covered (Fig. 1) is in north-central Idaho, east and southeast of Grangeville. It lies almost entirely within the Nezperce National Forest and largely within the Buffalo Range quadrangle. It includes the Elk City, Newsome (Tennison district of this report), and Castle Creek placer mining districts, but the Florence and Dixie districts, although adjacent to the mapped area, are not included.

Grangeville lies at the northwestern edge of the mapped area. It is the county seat of Idaho County and the largest town of the vicinity. Much smaller communities include Elk City, Orogrande, Golden, Mt. Idaho, and Harpster.

**Transportation**

Difficulty of access has long hampered development of this region, but in recent years transportation facilities have greatly improved. The supply point for the whole area is Grangeville, which lies at the end of a railroad spur from Lewiston and is on the Idaho north-south highway. The principal means of access is by a road that leads from Grangeville to Mt. Idaho and thence down into the canyon of the South Fork of the Clearwater River, up which it follows to the confluence of the Red and the American rivers where the road forks, one branch leading to Elk City and thence to Dixie, and the other south to Orogrande. Much of the 60 miles of road between Grangeville and Elk City is of fine modern construction and the few unimproved links were being improved in 1933. Another improved highway runs from Grangeville down into the South Fork Canyon near the mouth of Green Creek and thence leads down the river through Harpster. These highways are open all year round, but other roads are ordinarily not passable during the winter months.

A road leads from Stites, a railroad point on the Clearwater, to Elk City by way of Newsome, a distance of 56 miles. The Forest Service has constructed a road from near the mouth of Meadow Creek into the Meadow Creek basin and thence over Big Burnt Point to the old Elk City-Stites road near Chins Point. The Forest Service has also begun construction on a road up Mill Creek.

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Figure 1. Index map showing the location of the Nezperce National Forest (stippled) and of the area covered in this report.
One route to the vicinity of the Buffalo Hump is southward from Orangeville over the Florence road to Adams ranger station and thence eastward past Gospel Hill Peak. In 1933 an automobile could be driven as far as Moore's ranger station.

**Topography**

Clearwater Mountains

Most of the area described in this report lies within the Clearwater Mountains, but it includes also part of the Columbia Plateau that lies to the west of the mountains. (Plate 1.)

Characteristic features of the Clearwater Mountains are ridge tops with gentle longitudinal profiles separated by sharp, V-shaped canyons locally more than a mile deep. Some of the divides are broad and flat, others, where erosion is in a more advanced stage, are narrow and serrate. The highest country is in the southern part of the area between Gospel Hill Peak and the Buffalo Hump. Some of the higher peaks such as Pyramid Peak, Gospel Hill Peak, the Buffalo Hump, the North Pole, Oregon Butte, and Pilot Knob rise conspicuously above the general level of the surrounding country.

Several broad basins, from five to ten miles long and three to four miles wide, lie cradled within the surrounding mountains. The basins lie about 1,000 feet below their enclosing divides and contrast strongly with the more sharply incised valleys elsewhere.

Most of the area is drained by the South Fork of the Clearwater River that is formed by the confluence of the American and the Red rivers a few miles south of Elk City. The South Fork flows, in a canyon about 2,000 feet deep, almost due west to Castle Creek where it turns abruptly northward to define the mountains' border as far as Lightning Creek. From Lightning Creek north, the river is bordered on both sides by plateau country. The principal tributaries of the South Fork are Elk Creek, that enters the American River a short distance above the latter's junction with the Red River, the Crooked River, Newsome Creek, Tennyson Creek, John's Creek, Meadow Creek, and Mill Creek. The high country in the southern part of the area forms the divide between the Clearwater and the Salmon drainages.

The slope from the divide to the Salmon River is short and steep, for instance, Sheep Creek in about 11 miles drops from an altitude of about 8,000 feet near the Buffalo Hump to about 2,000 feet at its mouth in the Salmon. Lake Creek, Sheep Creek, and the Wind River are the principal tributaries of the Salmon River from the area under discussion.

Most of the streams that head against the Salmon-Clearwater divide, from either side, originate in the glacial cirques that scallop edges of the relatively flat upper country. U-shaped valleys are characteristic down to an altitude of about 5,500 feet and in some instances to 4,000 feet.

Columbia Plateau

In general, the surface of the Columbia Plateau is gently undulating with a local relief of a few hundred feet only. The plateau at the brink of the Clearwater Canyon west of Harpster lies at an altitude of about 2,600 feet. South and west from there the surface rises gradually until an average altitude of about 3,300 feet is attained in the vicinity of Orangeville. Southward toward Mt. Idaho altitudes increase more rapidly to about 3,900 feet. This part
Generalized topographic map of part of the Nez Perce National Forest.
of the plateau belongs to Camas Prairie that extends from the edge of the mountains northwestward as far as Lawyer's Creek and Cottonwood Butte.

Just south of Mt. Idaho, an abrupt rise carries the surface to an extensive flat area with an altitude of more than 5,000 feet in the vicinity of Fish Creek lookout station on Orangeville Mountain. The top of Blacktail Butte, although separated from the rest of the plateau, must be considered part of it. It appears to have once been coextensive with the plateau level on Orangeville Mountain. The relatively flat top is about six square miles in area and its altitude ranges from about 4,500 feet to 5,100 feet.

In the area under discussion the canyon of the South Fork of the Clearwater separates the mountains from the plateau. This part of the canyon is from 1,000 to 2,000 feet deep. Most of the tributary streams into the Clearwater from the plateau surface gain this depth in the last two or three miles of their courses so that the plateau in the area mapped is not deeply incised except at its very borders.

Climate and vegetation

The climate on Camas Prairie is less severe than that of the rest of the area. In general, the severity of the climate is a direct function of altitude. Precipitation also is greater in the higher country. At Orangeville, on Camas Prairie, the mean annual precipitation is about 20 inches and the total annual snowfall is ordinarily less than four feet. The mean annual temperature is probably a little less than 50 degrees. The last killing frost in spring ordinarily comes in May and the first in the fall in September or October.

In the higher parts of the Clearwater Mountains the annual precipitation may reach 40 inches, and a large part of this falls as snow. The higher country commonly is covered for seven or eight months of the year with five to 15 feet of snow, as is indicated by the height above the ground of winter-cut trees and blazes. Killing frosts here are common in all months except July and August, and sometimes occur even during these months.

Camas Prairie is essentially a wheat-raising section and the rich black soil yields good crops without irrigation. Most of the rest of the area is covered with dense coniferous forests and parts of it, especially the burned areas, with thick underbrush, so that travel away from beaten paths is generally difficult. Much of the land in the broad, flat basins is cleared and is utilized for the raising of hay and grazing. With the exception of Meadow Creek basin, these depressions are too high for wheat raising. The vegetation in the country above about 7,000 feet is relatively sparse and some of the peaks are quite bare.

GEOLOGIC OUTLINE

On Plate 1 all rocks older than the gravel deposits have been lumped together and mapped as a single unit. These rocks consist, for the most part, of a thick series of gneisses, schists, and quartzites that have been intruded by quartz monzonite and related rocks of the Idaho batholith. The gneisses, schists, and quartzites may correlate with the quartzitic and argillaceous formations of the Belt series that are widespread in northern Idaho.

