ARIZONA GOLD PLACERS
(Second Edition, Revised)

BY ELDRED D. WILSON


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122. Quicksilver (Mercury) Resources of Arizona, by Carl Lausen and E. D. Gardner.
123. Geology and Ore Deposits of the Courtland-Gleeson Region, by Eldred D. Wilson.

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PREFACE

Many people feel the lure of gold, and dream of finding great nuggets of the gleaming yellow metal. The wonderful thrill of such a discovery must, however, be experienced vicariously, if at all, by most of us. Tales of hardship followed by the acquisition of a fortune in golden dust and nuggets fascinate us even though we know that they are only fiction. How much stronger, then, must be the appeal of true accounts of such achievements. It is probably because of the almost universal interest in the subject that the first edition of this bulletin was so soon exhausted, and not because people in every state in the Union, who requested copies, desired data on the mineral resources of Arizona. At any rate, this bulletin has been the most popular one issued by the Bureau.

It is, unfortunately, true that, in spite of diligent efforts to gather all the information available, the account is incomplete and otherwise unsatisfactory. It could, however, hardly be otherwise. The pioneer prospectors and miners were too busy overcoming obstacles, struggling against hardships, and celebrating occasional periods of good fortune to write about their experiences, even if able to do so. Practically no authentic records of many of the earlier camps exist. Such statistics as are available are often far from reliable, and it requires good judgment to separate the true from the false.

Although a few attempts to work Arizona placer ground have been made since the Arizona Bureau of Mines was established, and a little placer gold is recovered each year, gold placering gives little promise of proving a profitable industry at the present time. That a number of large and relatively rich gravel deposits exist in the State is undeniable true, and it is very probable that the still unrecovered placer gold has a value greatly exceeding that already obtained, but lack of water and the cemented condition of much of the sand and gravel create a situation that has proved very discouraging. That these drawbacks will some day be overcome seems certain. Until that day arrives, however, the story of the gold placers of Arizona must deal with the romantic and somewhat legendary past and give some information concerning areas of potential future value. Of the present, there is almost nothing to say.

G. M. BUTLER,
Director.

May 20, 1927.
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INTRODUCTION AND ACKNOWLEDGMENTS

The first edition of "Arizona Gold Placers,"* which was mainly a compilation of information already in print, but scattered and difficult to find, has been entirely rewritten for this bulletin. Much additional information, based partly upon field work, has been added, and several more districts are considered. Greater emphasis has been placed, when possible, upon the geologic settings of the various placer districts, and a few geologic maps have been included.

Grateful acknowledgments are due the many persons who furnished written or oral information. Mr. Carl Lausen, particularly, provided many helpful data and suggestions. Mr. W. R. Hoffman assisted the writer in the field.

GENERAL ORIGIN AND FEATURES OF GOLD PLACERS

Gold placers, or deposits such as gravel and sand that contain notable concentrations of auriferous material, all result from the slow milling and concentration processes incident to the natural erosion of pre-existing gold-bearing rocks. The origin of most gold placers is traceable directly to auriferous veins, lodes, or replacement deposits, that, in many instances, were not of high grade.

According to Emmons,* placers are not apt to form from gold-bearing outcrops that contain notable manganese, chlorides, and iron sulphides, unless precipitating agents such as calcite, siderite, rhodochrosite, pyrrhotite, chalcocite, nepheline, olivine, or leucite are abundant, or unless erosion is very rapid. In other words, the gold may be dissolved and carried below by means of natural chlorination processes that are established when solutions containing chlorides, together with sulphuric acid from the oxidation of iron sulphides, act upon manganese dioxide; but this process is neutralized if precipitating agents are present, and may be ineffective if erosion is very rapid.

According to Lindgren,† the best conditions for the concentration of gold into placers are found in moderately hilly regions where deep secular decay of the rocks has been followed by slight uplift. As the rocks of a region break up and decay under weathering, rainfall washes away most of the resultant detritus, grinds it by striking and rubbing it together and by dragging it along the stream bed, and liberates most of the included gold. Because gold is six or more times heavier than ordinary rock, the liberated particles of gold will concentrate along the bottom and come to rest where the stream gradient lessens. The coarser particles will settle down first, but the fine and flaky gold will be carried farther along. The best placer concentration results probably obtain in rivers of moderate (about 30 feet per mile) gradient, under nicely balanced conditions of erosion and deposition. Except

†Lindgren, Waldemar, Mineral Deposits, pp. 211-234.
where gravel bars may form in certain slower reaches, very little concentration will take place in the gorges. Such bars, through further deepening of the channel, may be left as elevated benches.

Most of the gold in a placer usually rests on or near the bedrock. Occasionally, the coarser gold is scattered through the lower 4 to 20 feet, or the gravel may be richest a few feet above bedrock, but never are the values equally distributed vertically. Among the best types of bedrock are compact clays, somewhat clayey, decomposed rock, and slates or schists whose partings form natural riffles. Smooth, hard material does not catch or retain the gold effectively. Gold works down for some distance into the most minute crevices of hard rock, for 1 to 5 feet into the pores of soft rock, and for many feet along the solution cavities of limestones.

Crystallized gold, which is sometimes found in placers, according to Lindgren* indicates close proximity of the primary deposit. He states that there is probably no authenticated case of crystallized gold occurring in gravels that have been transported far, and that it is difficult to believe the assumption that such crystals are formed by secondary processes in the gravels. The high insolubility of gold in most surface waters is demonstrated by the fact that flake or flour gold, which often is in 2,000 particles per one cent's worth, may be carried by rivers of moderate gradient for hundreds of miles.

The fineness, or parts of unalloyed gold per thousand, of placer gold is usually greater than that of the vein gold of the same district. This increase in purity, which is proportional to the distance that the placer material has been transported, and to the decreasing size of the grains, has been shown to be due to the solution and abstraction of silver by surface waters.

YEARLY RAINY SEASONS OF ARIZONA

The advent of rain is of great importance to the placer miner in Arizona. It exposes nuggets and provides temporary water for wet methods of concentration, but it hinders the dry-washer, whose dirt must be dry. Usually in Arizona, as in much of the Southwest, the least rain falls in May and June, and the most during July, August, and the winter. Often this rain comes with a local violence that fills dry arroyos with torrents.