A formation composed of greenstone and shale with some limestone occupies an area of between 12 and 15 square miles in the vicinity of Harpster. The age of these rocks is probably Permian or Triassic.
Quartz monzonite of the Idaho batholith is the most abundant rock of the area. The intrusion of the batholith had a profound effect on the older sedimentary rocks, but some of their metamorphism may have been accomplished earlier as the granitic rocks cut folded gneisses and schists. In general, the strike of the foliation of the metamorphic rocks is a little west of north, but this is not true everywhere. Steep dips prevail. The time of intrusion of the batholith has not yet been definitely established. Estimates range from late Jurassic to early Eocene.

Gold-bearing quartz veins cut the rocks of the Idaho batholith and older rocks throughout the area covered. Some of these veins have been mined. The veins appear to be related to the later stages of the batholithic intrusion; some of them may have been formed after considerable erosion of the roof of the batholith. The principal sources of the placer gold in the region are the veins, but some of the gold may have come from the country rocks themselves. Some sheared zones in the country rocks contain appreciable amounts of gold.

After the intrusion of the batholith, erosion deeply planed this part of Idaho to a surface of little relief. Great thicknesses of the metamorphic rocks were removed, thus exposing large areas of the granitic rocks. Uplift of this surface caused its dissection by the rejuvenated streams, but remnants of it still remain in the higher parts of the country. A temporary base level, perhaps local, was reached at one stage at least during the uplift, for a pediment-like surface appears in places between the high peneplain and the present valley bottoms.

In Miocene time great floods of Columbia River lava from the west inundated the lower parts of the region. The dammed streams from the higher mountains ponded against the great flows and the sediments that collected were subsequently buried by later flows. Since then, and possibly in part during the time of the lava floods, faulting and warping formed certain basin-like depressions which later were partly filled with unconsolidated sediments. Most of the Columbia Plateau in this vicinity appears to have been depressed at least 2,000 feet since the extrusion of the lava.

Following the events outlined in the previous paragraphs, but before Wisconsin time, the drainage was again rejuvenated, the Salmon and the Clearwater rivers cut deep canyons far below the base of the Columbia River lava, erosion proceeded headward along the streams, and some of the enclosed basins were topped and part of their sediments was removed.

Wisconsin glaciation was active in the higher parts of the area, but the South Fork of the Clearwater River was never dammed by Wisconsin ice or its deposits.

DEVELOPMENT OF THE PRESENT LAND SURFACE (GEOMORPHOLOGY)

Higher erosion surface

From any of the more prominent peaks of the region, such as Oregon Butte or the Buffalo Hump, the high erosion surface that truncates the rocks of the batholith and older rocks is seen to extend away on all sides as a rolling plain. The great canyons that trench it, except the nearest ones, are largely invisible below the surface, and the minor irregularities in its broad sweep, although they have a local relief of several hundred feet, merge into insignificance in this general view.

Eastward, the surface appears to slope gently upward toward the distant crest of the Bitterroot Range. It also seems to rise locally toward certain
nearer mountain groups within the area mapped. The surface is clearly continuous in the Salmon River Mountains across the profound Salmon River canyon, but in this region has been so greatly dissected that only comparatively small remnants of it remain. The most extensive remnant of the peneplain within the area mapped forms the divide between the Salmon and the South Fork of the Clearwater rivers. It stretches from the vicinity of Umbrella Butte eastward all the way across the Buffalo Hump quadrangle to and beyond Big Creek Meadow. In this region, the surface is highest and is most easily recognized. (See Fig. 2.) Its altitude ranges from about 6,500 to about 8,000 feet.

The southern boundary of this portion of the old surface is clearly marked in most places by the high, flat country breaks off precipitously into the deep canyons tributary to the Salmon River, Lake and Sheep creeks and the Wind River, and their tributaries, make deep indentations into the high plain and the southern ends of the divides between these streams are favored sites for United States Forest Service lookout stations, because from such vantage points both the canyons and the high country are clearly visible.

The northern edge of the high surface around the heads of the tributaries of the principal streams, like Johns Creek, Tensmile Creek, and the Crooked River, that head against the divide is as well defined as the southern edge, but the north-south ridges between such streams carry the surface much less conspicuously. The surface appears to decrease in altitude northward from the Salmon-Clearwater divide and to lie at about 6,000 feet near the South Fork.

Eastward, the surface continues to and many miles beyond the area mapped. The western limit of this preserved remnant of the high plain is not clearly defined. From Hanover Mountain and Umbrella Butte, altitudes decrease markedly toward Florence and the country between Florence and Adams Ranger Station, and whether or not the surface in that vicinity represents part of the high plain has not yet been determined.

North of the South Fork of the Clearwater and in the Elk City district east of the Buffalo Hump quadrangle, no very extensive areas can be definitely referred to the high plain, but the relatively narrow, flat ridge tops presumably represent it there. West of Meadow Creek, part of the flat top of Blacktail Butte lies at over 6,000 feet. Between Meadow Creek and Newsome Creek, several prominent points are connected by high ridges such as Quartz Ridge and the ridges connecting Big Burnt Point, Silver Dome, and Coral Hill with China Point, and the ridge between China Point and Baldy Mountain. Read Mountain, Pilot Knob, and Baldy Mountain are on a divide that, without dropping below 5,000 feet, reaches clear around the head of Newsome Creek to the similar Iron Mountain-Elk Summit divide between Elk and Newsome creeks. A branch from the latter divide just south of Iron Mountain at the head of the East Fork of O'Hara Creek bounds the drainage basin of the American River and on the east includes such prominent points as Anderson Butte and Black Hawk Mountain.

The higher surface has been referred to both as a plain and as an erosion surface, but within the area mapped it ranges in altitude from about 5,000 to over 8,000 feet. In detail also it has a considerable local relief, in many places as much as 500 feet within a mile. Its identity as an erosion surface is based on its broad extent and on the fact that it truncates highly folded metamorphic and igneous rocks without regard to structural trends. Its range in altitude and its local relief appear to be due to incomplete reduction of the surface to base level; deformation since its formation, including warping, faulting, and unequal elevation; and modification by erosion since its formation.
It has been pointed out that the surface rises from all directions toward certain mountain groups. The two principal groups in the area covered are the mountains in the vicinity of Gospel Hill Peak and those near the Buffalo Hump. Peaks in these two groups and some others, such as Oregon Butte, Quartzite Butte, Pilot Knob, and Iron Mountain, rise so abruptly from the level of the high plain in their vicinity that they are regarded as monadnocks or erosion remnants that never were reduced to the old erosion surface.

Too little of the old surface remains to reveal much about the drainage system over it. The Big Creek Meadow occupies a depression in the old surface that may be part of an old valley. It seems likely that the structural trend of the rocks would control the directions of at least many of the streams, but the Salmon and the South Fork of the Clearwater now run nearly at right angles to the major structural trend and presumably have incised themselves roughly along the directions of old trunk stream courses across the old surface as it was elevated.

All that can be said about the age of the old surface within the area covered in this report is that it is younger than the Idaho batholith and older than the Columbia River lava. Some conception may be gained of the depth to which the country was planed in the erosion cycle that developed the surface by considering the many square miles over which are exposed granitic rocks that must have crystallized at a depth of several thousand feet.

**Lower erosion surface**

A lower, pediment-like erosion surface below the higher surface already described appears to have once had a considerable extent within the Nezperce Forest. It has been largely destroyed by erosion since its formation. At some places it can be readily recognized, but at many others it can be identified with difficulty and often not with certainty. At most places it appears to lie about 1,000 feet below the higher surface, but at some places the difference may be as much as 1,500 feet and at others as little as 500 feet or less.

The best development of the lower surface within the Forest, so far as is known, is between Mill Creek and Johns Creek, and northeast of the lower part of Johns Creek to and beyond the South Fork to the vicinity of Cougar and Nellie mountains. This area has not been mapped, but some of its features were disclosed by a hasty reconnaissance trip along Hungry Ridge and through Buck Meadows, and by many views of the region from surrounding vantage points. The surface is comparatively flat, a slope of about 100 feet in a mile is common although locally its grade is several times that amount. The surface is also broad, and the streams now flowing on it, for instance, Amos Creek throughout most of its course, are in wide, flat valleys of low gradient. A characteristic feature is the distinct break in slope upward toward the remnants of the higher surface. In many places, the altitude of the higher surface is attained within a mile or two. The trend of this steep slope between the two levels is too sinuous to be generally interpreted as due to faulting and the lower surface, therefore, can not be a downfaulted portion of the upper one. Downfaulted sections of the upper surface locally may have been misidentified as parts of the lower.

The lower surface rises from less than 4,000 feet to as much as 6,500 feet near the Salmon-Clearwater divide. In some places, for instance at the head of Hayfork Creek, one of the headward tributaries of Newsome Creek, it rises high enough nearly to merge with the higher plain. The country around Florence and northward from there toward Adams Ranger Station and beyond may be a high part of, and continuous with, the lower surface as developed south of Hungry Ridge.

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Other places where the lower surface appears to be present are: Near the head of Johns Creek between Kentucky and Square Mountain creeks; along Sixmile and Fourmile creeks; and in the drainage areas of Elk Creek and the American River.

The surface is younger than the higher one and is older than the Columbia River lava that rests on it in the vicinity of Adams Ranger Station and at other places.

Basins

The Nezperce Forest contains several basins between five and ten miles long and about three miles wide. Three of them, those drained by Elk, Newsome, and Meadow creeks respectively, lie within the area mapped and are prominent geomorphic features. Others, not examined in detail, are near Dixie, along the Red River between French Gulch and Red River Ranger Station, and near the head of Johns Creek.

The basins appear to be portions of the lower erosion surface cut off from their normal outlets by structural movements. Each of the three basins examined is entirely surrounded by a bedrock divide broken only by the narrow V-shaped canyon of the stream that drains it. Figure 3 is an isometric drawing of Newsome and Elk Creek basins in which the top of Rainy Day Mountain is approximately the point of view. The stippling indicates the unconsolidated sediments in the basins and the heavy black line is approximately the 4,600 foot contour.

The top of the canyon just below each basin is about 500 feet above the floor of the basin, but in most places the divides are between 1,000 feet and 2,000 feet above the floor of the basin. In general, the divide is closer to the west side of a basin than to the east side. The western wall of Meadow Creek basin is breached by a wide gap at the head of Lightning Creek only about 250 feet above the lowest place in the basin. The upper two cross profiles of Figure 4 are drawn to natural scale. The one at the left shows the outlet of Newsome Creek basin. The top of the canyon is more than 400 feet above the basin floor at a place in Newsome Creek basin about nine miles farther upstream near the mouth of Nugget Creek, represented by the profile at the right. The small notch near the center of the profile at the right represents the depth to which Newsome Creek has incised itself below the basin floor during the most recent cycle of erosion.

Where the basins have not been trenches during the present erosion cycle, the quiet meandering streams wandering through them are entirely cut off from the branches by meandering streams farther downstream. Meadow Creek basin has not yet been dissected and numerous meanders and oxbows on an alluvial flat testify to this point of its course. Just below the basin the creek is in a narrow canyon more than 1,000 feet deep, but most of the depth is because the rim of the basin rises steeply downstream and very little of it is due to the stream having cut below the altitude of the floor of the basin. The bottom profile of Figure 4 is a longitudinal one of Meadow Creek from its mouth in the South Fork of the Clearwater River to the head of one of its tributaries. It is drawn with the vertical scale twice the horizontal and shows the steep gradient of the stream into the basin, the very flat gradient across it, and the steeper gradient of the present cycle below it. The other longitudinal profile is parallel to the course of Meadow Creek and three-fourths of a mile west of it. It shows the manner in which the creek cuts through the rim of the basin. The two cross profiles are drawn to natural scale and represent the canyon and the basin respectively at the points indicated.
Figure 3. Isometric drawing of Newsome and Elk Creek basins as seen looking northeastward from the top of Rainy Day Mountain.

Figure 4. Profiles representing certain features of Meadow and Newsome Creek basins.
The size and shape of the basins, and their location in a region where the bed rocks offer about the same resistance to erosion, appear to rule out the possibility that they were excavated by simple erosion at the heads of certain streams while, farther down their courses, the same streams flowing over the same kinds of rocks cut narrow gorges. The basins, however, do appear to be in part erosional because their floors extend as benches well up into the basins of tributary valleys, except those that enter from the west.

The western sides of the basins are straighter and steeper than the others and there is evidence of considerable faulting. This will be discussed in a following section.

Present stream valleys

The base level of erosion has, in general, been lowered since the planation of the higher erosion surface. The lower surface appears to represent a major halt in this lowering for a span of time sufficient for the development of the surface. Since the development of the younger surface the lowering has been more rapid and the present streams flow in narrow, steep canyons from a few hundred to more than 5,000 feet deep. Step-like benches along the main canyons, particularly on the noses between closely-spaced tributaries, indicate that the downcutting has not been uniform but proceeded intermittently with minor halts. At a few places, the streams have changed their courses during these interruptions so that remnants of their old channels now remain on the benches at different levels above the present valley bottoms.

Most of the area drains into the South Fork of the Clearwater River. The river valley is quite crooked in detail, but it maintains a general westerly course across the trend of the foliated rocks as far as the vicinity of Castle Creek. The main tributaries are largely controlled by the foliated rocks and therefore enter the river at nearly right angles.

The deepest canyons are those tributary to the Salmon River. Figure 5 shows the canyon of Crooked Creek just below the mouth of Lake Creek.

All of the valleys that head against the Salmon-Clearwater divide have been glaciated down to an altitude of between 4,000 and 5,000 feet. They are U-shaped, are choked with morainic material, and head in cirques, many of which contain cirque lakes. These features show that the valleys had been eroded to approximately their present depth before Wisconsin time. The high land along the divide and the valleys spreading from it are the only parts of the area that have been glaciated.

Structural deformation since the formation of the higher erosion surface

There is abundant evidence within this area of both warping and faulting since the formation of the higher erosion surface. That surface has a range of altitude of at least 5,000 feet (5,000 feet to 8,000 feet) which is probably considerably greater than its original slope. The movements, however, have not been great enough to destroy the general continuity of the old erosion surface.

The principal structural feature is the apparent subsidence of the Columbia River Plateau (or elevation of the Clearwater Mountains) along a northeast-trending line that now approximately defines the mountain front. The lava-covered areas around Fish Creek lookout station and on Blacktail Butte lie south-east of this line and were not set down along with the rest of the plateau. Whether this movement took place by folding or by faulting is not known. If the
Figure 5. Canyon of Crooked Creek below the mouth of Lake Creek. A steep, narrow canyon cut below the higher erosion surface.
lava surface on either Blacktail Butte or Orangeville Mountain represents approximately the horizon of the top of Camsa Prairie near Mt. Idaho, then the displacement has been about 1,000 feet in a horizontal distance not exceeding two miles.