GENERAL DISTRIBUTION OF ARIZONA GOLD PLACERS

Due to the presence of gold-bearing rocks in the majority of the mountain ranges of the Southwest, gold placers that have been of

*Lindgren, Waldemar, op. cit.
Fig. 1. Index map showing location of Arizona placer districts.

1—Big Bug  
2—Black Canyon  
3—Canada del Oro, or Old Hat  
4—Castle Dome  
5—Chemehuevis  
6—Dome Rock  
7—Dos Cabezas  
8—Eureka  
9—Garcia  
10—Gila City  
11—Globe  
12—Gold Gulch, Bisbee  
13—Granite Creek  
14—Greaterville  
15—Groom Creek  
16—Harshaw  
17—Hassayampa, Maricopa County  
18—Hassayampa, Yavapai County  
19—Huachuca  
20—Humbug  
21—Kofa, or S. H.  
22—Laguna  
23—La Paz  
24—Las Guijas, or Arivaca  
25—Lynx Creek  
26—Minnehaha  
27—Morenci  
28—Nogales  
29—Old Baldy  
30—Oro Blanco  
31—Papago  
32—Patagonia  
33—Payson  
34—Pearce  
35—Placerritas  
36—Plomosa  
37—Quijotoa  
38—San Domingo  
39—Teviston  
40—Tyndall  
41—Vulture  
42—Weaver and Rich Hill.
economic importance occur in every county of Arizona except Apache, Coconino, Graham, and Navajo. As indicated on the accompanying map (Fig. 1), the placer districts of Arizona that have been notably worked are situated in the southern, mountainous and desert half of the State. They are localized in the vicinity of the Colorado River from a point south of Yuma to about as far north as Topock, and in various portions of the Gila River drainage area, but are best developed in Yuma, Yavapai, and Pima counties. As described further on in this report, very extensive placers occur also in Apache, Coconino, and Navajo counties, but under prevailing conditions they are of too low a grade for profitable mining. Many additional placers, not of economic importance, are found in the gulches that issue from the numerous mineralized mountain ranges throughout the southern half of the State.

HISTORY OF ARIZONA GOLD PLACER MINING

The original discovery of placer gold in Arizona probably was made by Indians long before the advent of white men. As early as 1774, according to Elliot’s History of Arizona (1884), certain placers of the Quijotoa district, about 70 miles west of Tucson, were being worked extensively by Padre Lopez, a Castilian priest. In 1858, according to Hamilton,* placers were discovered on the Gila River, about 20 miles east of where it joins the Colorado, by Col. Jacob Sniveley. About 1862, the La Paz placers, near the Colorado River about 65 miles north of Yuma, were discovered by Capt. Pauline Weaver. The greatly increased prospecting that followed these discoveries soon resulted in the finding of the Dome Rock, Plomosa, San Domingo, and Yavapai County gold gravels. The Greaterville placers became known in 1874, and by 1900 many additional, but less important, discoveries were made in various parts of the State.

Since the most important placer fields of Arizona were brought to light prior to 1875, and each of them was feverishly gophered as soon as possible, the most active and prosperous period for placer mining in the State was from 1858 to about 1880. Before 1885, most of the richer gravels had been harvested, largely by crude, although expedient, methods of dry-washing and, in some areas, by sluicing, rocking, and panning. In order to rework the gravels for the values not recovered by the early miners, various attempts at dredging, hydrauliciking, and large-scale dry concentration have been made, but so far these efforts have been unsuccessful. In general, the placer industry of

*Hamilton, Patrick, Resources of Arizona. 1883.
Arizona during the last 40 years has been unsteady, and has depended upon such factors as unemployment and seasonal rainfall, or promotional enterprises. Its particular decline during the past few years has been due to ever-increasing wages and costs of operation, as well as to the obvious fact that the richer, more easily-worked placers already have been harvested.

PRODUCTION

The total production of Arizona’s placers is difficult to estimate. Because the major production was during the early frontier days, when no records were kept, any estimate must be based largely on information secured from pioneers of the various districts. Such figures are necessarily inaccurate. They may be too low, because of the generally sporadic, often scattered operations of transient miners; they may be too high, because of the human tendency to exaggerate regarding gold; or, they may be lacking for districts where no pioneers remain who remember anything about early production. Furthermore, many of the early-day, migratory miners secretly carried their gold in belts or in packs with them when they left the country, and spent at the local towns only what was required for supplies and pleasure. In the table of the various placer counties and districts of Arizona, shown on pages 14 and 15, the U. S. Mineral Resources* yearly production records for 1900-1924 are given. This reported production, which from 1900-1924 was $825,367, has been falling off rapidly during the last few years, and for 1924 was the lowest of any year on record.

YUMA COUNTY

The important gold placer districts of Yuma County are La Paz, Plomosa, Dome Rock, Kofa (S. H.), Gila City, Castle Dome, and Laguna. These districts, which are situated in one of the most arid portions of the Southwest, have but little water outside of the Colorado and Gila rivers. The climate of the region is uncomfortable for placer mining during the summer, but very enjoyable in winter. According to the U. S. Weather Bureau, Quartzsite, which is situated near the Plomosa, La Paz, and Dome Rock placers at an elevation of 800 feet above sea level, has a mean annual rainfall of 6.53 inches, a mean annual temperature of 69.6°, a maximum temperature of 119°, and a minimum of 9° above zero on record. Likewise, Yuma, which is about 20 miles from the Laguna and Gila City placers at an elevation of 141 feet, has a mean annual rainfall of 3.13 inches, a mean

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*Published annually by the U. S. Geological Survey up to and including the year 1923, and by the U. S. Bureau of Mines since 1923.
annual temperature of 71.7°, a maximum temperature of 118°, and a minimum of 22° above zero.

According to Heikes,* Yuma County placer production from 1860 to 1880 is estimated at from $20,000,000 to $42,000,000 in gold, but these figures are probably excessive. The 1900-1924 yield was about $133,000.

LA PAZ PLACERS

The La Paz placers are situated in the Colorado River Indian Reservation of west-central Yuma County, along the west slope of the Dome Rock Mountains, about 9 miles west of Quartzsite, 9 miles northeast of Ehrenberg Ferry, and 6 miles west of the Colorado River. The district is accessible by desert roads from Ehrenberg Ferry and Quartzsite.