Broad folds have long been recognized in the lava 1/ and it seems reasonable to infer that similar movements have affected the older erosion surfaces in the Clearwater Mountains. The western sides of the basins are straighter and steeper than the others and in one placer pit, along the western edge of Elk Creek Basin, Lindgren actually observed a vertical fault separating unconsolidated sediments and gneises. Large blocks of Columbia River lava, more than a square mile in area, have been set down approximately 1,000 feet along a fault that still forms a well-defined scarp bounding Meadow Creek Basin on the west. This fault can be traced topographically at least as far south as the vicinity of Adams Ranger Station.

GRAVEL

Unconsolidated sediments, principally gravel, are widespread in the Nezperce Forest. Gravel deposits are found related to each of the principal geomorphologic features (higher erosion surface, lower erosion surface, basins, and present stream valleys) discussed in the foregoing section on the development of the present land surface, and other deposits are interbedded in the Columbia River lava.

The largest deposit that seems to be clearly related to the higher erosion surface is that in and around Big Creek Meadow, but the deposits near Dixie Meadow and around the town of Dixie perhaps belong to the same class. The Dixie deposits have not been mapped.

The lower surface (p. 10) carries much more gravel than the higher one. Only a small part of the lower surface lies within the area mapped (excluding the parts of the lower surface within the basins), but gravel is known to be present over considerable areas of this surface at Buck Meadows near the head of American Creek, in the vicinity of Adams Ranger Station, near Florence, and near Whitebird Station. The last two localities possibly are on the higher surface. The flat divide between Pesky Creek and Silver Creek is reported to carry gravel, but this locality was not visited.

As might be expected, the largest deposits of unconsolidated sediments lie within the rock-enclosed basins. The basins probably originally contained much more material than they now do, as is indicated by the small gravel areas on many of the interstream divides within the basins. Thus, in Meadow Creek Basin, gravel is found on one of the divides at an altitude of 4,100 feet, which is considerably higher than the general upper limit of gravel in the basin. Many of the mesas on both sides of the South Fork in the Newsome Creek Basin and between that basin and Elk Creek Basin carry small gravel deposits that correspond in altitude to the more widespread deposits in the basins. The same is true of the mesas along the Red River between Elk Creek Basin and French Gulch.

The basin near the head of Johns Creek was not mapped, but it is known to contain gravel at least on the divide between the lower courses of Square Mountain Creek and Twin Lakes Creek, and the gravel is probably widespread beneath the glacial moraine with which the basin is largely filled.

Gravel deposits occur locally on the benches on the sides of the present stream valleys. Some of these deposits are of considerable extent as, for example, the one in the "Cove" east of Fish Creek lookout station. At some places, there are sizeable gravel bars along the present streams or only a few feet above them. Among these may be mentioned the deposit along the South Fork between the mouth of Castle Creek and the mouth of Mill Creek, along the Crooked River near its mouth, along the South Fork just above the mouth of the Crooked River, and along the American River above the mouth of Elk Creek. Smaller gravel deposits occur along some of the minor streams even in the parts of their courses between the higher and the lower erosion surfaces.

Layers of unconsolidated sediments are not uncommon between flows of Columbia River lava. Such layers were particularly conspicuous near the top of the west side of the South Fork Canyon between Harpster and Mt. Idaho and also on Blacktail Butte, a short distance east of Blacktail Butte lookout station.

In addition to clean, well-sorted gravel, the unconsolidated sediments include poorly-sorted gravel, sand, clay, and locally lignite, ferruginous beds, and tuffaceous beds. No material except that of the tuffaceous beds is foreign to the drainage area in which it is found.

The well-sorted gravel beds are made up principally of quartz that originally may have been either vein quartz or quartzite, but such rocks as quartz monzonite and gneiss are represented also. The beds may range in thickness from an inch to 30 feet. An average thickness might be about four feet. The material of the beds may range in size from pebbles one-half inch in diameter to boulders as much as three feet in diameter. The pebbles and boulders are ordinarily well-rounded and smooth. The gravel interbedded with lava on Blacktail Butte is exceedingly well-rounded and is characteristically dark brownish-red.

Poorly-sorted, subangular gravel and boulder beds are not uncommon. In many places such beds are found not far above the underlying bedrock. The proportion of boulders and pebbles of rocks other than quartz is higher in these beds. Boulders up to at least four feet in diameter are common and the interstitial finer material may be well-rounded in part. Boulders as much as 30 feet in diameter are exposed in Fisher's placer near the mouth of Meadow Creek.

Sand beds are locally very prominent and include varieties ranging from fine quartz sand to coarse granitic sand in which all the essential minerals of the quartz monzonite can be easily recognized and which carries an occasional quartz pebble. Clay is less common than sand, but it occurs locally and is exposed in some placer pits. Most of the clay is white or light yellow, but at a few places it is a deep red.

Lignite or peat beds are present in the basins and in places attain a thickness of several feet. Less commonly they are found in the sediments on some of the benches within the present canyons. Peat beds are widespread in the Florence district.

The total thickness of the unconsolidated sediments varies widely from place to place. In some placer pits in the basins well over 100 feet of material is exposed and in some places the deposits appear to be several hundred feet thick. At other places only a thin veneer of gravel remains.

The gravel on the higher erosion surface was probably deposited at a late stage in the development of that surface. No fossils have yet been found in this gravel and its age has not been definitely determined.
Fossil leaves have been found in a few places in the sediments in the basins. Some of these were collected from Meadow Creek basin, but have not yet been examined in detail by a paleobotanist. Brown's 1/ preliminary opinion, after a cursory examination, is that they are Latah and therefore Miocene in age. Similar leaves were obtained from the Geary placer that is on a bench a few hundred feet above the South Fork in the "Cove." No lava beds were found under the leaf-bearing strata at either place and careful search failed to reveal any lava pebbles in fragments in the beds below the leaf-bearing ones. At both places Columbia River lava was found in place not far above.

The faulting that appears to be largely responsible for the basins occurred after at least part of the Columbia River lava was poured out. This is certainly true for the Meadow Creek basin where the lava is faulted into the basin, and is probably true for the other basins as well. Part of the sediments now found in the basins, therefore, were deposited in old valleys, probably on the lower erosion surface, and were subsequently covered by Columbia River lava and then faulted down into the basins where they have been preserved.

Lindgren 2/ believes that the unconsolidated sediments are due to damming by flows of Columbia River lava and this is probably true for a large part of them, but it does not seem to be a sufficient explanation for the sediments in Elk Creek basin where no lava has been found, or in Newome Creek basin, where lava has been mapped in one very restricted locality only.

A part of the sediments in the basins has accumulated there as the basins were dropped below the surrounding country or after they reached their present position. No distinction could be made between the early and the late gravel in any of the basins except that of Meadow Creek where what appears to be the later gravel is quite angular and poorly sorted and seems to rest on the older gravel and the downfaulted blocks of lava.

Some of the beach gravel, particularly that on the lower benches, is clearly younger than the lava as it contains many pebbles and boulders of that rock.

PLACERS

All of the detrital material within the Nezperce Forest, except the relatively insignificant amount from areas of Columbia River lava, came from a terrane in which there are many gold-bearing quartz veins. Thus, nearly all of the unconsolidated sediments carry at least a small amount of free gold and the sediments that carry enough to pay for its extraction constitute the placer deposits of the region. The foregoing sections on Geomorphology and Gravel have attempted to explain how the sediments accumulated at different times and at different places in response to changing geological conditions that finally resulted in the land surface as it stands today. The placer deposits have been classified according to their situation and their relation to the geomorphologic conditions that resulted in their formation into a high-level type, and a recent-valley type.

High-level type

The high-level deposits include those on the higher and lower surfaces and those in the basins on or above the basin floors. For the most part, these

1/ Brown, R. W., Personal communication.

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placer deposits are in original accumulations of gravel that have not been re-worked since their deposition and they ordinarily contain less gold per unit volume than deposits of the other type. Nowhere apparently is the gold content of deposits of this kind great enough to allow the deposits to be worked profitably except on a fairly large scale or where local conditions make small scale placer mining unusually inexpensive, but gold is present in small amounts throughout very large volumes of the sediments.

Some examples of this type are the deposits in Big Creek Meadow, possibly some of the Dixie deposits, the Cal-Idaho, the Moose Creek (in part), the Montana, and the Backeyes placers.

Recent-valley type

As the base level of erosion was lowered, after the formation of the basins, the rejuvenated streams cut into the high-level deposits in many places even below their bases into their bedrock floors. The streams removed much of the old, high gravel, worked it over down the valley sides and along their bottoms, and further concentrated the gold from it.

Thus were formed the rich re-accumulated "skim" deposits on the valley sides and the gulch deposits. French Gulch, Newsome Creek, and Nugget Creek are examples of this type that to the present time have been by far the most productive.

As the valleys were deepened, limited flood plains were developed at certain levels, indicating temporary interruptions in the cutting, and then, when down-cutting was resumed, benches of gold-bearing gravel were left, particularly at places where the streams changed their courses slightly. Such was the origin of the bench and old-channel placer deposits such as the Geary, Fisher, Moose Creek (in part), and Telegram.

Small gravel deposits have accumulated along the courses of the streams that flow above the old basins and across the slopes between the higher and the lower erosion surfaces. The drainage areas of many of these streams include none or little of the old gravel yet the deposits are locally auriferous enough to be worked commercially on a small scale. The gold comes from the veins and rocks of the immediate watershed and is ordinarily not so pure as the high-level or re-concentrated gold, showing that it probably has not traveled so far. Gold of this type ordinarily assays around 700 fine, whereas much of the gold in the older deposits runs between 800 and 900 fine.

PRACTICAL APPLICATIONS

Large volumes of gold-bearing gravel remain in many places in the Nezperce Forest. The rich "skim" diggings and the re-accumulated gulch deposits are probably nearly exhausted, although possibly some may still be discovered. Future production probably will come mostly from large scale operations in low grade ground. Much of the gravel of Elk and Newsome Creek basins has not been touched. Apparently no placer mining has ever been done in Meadow Creek basin. Much un-worked gravel lies in Big Creek Meadow, around Dixie, in Buck Meadows, near Adams Ranger Station, in the vicinity of Florence, and at other places. Smaller un-worked deposits cap the benches along the South Fork.

The gravel of these deposits is known to be low grade. The production records and the size of some of the old pits would indicate that part of the gravel ran only about 3 cents a cubic yard, but this method of calculation,

\[ \text{All estimates of value are based on gold at $20.67 per ounce.} \]
of course, can not consider the amount of gold lost or the amount of barren ground handled. Some large pits are said to assay around 20 cents per yard, and locally values of more than a dollar a yard are claimed.

A large part of the available ground has never been thoroughly tested with the idea in mind of operation on a large scale-low cost basis. The very much better transportation facilities lately provided in the region, the increased price of gold, and the improved methods of handling and washing gravel, may justify rather extensive drilling or test-pit sampling in favorable localities.

Water has been, and for a long time probably will continue to be, one of the principal concerns of the operator working the high-level gravel. The period of abundant water in any but the larger streams is limited to the spring months. Most of these streams flow at least 700 feet below the high-level gravel. Thus, either long, expensive ditches and flumes, or pumping, would be necessary.

PLACER MINES

The placer mines are grouped in the Elk City district, the Temnile district, and the Castle Creek district. The Elk City district includes the mines in Elk Creek basin and some close to, but not strictly within, the basin. The Temnile district includes the placer mines in and near Newsome Creek basin. Big Creek Meadow is at the head of Big Creek in the Orogrande district, but for convenience is here described with the Temnile district. The Castle Creek district embraces the placer mines along the South Fork for several miles above and below the mouth of Castle Creek.

The mine descriptions for all but the Castle Creek district are taken from the report of Shonon and Reed [1] on the Elk City, Orogrande, Buffalo Hump, and Temnile districts.

Elk City district

American (Golden Rule)

The American or Golden Rule placer is about 5½ miles by road north and a little west of Elk City. It is just north of the Elk Township line on the west side of American River. Mr. Charles Tiedeman located the property in 1906 and worked it for five or six years. The total production is reported to be about $8,000. According to Tiedeman, the values were spotty, the gulches were the best, and the basal sediments were not very rich. The pit is about 700 feet long and 200 to 300 feet wide. In 1933, this property was operated by Mr. Jim Dyer.

At the lower end of the cut the elevation of the gneiss bedrock is 4,360 feet. The banks in the pits are composed largely of gravel, but there are some layers of sandstone. Most of the boulders are less than six inches in diameter, but some exceed two feet. The boulders and pebbles are well rounded and are composed principally of quartz and quartzite, although some are of gneiss and granitic rocks. A few clay beds in the section indicate horizontal bedding. One thin oolitic stratum was noted near the top of the bank.

American Hill

The old American Hill placer is on the north side of American River about a mile south of Elk City. The placer has not been active for many years. The

bedrock floor of the pit is irregular, but in general lies at an altitude of about 4,050 feet, just a few feet above the present river a few hundred feet to the south. The banks are about 100 feet high on the north side and the strata exposed consist of gravel, sand, and considerable clay. The bedding is nearly horizontal. The bed rock is gneiss. According to Lindgren 1, the top stratum, consisting of 10 feet of gravel and clay, was rich and was worked in the early days as "skim" diggings. The basal strata, consisting of 15 to 20 feet of bluish clay, contain most of the fairly coarse gold.

Buffalo Hill

The abandoned Buffalo Hill placer is about 1.5 miles west of Elk City just north of American River. According to Lindgren 2, about 180 acres are contained in the pit, and the sedimentary section is made up of sand with some gravel and heavy-bededd clay containing much clayey material. The elevation of the gneiss bedrock is about 4,000 feet and in places the banks are 100 feet high, although 50 feet may be an average. Lindgren 2 mentions "a well-defined perpendicular fault line" separating the clays from the gneisses on the northwest.

Cal-Idaho (Gold Hill)

The Gold Hill placer is now being operated by the Cal-Idaho Mining Company, and Mr. Thomas Berry is the manager. The placer lies about a mile south of the Buffalo Hill placer on the point between the Red and the American rivers.

A rock cut lowers the tail race several feet to allow lower ground to be worked. Undercutting are used in addition to sluices. Water is led by an eight-mile ditch from Kirk’s Fork of the American River and a head of 155 feet is developed. The altitude of the augen-gneiss bedrock is about 4,100 feet, but this bedrock surface is very irregular. The gravel banks of the pit are in places nearly 100 feet high. The section is made up largely of bluish clay, but contains sandstone, conglomerate, well-rounded gravel, and, at the base, a conglomerate composed principally of angular granitic boulders separated by rounded quartz pebbles.