The Dome Rock Mountains, which rise precipitously to heights of as much as 2,200 feet above the adjacent plains, attain at Ferrar Peak an elevation of 2,900 feet above sea level. From their western foot, bench lands, composed largely of sand and clay overlain in part by gravel and coarse outwash, slope gently westward nearly to the river, where usually there is an abrupt descent of about 100 feet to the bottom lands. No perennial streams flow through the placer district, but several branching arroyos drain the run-off of the rainy seasons to the Colorado River. A very scanty water supply is obtained from Gonzales Wells, or from uncertain natural tanks, such as Goodman Tank, in the bedrock of arroyos.

History—According to former State Historian Hall,† the presence of placer gold near the Colorado River was learned from the Indians soon after the establishment of the military post at Yuma. These Indians gave a few small nuggets and eagle quills of the gold to a trapper, Capt. Pauline Weaver, and in about 1862, according to Browne,‡ guided Weaver and his party to the rich gravels. It is said that the party picked up about $8,000 in nuggets, returned to Yuma for supplies, and spread news of the discovery. Several hundred miners soon rushed to the district, found the placers to be very rich, and established the adobe town of La Paz about 2¼ miles from the river. This town, which soon attained a cosmopolitan population of over 1,500, became a station on the Overland Trail from San Bernardino to Ft. Whipple, and was the county seat until 1871.§ The district flourished

†Hall, Sharlot M., Personal communication.
‡Browne, J. Ross, Resources of the States and Territories West of the Rocky Mountains, 1868.
ARIZONA GOLD PLACERS

until about 1864, when apparent exhaustion of the higher-grade placers and discoveries of new diggings caused a decline in activity. In 1873, 1874, and 1876, additions to the Colorado River Indian Reservation included much of the placer ground and greatly restricted mining. La Paz became practically deserted, and the site of this once flourishing town is now marked only by adobe ruins.

Production—Information on the earlier production of the La Paz placers is given by Browne,* who quotes a letter from Mr. A. McKay, a member of the Territorial legislature from La Paz, as follows:

"Of the yield of these placers, anything like an approximation to the average daily amount of what was taken out per man would only be guess work. Hundreds of dollars per day to the man was common, and now and again a thousand or more a day. Don Juan Ferra took one nugget from his claim that weighed forty-seven ounces and six dollars. Another party found a chispa weighing twenty-seven ounces. Many others found pieces of from one to two ounces up to twenty, and yet it is contended that the greater proportion of the larger nuggets were never shown . . . . It is the opinion of those most conversant with the first working of these placers that much the greater proportion of the gold taken out was in nuggets weighing from one dollar up to the size mentioned above . . . . As has been said above, the gold was large and generally clear of foreign substances . . . . All that was sold or taken here went for $16 to $17 per ounce. Since the year 1864 until the present, there have been at various times many men at work in these placers, numbering in the winter months hundreds, but in the summer months not exceeding seventy-five or one hundred; all seem to do sufficiently well not to be willing to work for the wages of the country, which are and have been for some time from $30 to $65 per month and found. No inconsiderable amount comes in from these placers now weekly, and only a few days ago I saw, myself, a nugget which weighed $40, clear and pure from foreign substance . . . .

"Of the total amount of gold taken from these mines, I am . . . . at a loss to say what it has been . . . . I have failed to find any pioneer whose opinion is that less than $1,000,000 were taken from these diggings within the first year, and in all probability as much was taken out in the following years."

According to Hall,† local gold nuggets and dust were the principal currency, particularly for gambling, in La Paz; but a large portion

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*Browne, J. Ross, op. cit. 1868.
†Personal communication.
of the gold obtained by the Mexican placer miners went to Mexico.

According to Heikes,* the largest nugget found in this region was valued at $1,150 and assayed about 870 in fineness. Most of the gold particles or nuggets ranged in value from 5 cents to $10, although $20 and $40 pieces were not uncommon. On account of the crude methods of recovering the gold entirely by dry washing in pans or wooden “bateas,” it is apparent that only the coarser gold could be saved, and only extremely rich ground would be payable. Wet methods were out of the question, for, according to Jones,† Water

VALUE OF GOLD AND COMBINED SILVER PRODUCTION OF ARIZONA GOLD PLACERS

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<td>1900-1924</td>
<td>$2,701</td>
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packed from the town of La Paz to the placers brought $5 a gallon during the rush period. With the introduction of dry-washer machines in the late sixties, greater quantities of material could be handled and a greater percentage recovery effected, but by that time most of the richer ground had been worked over. Many old-time miners of the district assert that production between 1862 and 1869 amounted to $7,000,000. Later production, however, has been comparatively small.

Geology—The geology of the region, as interpreted by Jones, is indicated on the accompanying map (Fig. 2). He considers that the bench-land deposits were formed by the Colorado River, but that the placer gravels were derived largely by erosion of the gold-bearing quartz
Fig. 2. Geologic reconnaissance map of the La Paz, Dome Rock, and Plomosa placer regions, after E. L. Jones, Jr., and N. H. Darton.
veins and stringers contained in the pre-Cambrian schists of the Dome Rock Mountains.

The placers occur mainly in Goodman Arroyo and Arroyo La Paz, and in certain tributary gulches such as Ferrar, Garcia, and Ravenna. According to Jones,* "Ferrar Gulch, tributary to Arroyo La Paz, contained the richest and most productive placers of the district. Evidences of former work are seen in the old excavations and . . . . in exposures of bedrock where the wash was shallow. . . . The thickness of the gold-bearing wash is variable, ranging from a few feet on the mountain slopes to an unknown measure in Arroyo La Paz and in the gulch traversed by the Quartzsite-Ehrenberg road. Shafts have been sunk in the wash to depths of 30 feet without reaching bedrock and it is reported that in places the wash is at least 60 feet deep. By far the greater part of the auriferous material is unworked, especially that in the lower courses of the arroyos, where the wash is deep. Ferrar Gulch for most of its course has been practically worked out.