French Gulch

French Gulch, a small tributary to the Red River at the north end of Red River Meadows and the first stream north of Segal Creek, is a little more than five miles by road from Elk City. This gulch is reported to have been very rich in the old placer-days. The gravel in the gulch has been washed all the way up the stream, but gravel deposits at slightly higher elevations on either side have not been worked, thus indicating that the rich deposits were reconstituted. In 1932, Mr. Brown was operating a placer pit in French Gulch at an altitude of 4,400 feet. The unconsolidated material in the pit consists of poorly-sorted boulders in a clay matrix. The bedrock is augen gneiss.

Tiernan Hill

At the old Tiernan Hill diggings on the divide at the head of Glass Creek, just northwest of Red Horse Creek and about three miles southeast of Elk City, over 100 feet of unconsolidated sediments lie on gneiss bedrock. The placer is higher than most of the big pits. It lies at an altitude between 4,400 and 4,500 feet. The sediments are interbedded sand, clay, and gravel. Much of the ground along Glass Creek has been washed as "skim" ground.

1Lindgren, Waldemar, A geological reconnaissance across the Bitterroot Range and Clearwater Mountains in Montana and Idaho; U.S. Geol. Surv. Prof. Paper 27, p. 93, 1904
2Lindgren, Waldemar, op. cit., pp. 94 and 95.
3Lindgren, Waldemar, op. cit., p. 95.

18.
Figure 2. Higher erosion surface west of Buffalo Hump.
Other placers

Many of the streams of the district have been placered locally. For the most part deposits re-concentrated from the high-level gravel have attracted attention. Some of the streams where work has been done are Little Elk Creek, Buffalo Creek, Segal Creek, and Red Horse Creek where Mr. Schuyler Simmons has taken out some gold for many years.

Tennmile district

Big Creek basin

Considerable gravel has been washed along some of the streams that flow into the Big Creek basin. It seems probable that the gravel which fills the basin accumulated in the Tertiary, but whether the gravel that has been washed was re-concentrated is not known.

Buckeye

The Buckeye placer is in a small gulch just west of Newsome Creek and about one-half mile south of Newsome. The property was worked in 1902 and 1903. The total reported production is 380.27 ounces of gold. The pit covers an area of over two acres and it is roughly estimated that 125,000 cubic yards of gravel were mined. The gold content of the gravel is not known, but based on the assumption that the reported production is the total output for the mine, and that the yardage estimate is approximately correct, the gold saved was about 6 cents per cubic yard. A ditch eight or nine miles long was dug to divert water from Sawmill Creek.

The deposit at the Buckeye mine consists principally of beds of sand and clay with layers of conglomerate which, where exposed in the pit, range in thickness from 20 to 40 feet. The boulders are chiefly quartzite, quartz, and gneiss. In general, they are subangular and practically all are less than one foot in diameter. The boulders of gneiss are decomposed where exposed in the banks. The bedrock is gneiss with well-defined light and dark bands which trend north and dip 45° E. The surface of the bedrock is extremely irregular.

Gravel flat along Crooked River

For the last two miles of its course before emptying in the South Fork, Crooked River flows in a gravel-floor plain about a quarter of a mile wide. Some of this gravel has been prospected, but no considerable amount of placer work has been done. The altitude of the plain ranges between 3,900 and 4,000 feet, which corresponds to the lowest gravels in Elk and Newsome Creek basins. The gravel may well be a Tertiary deposit and more prospecting may reveal re-concentrated auriferous gravels either on the flat, along tributary streams, or on the valley sides.

Koyos (Bluebird)

The Koyos (Bluebird) placer is at the head of a gulch tributary to Leggett Creek about 1 1/2 miles north of Fall Creek. The property was worked previous to 1932 and has some reported production. In 1932 and 1933, the Koyos Placer Corporation operated the property.

The placer deposit at the mine lies immediately below a large area of high-level gravel. The upper part of the pit, at an altitude of about 4,450 feet, has cut into the high-level gravels. The deposit is sandy with angular and subangular
quartz and quartzite pebbles and in some places contains small lens-like bodies of clay. The average depth of the gravel in the pit is about five feet. According to Mr. A. C. Coleman, superintendent, gold is found all through the deposit, but is largely concentrated in the first two inches above bedrock. The bedrock exposed in the pit is augen gneiss.

Montana

The Montana placer, known at different times as the Sacajawea and Idaho placer mine, is located on Newsome Creek about 1/2 mile north of Newsome. The property was worked principally during the four-year period 1906-09, although some ground was washed in 1915. The total reported production is 517,08 ounces of gold and 99 ounces of silver.

A large pit roughly 400 feet by 800 feet in ground plan and from 30 to about 100 feet deep has been excavated. Interbedded gravel, sandstone, and clay rest on gneiss bedrock where exposed in the mine pit. The bedrock which is cut by many pegmatite dikes is at an altitude of approximately 4,300 feet.

It is roughly estimated that 600,000 to 600,000 cubic yards were removed from the pit. The tailings were diverted to Newsome Creek by natural run-off.

Moose Creek

The Moose Creek placers of Mr. Max R. Crosby lie on the north side of the South Fork in the drainage basins of Allison and Trail creeks, small tributaries of the river between Newsome and Moose creeks. They are about four miles east of Fall Creek by way of the new river highway and the road which leads up out of the canyon near the mouth of Trail Creek. The placers consist essentially of two small pits, No. 1 and No. 4, from which about 18,000 yards and 23,000 yards, respectively, have been mined, and two large pits, No. 3 and No. 2, which have areas of about seven acres and thirty-three acres, respectively, and which have an average depth of approximately 75 feet. (Fig. 6) The company controls about 14 miles of ditch, in part out of repair at the time of this survey, through which water was brought from Moose and Bear creeks. Mr. Crosby plans to extend the ditches and tap both Nugget and Beaver creeks.

The first placer location was made about 1863 in Allison Gulch by the man after whom the creek is named. He worked the gulch bottom only and in about 1869 sold out to the Chinese, who worked the gravel on the west side of the gulch and discovered what is now the No. 2 pit. In order to work the higher gravel, the Chinese constructed about six miles of ditch from Bear Creek, but they were never able to clean off the bedrock at the site of the No. 2 pit because of their inability to make a rock-cut needed for drainage. According to reports the Chinese left with a clean-up of about $40,000, and the placers were next worked in 1871 by Flynn, McIntoy, Murray, and Russell, who washed only the creek-bottom gravel. Early in the eighties Paddy White dug the Moose Creek ditch and diverted water to the top of the east side of Allison Gulch. He placered principally in Alder Gulch, a small tributary to Allison Gulch, and according to reports took out nearly $20,000 in one year. In 1889 the bottom and side slopes around Allison Gulch were worked by Mr. Hepner. Mr. Charles Richardson acquired a half interest from him early in the nineties. Richardson made the rock-cut into No. 2 pit and after working there for several years opened the No. 3 pit on the west side of Trail Creek in 1902. The next year he sold out to Rhodus Brothers of the Moose Creek Gold Mining Company, who operated until 1910, when the placers passed to the ownership of Mr. Giles, who sold out to Mr. Crosby in 1927.