"The gold-bearing material consists of sand and clay inclosing angular rock fragments of greatly variable size. Tests indicate that about 20 percent of the wash will pass through a quarter-inch screen, and the largest boulders weigh several hundred pounds. The material near the surface is unassorted and is unconsolidated, being readily worked with pick and shovel. That at depths of 15 or 20 feet is consolidated, but the cementing substances readily disintegrate on exposure to air. Deposits of wash below the depths of test pits may prove to be similar to the outwash on the east slope of the Dome Rock Mountains and in the Plomosa placers, where the material is firmly cemented with calcium carbonate and requires crushing in order to free the gold. In Goodman Wash below the Goodman tank a deposit of calcareous tufa several feet thick was noted. The ground stands sufficiently well to permit the sinking of shafts without the use of timber. The wash is readily worked in dry-washer machines, the only requirement being that the ground must be dry. The gold is said to be distributed throughout the wash, though in the early workings the richest yield was obtained near bedrock. The size of the gold now recovered from the deposits of the La Paz district probably averages only a few cents, but, as already stated, the gold recovered from the early workings was much coarser. The gold is rough and angular, and particles of iron cling to some of the nuggets. Magnetite is always found in the con-

*Jones, E. L., Jr., op. cit., p. 51.
centrates, and boulders of magnetite, the largest weighing several pounds, are frequently found on the surface.

"No estimate could be made of the probable gold content of the wash in the La Paz district because of lack of detailed data and of uncertainty as to the limits of the wash, but in one area the deposit, said to contain values of 50 to 75 cents per yard and much of it 30 feet or more deep, occupies at least 640 acres, and considerable areas extend into the smaller gulches."

Present Operations—Occasional dry-washing and some assessment work are still carried on within the La Paz district. Many plans for dry concentration have been tried, but so far they have not met with desired success. Hydraulic treatment of the gravels was planned several years ago by the New La Paz Gold Mining Co., which is said to plan to begin operations in 1927. This company secured a large portion of the placer ground of the district after it had been excluded from the Colorado River Indian Reservation in 1910, but in 1912 the land was included again in the reservation, where it remained until late 1915. Since 1915, the company is said to have been engaged in litigation and preliminary development. Their plan is to pump water from the Colorado River, or from wells near the river, for about 4½ miles to a reservoir 540 feet above the river, or 225 feet above the placers. According to the engineers who sampled the property for the company, there are available 1,300,000 cubic yards of relatively un-bouldery, uncemented, clay-free gravel that averages $2.80 per cubic yard.

PLOMOSA PLACERS

The Plomosa placers are situated, as shown in Fig. 2, about 5 miles southeast of Quartzsite and 14 miles east of the La Paz placers, near the western foot of the Plomosa Mountains, and at the eastern edge of La Posa Plain. This district produced considerable gold soon after its discovery in the early sixties, but no estimate of the amount is available. Its 1900-1924 yield, together with that of the Dome Rock placers, is given by the U. S. Mineral Resources as $39,757. Unsuccessful attempts have been made to work the Plomosa placers on a large scale both by dry concentration and by hydraulicking, but, so far as is known, all the production made has been by small, individual dry-washers.

Geology—The general geology of the Plomosa placer district is indicated in Fig. 2. The Plomosa Mountains, which east of the district are about 2,000 feet above sea level, or 1,000 feet above the plain,
consist largely of pre-Cambrian schist, granite, and later volcanic rocks. These schists, which contain gold-bearing quartz veins and stringers, probably were the original source of the Plomosa placers.

According to Bancroft,* the placer gravels, which occur in certain old drainage channels leading away from the southwestern part of the mountains, are made up of fragments of schist, granite, and quartz, cemented by lime carbonate. This conglomerate or "cement rock" varies in thickness from a few inches up to many feet, depending largely on the shape and size of the former channels, and rests upon grayish-green, schistose bedrock.

Regarding the placers, Heikes† quotes extracts from a professional report by John A. Church as follows:

"In some localities pits have been sunk to a depth of 20, 30 and 50 feet or more to beds of cement which are richer than the gravel. Near the mountain the gold is coarser, but the gravel is much less. Miles of the great deposit, extending westward from the mountains and from 3 to 4 miles in width, have been cut into by floods from the mountains, forming deep ravines, and they afford miles of banks 10 to 15 feet high in which the upper layer of gravel is well exposed. From these banks, as far as investigations could be made, samples gave an average return value of 64 cents per cubic yard with gold estimated at $18 per ounce. . . . There were no failures. The results lay between the extremes of 42 cents and $1.04 per cubic yard. To get the limit of the deposit it would be necessary to pursue the tests to points where gold failed. . . . The limit of the gravel actually explored was 2,400 by 1,500 feet and 8 yards deep. . . . Within this area bedrock was not reached at any time. . . ."

DOME ROCK PLACERS

Quartzsite vicinity is an extensive dry-placer field. Heikes‡ states:

"Surrounding the postoffice of Quartzsite . . . and extending in every direction, covering an area of about 7,500 acres, is found dry-placer ground with values to an average depth of 15 feet and varying from 5 to 50 feet. The coarse gold content is reported to average from 10 cents to several dollars."

On the east side of the Dome Rock Mountains, from 2 to 7 miles west of Quartzsite, several placer tracts occur among certain large and small branches of Tyson Wash. The three most important tracts,

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† Heikes, V. C., op. cit., pp. 257-258.
‡ Heikes, V. C., op. cit., p. 258.
namely, Middle Camp, Oro Fino, and La Cholla, as roughly outlined by Jones, are shown on Fig. 2. Like the Plomosa placers, these gravels have been worked intermittently by individual dry-washers since the early sixties, but none of the several attempts that have been made to work the ground on a large scale have proved successful.

Regarding these placer tracts, Heikes quotes Church as follows:

"Middle Camp, the most northerly of the three, has granite gravel; Oro Fino, in the center, has much porphyritic slate; and La Cholla, at the south, is mostly composed of quartzite and schist pebbles . . . . At La Cholla . . . . which is nearer the mountains, there is a siliceous cement, very rich, but also so very hard that it requires to be broken by powder before going to the dry-washer. At Oro Fino the shale bedrock is very near the surface. In Middle Camp there is cement, but of a much softer kind. . . . (Here most of the sampling was performed) . . . . The camp (?) occupies the east and west valley crossing the mountain range, a mile wide and 4 or 5 miles long. . . . This is the chosen locality for the individual dry-washer, who takes his machine to some point where the bedrock can be reached quickly. It is here that the rich seams of gravel on the bedrock yield from four to ten times the value of the thicker gravels, and in crevices there have been found nuggets worth $10 to $25. La Cholla, south of Middle Camp, lies along the foot of the mountains, like Plomosa, and is 3 or 4 miles in length. . . . The depth of the gravel is irregular in passing from Middle Camp through Oro Fino to La Cholla. . . . The value of these placers was known to the miners who, in that early day, passed over all the region adjoining the Colorado, but the almost total absence of water in the mountains compelled the miners to pack their rich dirt to the river or to distant tanks to be washed. Oro Fino was the most celebrated camp of that day. There, when the art of dry-washing was learned, the rich bedrock was the scene of active work."