1/ Production data furnished by Mr. C. N. Gerry of the U. S. Bureau of Mines.
Figure 6. Sketch of vicinity of Moose Creek Placers.
No authentic record of complete production is available, but Mr. Crosby made the following estimate in 1932:

<table>
<thead>
<tr>
<th>Company</th>
<th>Production previous to 1898</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Richardson</td>
<td></td>
<td>50,000</td>
</tr>
<tr>
<td>Rhodes Brothers</td>
<td></td>
<td>185,000</td>
</tr>
<tr>
<td>Giles</td>
<td></td>
<td>9,000</td>
</tr>
<tr>
<td>Since</td>
<td></td>
<td>2,000</td>
</tr>
</tbody>
</table>

$335,000

The Moose Creek placers are developed in three small patches of gravel which lie, respectively, on the noses between Moose and Allison creeks, between Alliam and Trail creeks, and between Trail and Newsome creeks. The altitude of the lowest gravel in all these areas is about 4,000 feet. This is about 500 feet above the South Fork, that flows in a youthful canyon a short distance to the south. The highest gravel that remains is just over 4,500 feet. The gravel areas appear to be remnants of the once much more continuous deposits that lay in the extensive basin-like depression now drained and dissected principally by Newsome Creek and the South Fork of Clearwater River. In the No. 2 pit, nearly 200 feet of nearly horizontal beds of sand, gravel, and clay are exposed, and, according to Mr. Crosby, gold occurs at several horizons within these beds. The texture of the beds seems to indicate that they were deposited at least in part in the quiescent waters of a lake, although a stream may have flowed here at different stages during the deposition of the beds.

The gravel in the vicinity of the Moose Creek placers appears to include high-level gravel, re-concentrated gravel, and gravel deposited along the present gulch bottoms in places where it could not be mixed with re-concentrated high-level gravel. The gold itself reflects in some degree the origin of the gravel in which it is found. That in the high-level gravel is rounded, and is reported to run between 800 and 900 fine. The gold in the re-concentrated gravel runs considerably higher to the yard than that in the high-level gravel and is ordinarily at least 900 fine. The gold in the gulch gravels, which presumably is from the country rock gneiss, is coarse and angular and runs around 700 fine.

When the development work in progress is completed, Mr. Crosby plans to handle about 500,000 yards of gravel a year by using several giants, grizzlies, and tables, and he estimates a reserve sufficient for at least seven years at the above rate. Considerably less than half of the area of high-level gravels on the noses between Allison and Trail, and Trail and Newsome creeks, has been worked, but it does not follow, of course, that all the unworked ground is necessarily rich enough, or suitable, for placer mining. The problem of getting water to some of the places will no doubt prove difficult.

Newsome Creek

Much of the gravel along Newsome Creek was worked over by early miners, so that only a few small un-worked areas remain along the lower reaches of the stream. In 1931, the Newsome House Placer Company had completed repairs on the Buckeye ditch and had installed a Hendy hydraulic elevator for the purpose of mining the creek gravel underlying the flat at Newsome. According to Mr. R. C. Racer, in charge of operations, the gravel is about 10 feet thick and has an average gold content of about 50 or 40 cents per cubic yard, and in some places it prospected over $1.00. The gold is coarse and the larger pieces are well rounded. Mr. Racer states that the gold on the west side of the flat rests on a clay bed, whereas on the east side it occurs on gneiss bedrock.

21.
In 1931, Fell Brothers were sluicing in the bed of Hayfork Creek about two miles above its junction with Radoliff Creek. They reported some production in 1931.

Newsome and Leggett Creek

The Newsome and Leggett Creek placer is about five or six miles northeast of Golden and is reached by the road that turns north from the South Fork highway at Fall Creek.

Very little was learned about the history of the mine. Production reported from 1904 to 1912 was 930.37 ounces of gold and 188 ounces of silver.  

A pit 2,000 feet long, and at its widest place about 600 feet wide and from 30 to 100 feet deep, has been excavated partly in gravel and partly in gneiss bedrock. The tailings were diverted into Leggett Creek by natural run-off.

The gravel at the Newsome and Leggett Creek placer is in general poorly assorted and contains but few clay bands. In places lenses of sand occur in the gravel. The boulders are not excessively large; some are over 14 inches across, but the average diameter is less than five inches. Boulders of white and grayish quartzite, gneiss, and granitic rocks prevail. The gneiss and the granitic rocks are greatly altered where exposed in banks, and most of them disintegrate when removed. The bedding appears to dip north at about 10°. The gneiss bedrock has conspicuous banding that in places is considerably contorted. The contact of the gneiss and gravel is at an altitude of about 4,325 feet. The gravel in the upper part of the pit is from 30 to 55 feet thick and at the lower end about 15 feet thick, and the average thickness is not over 20 feet. It is roughly estimated that about 650,000 cubic yards of gravel were removed from the pit, and, assuming that the reported production represents the total output of the mine, the average gold content of the gravel mined was approximately four cents per cubic yard.

The high-level gravel where exposed is similar in appearance to that at Moose Creek. Mr. George Craig ran a drift 100 feet long at the contact of the gravel and bedrock at the upper end of the Pioneer working, and states that he took out $15.00 on bedrock from one set of timber (5 x 6 ft.), but that the gold was only sparingly present in the gravel above bedrock. He also states that the gold was quite angular and that some of it was attached to white quartz.

A considerable amount of the high gravel remains unworked because it lies above the ditch level. There are also some patches of unworked gneiss gravel that, for some reason, were left by both white and Chinese miners.

Pioneer

The Pioneer placer is on a divide between Santiam Creek and the South Fork of the Clearwater River, about two miles east of Fall Creek Station. According to Mr. W. B. Huston, the placer was first worked in the late sixties. In the early seventies, Mosers, Dan and John McPherson built a ditch for a group of miners called the 17-mile ditch to divert water to the placer from Crooked River. This ditch elevated the water sufficiently to work all except a narrow strip of the placer ground.

Both high-level and concentrated gravel have been mined at the Pioneer mine. The high gravel rests on quartzite bedrock at an altitude between 4,400 and 4,500 feet.

Production figures furnished by Mr. C. N. Gerry of the U. S. Bureau of Mines.
The Tipple placer is in a gulch tributary to Newcomer Creek about a mile north of the Newcomer and Legget Creek placer. The property was worked in the early days by both white and Chinese miners. The first production records available for the property are for 1902. With the exception of four years, production was reported until 1925. In 1932, preparations were again being made to work the property by Mr. H.C. Howard and Mr. C. H. Whinery. During the 19 years in which production was reported, the property produced 441.18 ounces of gold and 51 ounces of silver. In 1921, the fineness was reported as 880.

The gulch at the Tipple placer has derived much of its gravel from the high-level deposit that caps the ridges to the west. The gulch branches at the cabins; one branch trends nearly north and the other nearly east. Both branches have been mined and are said to have been about equally rich, and, since the streams in the two branches have flowed only a short distance over bedrock, it follows that the gold has probably been almost entirely derived from the re-concentration of the high-level gravel.

Castle Creek district

Clara Ophelia

The Clara Ophelia claim of Mr. P. E. Woodruff of Grangeville is on the south bank of the South Fork about 1½ miles above Castle Creek Ranger Station. Development consists of a prospect pit from which about 400 cubic yards of gravel have been taken. The property, when visited, was not being operated, but a gasoline motor and a pump were set up to deliver water from the river to a small giant. Some of the ground was worked years ago by Chinese miners.

The claim lies along the bank of the river and includes low gravel terraces that locally reach an altitude as much as 100 feet above the river. Above these terraces the rock wall of the canyon rises 700 or 800 feet higher. The bedrock is steeply dipping gneiss and schist that strikes nearly north.

The prospect pit is about 100 feet from, and about 10 feet above, the river. About 10 feet of well-rounded gravel are exposed and this is overlain by several feet of talus material from the canyon wall. The irregular surface of the bedrock is exposed in the pit. Part of the gravel contains many boulders up to two feet in diameter and the handling and disposal of these is one of the principal problems confronting the owner.