According to Jones,* 640 acres of the Oro Fino tract was sampled by the Catalina Gold Mining Co. with test-holes, up to 30 feet deep, sunk every few hundred feet. From these samples it was found that the gold content ranges from a few cents to over $1 per cubic yard and averages 38 cents per yard. The colors run from less than 1 cent to 24 cents each, and the gold is of about $19 per ounce fineness. Here the gold-bearing material consists of unconsolidated rock debris up to 12 feet thick, and an underlying cemented gravel 18 more feet thick.

*Jones, E. L., Jr., op. cit., pp. 52-53.
KOFA, OR S. H., PLACERS

A small area of gold placers situated in the Kofa, or S. H., Mountains of central Yuma County, about 56 miles northeast of Yuma, has been described by Jones.* A geologic sketch map of the vicinity is shown in Fig. 3. Of these placers, Jones says:

"The known placer deposits of the Kofa Mountains occur in a gulch draining westward north of the detached hills in which the King of Arizona Mine is located. These placers have been worked for many years, and the production is reported to be about $40,000 in gold nuggets. At present (1914) the placers are being worked in a small way. and a yearly production of several hundred dollars is reported. The gold occurs in outwash deposits which consist of boulders and fragments from the metamorphic and volcanic rocks. The gold-bearing debris is said to be from a few feet to 70 feet deep over an area of approximately 60 acres. The gold is coarse and occurs near bedrock. It has evidently been derived from the disintegration of auriferous veins in the metamorphic rocks, as it is much coarser than that contained in the North Star and King of Arizona veins."

GILA CITY PLACERS

The Gila City placers are situated in southern Yuma County, about 20 miles east of Yuma, in the vicinity of Dome station.

According to Hamilton,† these placers were discovered in 1858 by

†Hamilton, Patrick, Resources of Arizona. 1883.
Col. Jacob Sniveley, and Hall* states that they were known to certain trappers in the middle forties. During the few years following, this area was worked very actively. Farish† says that Lt. Mowry, who visited there in 1859, found about 100 men and several families working the gravels at Gila City, near the present site of Dome. He saw more than $20 washed from 8 shovelsful of dirt, and was told that from $30 to $125 per day was recovered by each worker. Hall* states that the early-day miners here were largely Mexicans, who took most of their gold to Mexico. Consequently, no estimates of the production of these placers can be made.

According to Carl Lausen,‡ the Gila City placers are said to average 35 cents per cubic yard, and the distance to bedrock, where the best values are, is 8 to 20 feet. The gold-bearing gravels, which extend for 1 to 2 miles between the northern termination of the Gila Mountains and the Gila River, were probably derived by erosion of gold-bearing quartz veins contained in the schists and granites of the Gila Mountains.

Occasional mining of the gravels is still done by individuals, and it is said that the average daily returns are at least miner's wages. One nugget worth $88, brought to the Arizona Bureau of Mines in 1926, is said to have come from these placers.

In December, 1926, it was reported that dredging operations were being contemplated for the McPhaul & Palm holdings, 3 miles west of Dome.

CASTLE DOME PLACERS

The Castle Dome placers are situated about 3 or 4 miles south and west of Castle Dome, or about 32 miles northeast of Yuma, at an elevation of 1,100 to 1,200 feet above sea level. Finely-divided gold is said to occur in the gravels of the arroyos and intervening mesas. This gold probably occurred originally in a finely-divided condition within quartz veins of the Castle Dome Mountains. Nothing is known of the early production of these placers, but their yield from 1909 to 1918 is reported at $7,086.

LAGUNA PLACERS

The Laguna placers are situated in southwestern Yuma County, along the Colorado River, in the vicinity of Laguna Dam, about 10

*Personal communication.
‡Oral communication.
miles northeast of Yuma. According to Mr. A. P. Irvine,* of Wickenburg, a large amount of coarse gold was found in potholes in the gneissic rock about 100 feet above the river. This coarseness points to a rather local origin instead of to a long transportation by the Colorado River. The U. S. Mineral Resources report from the Laguna placers a production of $1,457 in 1910 and $1,989 in 1912.

YAVAPAI COUNTY

The principal gold placers of Yavapai County are in the Lynx Creek, Weaver, Rich Hill, Hassayampa, Big Bug, Groom Creek, Minnehaha, Granite Creek, Placeritas, Black Canyon, Eureka, and Humbug regions.

LYNX CREEK PLACERS

The Lynx Creek placers are situated in central Yavapai County, along Lynx Creek from near Walker, 7 miles southeast of Prescott, to its junction with Agua Fria Creek, 13 miles east of Prescott.

Lynx Creek, which flows north between foothill ridges of the Bradshaw Mountains, and northeast and east through the conglomerate terraces of Lonesome Valley, has an approximate length of 18 miles. Since it extends between elevations of about 7,000 and 4,600 feet above sea level, and drains a large, high region, it receives a considerable amount of water each season, and is perennial in its upper, pine-wooded course. At Prescott, which is about 5 miles west of the creek at an elevation of 5,320 feet above sea level, the 1926 fall of rain and snow water was 18.16 inches, the highest temperature was 101°, and the lowest 2° below zero.

History and production—According to former State Historian Hall,† the Lynx Creek placers were discovered in 1863 by a party of California miners headed by Capt. Joe Walker. As the news of their discovery filtered back to California, the number of placer miners on Lynx Creek increased to 200 or more. Active work, with hand rockers, pans, and small sluices, continued along the stream for several years before the exhaustion of the richest gravels.

Like most of the placers of the Southwest, unfortunately, no records of the early-day yield are available, but Lynx Creek is noted as one of the most productive gold-bearing streams in Arizona. Raymond‡ reported its 1874 production at $10,000, and Hamilton§ estimated the

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*Oral communication.
†Personal communication.
‡Raymond, R. W., Statistics of Mines and Mining in the States and Territories West of the Rocky Mountains for 1874.
total prior to 1881 at $1,000,000. According to Mr. A. C. Gilmore,* of Prescott, about 100 men were working the Lynx Creek placers prior to 1885, and some of them recovered about $20 per day. Mr. W. R. Shanafelt,* of Prescott, states that one man recovered $3,600 in 11 days from the lower reaches of the creek. Inasmuch as many of the early miners carried a large portion of their gains out of the country, Hall† asserts that the Lynx Creek placers have produced at least $3,000,000. As shown in the table on pages 14 and 15, the production from 1914 to 1924, inclusive, was $20,438.

Much money has been spent in efforts to work these placers on a large scale. In the late eighties, an Englishman, B. T. Barlow-Massick, built a small dam above the present highway bridge, installed about 2½ or 3 miles of 30-inch pipe line, and did some hydraulicking, but a flood destroyed the dam. About 1900, the Speck Company tried out an old dredge a short distance below the bridge, but the roughness of the bedrock there prevented its success. Later, Mr. G. S. Fitzmaurice operated this dredge farther down the creek, but, after recovering about $800 worth of gold, the dredge fell apart. A large, expensive, patented, gold-saving machine was tried out nearby at about this time, but also without success.

Geology—The geology of the Lynx Creek placer region is indicated on the accompanying map (Fig. 4). The oldest rocks are coarse to mediumly-fissile schists of sedimentary and igneous origin, extensively intruded by slightly schistose dikes of granite, pegmatite, and diorite. These schists strike roughly N.-S., and dip steeply. Larger masses of dark, hornblende diorite and light-colored, medium-grained granite intrude these schists. In the northern portion of this area, these pre-Cambrian rocks are overlain by a conglomerate of medium-grained, fairly well-rounded gravels, stiffly cemented in a matrix of sand and volcanic ash. This conglomerate, which constitutes the bedrock of the placers of lower Lynx Creek, appears to be overlain by the late Tertiary basalts in Bald Hill. The youngest formation in the region is the series of gravels, sand, and boulders that occupy the bed of Lynx Creek. This material, which contains the placer gold, is generally well-rounded except in the upper reaches of the stream.

From near Walker to a point about 8 miles in air line downstream, or to the Lynx Creek Mining Co. dam, 2 miles below the bridge, the placers occur as thin benches or bars whose few yards of width can not be shown on a map the scale of Fig. 4. Downstream from that

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*Oral communication.
†Personal communication.
point, in the bottom of the steep-walled gulch formed in the conglomerate fill of Lonesome Valley (see Fig. 5), the placers attain a maximum width of over one-eighth mile and a thickness of 8 to 24 feet. It is said that, although some gold is present throughout this 8 to 24 feet of thickness, the richest material is at the conglomerate bedrock
and in a 4-foot streak about 2 feet higher. Lindgren* states that the average value is reported at 18 cents per cubic yard.

According to Lindgren,† “At Walker the placers yielded nuggets worth as much as $80, at about $16 an ounce. Lower Lynx Creek produced a finer-grained gold of higher value, worth about $18 an ounce. Such an enrichment in the value of the gold is common and indicates a solution of the silver by the waters.” The gold of lower Lynx Creek ranges from finely-divided material up to $4- or $5-nuggets, and is associated with considerable hematitic and magnetitic black sand.

The placer gold of Lynx Creek was doubtless derived from disintegration of the numerous gold-bearing quartz veins contained in the pre-Cambrian rocks of the Walker region.

Present operations—A few individuals still do a little placer mining on upper Lynx Creek, and, downstream, the Lynx Creek Mining Company is starting large-scale operations. This company has leased a length of about 7½ miles of the lower Lynx Creek ground, and built a strong concrete dam, about 55 feet high, across the creek at a point 2 miles below the highway bridge (see Fig. 6). An Insley excavator and a Barber Green stacker, with a capacity of 1/3 cubic yard every 20 seconds, have been installed. The oversize gravel from the shovels is to be screened out, conveyed away on a belt, and stacked. The undersize is to pass into sluice boxes, and the fines concentrated therein are to be amalgamated. According to Mr. T. Van Dervoort, manager of the property, a market has been promised for the black sand that will be recovered as a by-product.

WEAVER AND RICH HILL PLACERS

The Weaver and Rich Hill placers are situated in southern Yavapai County, from Stanton to Weaver Creek, a short distance northwest of Octave and from 6 to 8 miles in air line east of Congress Junction.

This placer area is at the southern margin of the Weaver Mountains, which rise to over 5,000 feet above sea level, or to more than 2,000 feet above the adjacent desert plain to the south. Rich Hill stands at an elevation of 5,200 feet above sea level between the deeply-eroded canyons of Antelope Creek on the west and Weaver Creek on the east. Since the higher portions of the Weaver Mountains receive at least 18 inches of rainfall per year, these two south-flowing creeks

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Fig. 5. View northeast across lower Lynx Creek placers and Lonesome Valley. Photo by W. R. Shananfelt.

Fig. 6. Dam and reservoir of Lynx Creek Mining Co. Photo by W. R. Shananfelt.
Fig. 7. Ruins of old Weaver.

Fig. 8. Typical gravels of Weaver Creek placers.
generally have some water in their upper courses, and are subject to torrential floods during the rainy seasons.

*History and production*—In the early sixties, certain Indians who came to La Paz, near the Colorado River, to trade, reported the occurrence of much gold many miles farther east. One of them was persuaded to guide a party, consisting of Capt. Pauline Weaver, Maj. A. H. Peeples, and others, to the locality. This party happened to camp at the base of Rich Hill, after their guide had deserted them on the desert north of Wickenburg. A Mexican of the party, while looking for their strayed animals, discovered loose gold nuggets on top of Rich Hill. This discovery led also to the finding of the placers on Weaver and Antelope creeks.

This whole area became the scene of intense activity, and in 5 years, according to Hall,* produced about $500,000. The loose gold underneath the boulders and in the crevices of the rocks on Rich Hill was easily gathered, but more effort was required to work the bouldery gravels of Weaver and Antelope creeks by panning, rocking, and sluicing. As much as $40,000 is said to have been taken from a certain acre, and the production of the whole area, prior to 1883, was estimated by Hamilton† at $1,000,000. The town of Weaver, on Weaver Creek, flourished until about 1896. Blake,‡ in 1899, stated that the score or so of men who were working these placers from year to year were supposed to be recovering over $2,000 per month. Production from 1905 to 1924, inclusive, amounted to about $75,500, and the purchase of about $1,000 worth of gold at Octave alone, during the first half of 1927, is reported by Mr. F. W. Lyman, storekeeper. The old town of Weaver, however, has long been deserted, and is marked by crumbling ruins, as shown in Fig. 7.