According to Mr. Woodruff, the gravel on the Clara Ophelia claim will average in the neighborhood of 25 cents per yard on a basis of gold at $20.67 per ounce.

Geary (Big Cove)

The Geary or Big Cove placer of the M. B. Geary estate is on the southwest side of the South Fork between 400 and 600 feet above the river opposite the mouth of Earthquake Creek. The placer has not been worked for a number of years and all the equipment is in hopeless disrepair. Development consists of two pits a little more than a mile apart from which about 250,000 yards and 300,000 yards, respectively, have been washed. Figure 7 shows the situation of the pits relative to each other and to the river. Water for operating the placer was obtained from several of the small streams nearby. A large volume of unwashed gravel remains.

1/ Production figures furnished by Mr. C. N. Gerry of the U. S. Bureau of Mines.
Figure 7. Map of vicinity of Geary placer (after Reuben McGregor).
The Grouse placer is at the lower edge of a sloping shelf or bench, called "The Cove", that lies above the South Fork and extends from the vicinity of Bully Creek north and west to and beyond Cove Creek. In places the bench is as much as two miles wide, and it slopes from an altitude of about 4,000 feet below Fish Creek lookout station to less than 3,000 feet along the brink of the shelf above the South Fork. "The Cove" is largely filled with landslide material, predominately composed of Columbia River lava. The pits are excavated to a depth of nearly 100 feet below the bench level at the edge of the canyon and may be in old filled stream channels. Both pits reach the quartz monzonite bedrock that is well exposed in this vicinity in the South Fork canyon.

The following generalized section was measured from the head of the sluice box up the 70-foot bank at the west side of the No. 1 pit (Fig. 7): Pitted, weathered, irregular quartz monzonite bedrock-60 foot bed composed principally of boulders ranging from eight inches to five feet in diameter of quartz monzonite and quartz, with some schist boulders, with the interstices filled with finer gravel - more than 40 feet of alternating beds of grey, angular, micaceous sand locally cemented with clay, granitic sand, dark carbonaceous and micaceous shale, and poorly-sorted, but well-rounded, gravel composed principally of pebbles between one-half inch and three inches in diameter - and 10 feet or more of dark brown, clayey landslide or mudflow material, containing quartz pebbles up to two inches in diameter, and lava pebbles, boulders, and fragments up to six inches in diameter. The latter material rests unconformably on that below. Similar lava breccia caps the sediments in the No. 2 pit.

Fossil leaves were collected from some of the shale beds in both pits.

Grouse Creek

The Grouse Creek placer is a little more than a mile below the mouth of Castle Creek on the south side of the river. Mr. D. Williams is reported to be the owner. The development consists of a single pit at the edge of the river from which a few thousand yards have been washed. A ditch about one-fourth mile long leads water from Grouse Creek to a penstock, whence it is fed to a 4-inch giant. According to Mr. A. S. Holmes, who made a test run at the property, the gravel runs about 15 cents to a yard. The pit was opened in 1890, but the production has been insignificant.

The pit is in bench gravel that reaches as much as 50 feet above the river. The quartzitic gneiss bedrock at the pit is about 10 feet below river level. This material consists of about 35 feet of poorly-sorted gravel and boulders with a sandy matrix, four feet of sand, and 10 feet of poorly-sorted bouldery material. According to reports, the principal values lie below river level in the bottom 10 feet of gravel.

Fisher

The Fisher placer lies on a bench about 200 feet above the South Fork of the Clearwater on its north canyon wall about three-fourths of a mile above the mouth of Meadow Creek. The property is opened by a large pit. (Figure 8) The placer-mining equipment is in total disrepair. The placer was opened, according to Mr. Bernice McConnell of Grangeville, by a man named Fisher some time in the nineties. Fisher worked what is now the lower end of the pit. The placer was last operated between 1916 and 1918 by a man named Ball. In the last period of operation, water was brought from Meadow Creek by a flume more than four miles long that carried 27 inches of water. The fall from the headgate to the two 6-inch giants was more than 400 feet. Careful sampling of the west side of the pit in 1918 showed that the gravel there, throughout its entire exposed thickness, averaged about 15 cents to the yard.
Figure 8. Map of Fisher's placer.

- 24 - A
The placer is at the southeast edge of a sloping bench on the east side of Meadow Creek, but ranges in altitude from about 2700 feet to about 3200 feet. A similar but smaller bench is present at a concordant level on the west side of Meadow Creek. The bench is largely capped by Columbia River lava. The placer is below the bench level in an old gravel-filled channel whose bottom, at the pit, is about 200 feet above the present river level. The channel appears again in the canyon of Meadow Creek about one-third of a mile above its mouth. Here it has not been opened by placer mining operations, and is partly concealed by forest cover and rock float.

The bedrock at Fisher's placer is quartz monzonite that strikes northeast and dips steeply southeast. The basal layer in the old channel is a boulder bed that ranges in thickness from 15 feet to at least 50 feet, and contains boulders up to 30 feet in diameter. Most of these are of quartz monzonite identical in appearance with the bedrock, but some are quartzite. The boulders are well-rounded to angular and some of them contain well-formed pot holes. The interstices are filled with a variety of material, including coarse gravel, fine gravel, sand, mudstone, and locally coaly material in which wood is recognizable. In places the boulder bed appears to grade into coarse granitic sand in which rounded pebbles of quartz and quartz monzonite are prevalent.

The strata in which the pit is principally opened lie unconformably above the boulder bed. They consist of alternating layers of gravel, sand, and silt, with a maximum exposed total thickness of about 120 feet.

The gravel lies nearly horizontal. Some beds are continuous across the exposed part of the pit. Others vary in thickness and some lens out.

A breccia bed that appears to represent a mudflow, originating farther north, overlies the gravel. The breccia lies on a very irregular gravel surface. The composition of the breccia has a wide range. In some places it consists of little but mudstone. The typical material consists of a mud matrix in which are embedded angular to rounded fragments of lava from less than an inch to eight feet in diameter, as well as occasional pebbles of quartz, quartzite, and quartz monzonite. Locally, angular blocks of lava predominate.

Holmes

The two claims of Mr. A.S. Holmes lie on the south bank of the South Fork at the sharp bend of the river about a half mile below the mouth of Meadow Creek. Holmes gets water from Mill Creek through a flume and ditch with a total length of about one-half mile. The gravel is shoveled into a sluice box. The property has been operated since about 1929 and several thousand yards have been washed. The gravel is reported to run from 80 cents to a dollar a yard.

The bedrock is gneiss and gneissic quartz monzonite, and at the placer its irregular surface lies about six feet above the low-water level of the river. The pit shows about four feet of gravel containing some boulders up to six inches in diameter followed by about 10 feet of bouldery gravel with boulders as much as two feet in diameter.

Telegram

The Telegram placer is about two-thirds of a mile above the mouth of Castle Creek on the south side of the river. It was last worked in 1916 when the gravel was dug by steam shovel and washed with water brought by ditch and flume from Mill Creek. According to Mr. A.S. Holmes, who was in charge of the operations,
the gravel ran about 40 cents to the yard exclusive of the over-burden, which is about 30 feet thick at the back of the pit. About $2,200 was taken from the pit. A large volume of unwashed gravel remains.

The bedrock is quartzitic gneiss. Boulder piles indicate a considerable proportion of large boulders, many of them of Columbia River lava, in the gravel. The pit was so badly caved when visited that no gravel in place was exposed.