*Geology*—The Weaver Mountains, which are made up mainly of pre-Cambrian granites and schists, overlain by Tertiary lavas, contain numerous gold-bearing quartz veins that were the source of these placers.

Broadly speaking, the placer ground covers an area of approximately 8 by 5 miles. It is said that the most productive portions, which were in the northern half of this area, included about 10 acres on the north-eastward-sloping top of Rich Hill; certain portions of the sides of the hill; the channels and benches of Weaver, Antelope, and other

*Personal communication.
†Hamilton, Patrick, Resources of Arizona, 1883.
washes; and the gravel mesas that lie between these washes. On the top of Rich Hill the gold occurs on bedrock that in places is covered with boulders and a thin layer of residual clay. Along the washes below, and in the mesas, however, the placer material consists of iron-stained gravel and sand, up to 10 or more feet thick, together with abundant, subangular boulders that are 2 to 6 feet in diameter (see Fig. 8). On Rich Hill, according to Blake,* one nugget worth $450, and three worth a total of $1,008, were found. Mr. C. B. Hosford,† of Octave, stated that the largest nugget found on upper Weaver Creek was worth $396, and that two chunks of quartz contained $450 worth of gold. Occasional nuggets worth from $1.50 to $7 are still being found above old Weaver. Away from the margin of the mountains, however, the particles of gold are much smaller. According to Heikes,‡ the fineness of the Rich Hill and Weaver placer gold is 910.

**Present operations—**A few individuals are still panning, rocking, or sluicing in Weaver, Antelope, and Rich gulches, and it is said that each man recovers from $5 to $25 worth of gold per week. Along Weaver Creek above old Weaver, 160 acres, owned by Mr. C. B. Hosford, have been leased to Mr. P. M. Caffee, but only development work is being done. Because of the large boulders in the placer gravels, no large-scale operations have been attempted. Considerable churn-drilling was done in 1926 about 1 mile south of Stanton, but the results of this testing have not been ascertained. Some individual dry-washers are working in the vicinity of Oro Fino Gulch in the southern half of the area, but, due to the fact that much of the gold there is rather finely divided, they seldom earn more than 75 cents per day each.

**HASSAYAMPA PLACERS**

Placer gold occurs along practically the whole course of the Hassayampa in Yavapai County. Hassayampa Creek rises in the Bradshaw Mountains at an elevation of approximately 7,000 feet above sea level, about 8 miles south of Prescott, and crosses the Yavapai-Maricopa County line 2 miles north of Wickenburg at an elevation of about 2,000 feet. Due to its large drainage area, this creek carries torrential floods in the rainy season, and abundant subsurface water during the dry months.

**History and production—**According to Mr. T. J. Laird, of Groom

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*Blake, W. P., op. cit.
†Oral communication.
Creek, the placers of Hassayampa Creek in Yavapai County were first worked by the early Spanish explorers, then, after the sixties, by Americans, and finally by Chinamen, who reworked some of the ground prior to 1899. The period of greatest activity in these placers is said to have been from 1885 to 1890, and very little mining has been done in them since 1899. Large-scale operations were at one time about to be tried below Walnut Grove reservoir; but the washing out of the earth- and rock-fill Walnut Grove dam in 1890 stopped this project. It is supposed that most of the gold that could be recovered by ordinary, small-scale methods has been harvested; but, according to Mr. W. N. Agnew, of Groom Creek, a few experienced placer miners who reworked a portion of the ground about 1912 recovered over $1 per day each. No records of the total production are available, but all the local estimates are over $1,000,000.

Geology—The principal rocks of the lower Hassayampa region of Yavapai County are pre-Cambrian granite and Tertiary lavas. In the upper, or Bradshaw Mountain region, are pre-Cambrian schists and granite, intruded by smaller masses of diorite, granodiorite, and rhyolite porphyry. Pre-Cambrian and Tertiary quartz veins within the schists and granites provided the gold that erosion has concentrated in the placer deposits. The gold along the upper reaches of the creek was generally coarse, but downstream it was progressively finer.

Present operation—In December, 1926, it was reported that a dredge was being built by the Walnut Grove Mining Company to operate on placers along the Hassayampa, about 30 miles south of Prescott.

BIG BUG PLACERS

The Big Bug placer region is situated in south-central Yavapai County, in the general vicinity of Big Bug Creek, Mayer, Poland, McCabe, and Humboldt. This region lies on the northeast slopes of the Bradshaw Mountains, and extends from Big Bug Mesa, 7,100 feet above sea level, down to Agua Fria Creek, 3,600 feet lower. Big Bug Creek, which empties into Agua Fria Creek, is perennial in approximately the upper half of its course.

History and production—Gold was discovered within the Big Bug region in the late sixties, but the greatest activity in placer mining there was during the eighties. Considerable rocking and panning have gone on, especially in upper Big Bug Creek as far down as Mayer, and in Chaparral and other gulches near McCabe. Dry-washing has been done to some extent in the drier portions of the region, and a large-scale hydraulic project was once contemplated for the mesa land be-
tween Mayer and Humboldt. No estimates of the early production are available, but the 1910 to 1921 reported yield, as shown in the table on pages 14 and 15, was $20,088.

Geology—The principal rocks of the Big Bug region are pre-Cambrian schists, smaller amounts of granite and granodiorite, abundant rhyolite dikes, and Tertiary basalt flows.

These placers occur in the stream channels and on certain of the intervening mesas of a roughly-triangular area that extends for about 20 miles east and northeast from the head of Big Bug Creek. The gold of the stream placers is generally coarse. One of the largest nuggets found in the Big Bug region contained about $500 worth of gold, and is illustrated in Fig. 10. In the gravel mesa between Humboldt and Mayer, the gold, which is rather finely divided and associated with considerable clay, amounts to about 30 to 40 cents per cubic yard.*

Certain quartz veins within the older rocks of the vicinity provided the gold for the stream placers, but the finely-divided gold of the gravel mesas between Mayer and Humboldt probably has undergone longer transportation.

GROOM CREEK PLACERS

The Groom Creek placers are situated in south-central Yavapai County, along Groom Creek, from 4 to 6 miles south of Prescott. This creek heads in the Bradshaw Mountains west of Walker, at an elevation of about 7,300 feet above sea level, and joins Hassayampa Creek at a point some 5 miles in air line farther southwest and some 1,900 feet lower.

These placers were discovered in the sixties, and were worked actively during the eighties. Their total production, according to former State Historian Hall,† probably has amounted to about $100,000.

Quartz veins contained within the local pre-Cambrian schist, which has been intruded by diorite, granodiorite, granite, and dikes of rhyolite porphyry, were the original source of the gold of these placers.

MINNEHAHA PLACERS

Placer gold occurs along Minnehaha Creek, about 25 miles in air line south of Prescott, below elevations of 5,500 feet above sea level. Lindgren‡ says: "Minnehaha Flat is a northward-trending, well timbered and watered basin on the headwaters of Minnehaha Creek, which discharges into Hassayampa River near Walnut Grove... Placer min-

*Oral communication from Mr. Homer R. Wood, of Prescott.
†Oral communication.
ing was carried on here in the eighties of the last century all the way up from the ‘Old Log House’ to the Button Mine, also in branches coming in from the east. The gold was worth about $17 an ounce and was extracted by arrastres, sluices, and dry-washers. The probable production was $100,000, according to Mr. M. A. McKay, an old-time resident of the district. The gold is believed to have been derived from the Fortuna lode near Lapham’s place.”

GRANITE CREEK PLACERS

Placer gold occurs along the upper branches and main course of Granite Creek, which rises a few miles south of, and flows northward through, Prescott. These placers were discovered in the sixties, and were worked south of Prescott to a considerable extent during the eighties. It is said that New England Gulch, a branch of Granite Creek about 4 miles south of the city, was very rich, and that one old-time placer miner recovered about $20,000 worth of gold from there prior to 1922. According to Mr. Homer R. Wood, of Prescott, some small nuggets have been found in digging excavations for buildings in that city. Lindgren* states that a little placer gold has been mined also at Del Rio, about 22 miles north of Prescott.

PLACERITAS PLACERS

Placeritas placers are situated in southwestern Yavapai County, about 11 miles in air line south-southeast of Kirkland, at elevations of less than 5,000 feet above sea level, in the vicinity of Placerita, French, and Arrastre creeks. In 1899, Blake† stated that “The placers . . . . at Placeritas have long been known and worked, and are regarded as good-wages mines.” According to A. B. Colwell,‡ a dredging project was attempted a few years ago on a rather small area of ground in French Gulch, about 1 mile below Zonia, but the dams failed. Mr. W. R. Shananfelt, of Prescott, states that some $10 nuggets have been found in this gulch, but a large number of coarse, flat boulders occur throughout the gravel.

BLACK CANYON PLACERS

Placer gold occurs along Black Canyon, which drains the water of Turkey, Poland, and Bumblebee creeks southward into the Agua Fria River. According to Lindgren,§ “Placers have been worked at several

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‡Oral communication.
places in Black Canyon, particularly below the Howard Copper Company's property. A few years ago a Portuguese is said to have taken out $20,000 near the old stone cabin 1 mile below Howard. There are also small placer deposits near Turkey Creek station, and every year more or less dry washing is done by Mexicans in this locality.”

EUREKA PLACERS

Gold placers occur in Burro Creek and other gulches of the Eureka district of western Yavapai County, about 18 miles in air line northwest of Hillside. According to Mr. Homer R. Wood, of Prescott, more than 100 men were dry placer mining at the old Placeras, near the Cowboy Mine, during the late fifties. The U. S. Mineral Resources record a placer production of $363 from the Eureka district in 1914, and a little in 1922.

HUMBUG PLACERS

Regarding gold placers in the Humbug district of southern Yavapai County, Lindgren* says: “The Humbug district, adjoining the Tiptop on the west, contains many gold-bearing veins, but most of its production evidently came from placers, now exhausted, in Swilling, Carpenter, and Rockwall gulches, which are small tributaries of Humbug Creek.” According to Allen,† an attempt to work the placers of Humbug Creek was made in the early nineties by an English company that spent considerable money in building a camp, dams, and pipe lines for hydraulicking; but the attempt failed through lack of water and through inability to save the gold known to be present.

OTHER YAVAPAI PLACERS

Jaggar and Palache‡ state that “some of the gravelly beds in the western belt of volcanic agglomerate are auriferous, and . . . . on Slate and Milk creeks, some hydraulic washing is being done on deposits belonging to this formation.” They also state that a little placer mining was being done in 1901 along Oak and Cherry creeks, about 25 miles in air line south of Prescott.

Some placer gold occurs along Castle Creek, in southern Yavapai County, particularly in ravines near Copperopolis, and a little mining of it was done prior to 1890.

PIMA COUNTY

The principal gold placer districts of Pima County are Greaterville, Quijotoa, and Las Guijas. Other placers are known in various portions of the county, but, except in the Old Baldy and Papago districts, they have not been of any economic importance.

GREATERVILLE PLACERS

Greaterville district is situated in southeastern Pima County, at the eastern foot of the Santa Rita Mountains. The small village of Greaterville, which is in the approximate center of the placer area at an elevation of 5,280 feet above sea level, is about 34 miles in air line southeast of Tucson and 8½ miles northwest of Sonoita, a station on the Nogales-Benson Branch of the Southern Pacific railroad. The district is accessible by several short roads that branch west from the Tucson-Patagonia highway.

The Santa Rita Mountains, which attain in Old Baldy Peak, 7½ miles southwest of the camp, an elevation of 9,432 feet above sea level, receive abundant rainfall and are well timbered. Although this rainfall varies somewhat from year to year, the average annual amount for elevations of 4,000 to 6,000 feet above sea level is over 14 inches, and for elevations over 6,000 feet is from 16 to more than 20 inches. About 75 percent of this precipitation occurs in July, August, September, and October, and a large part of the other 25 percent falls during the winter as snow. The rainy season run-off has dissected the eastward-sloping placer region with numerous steep-sided, nearly east-west arroyos that drain to Cienega Creek and are about 100 feet deep near Greaterville. However, the only perennial stream of the district is fed by springs and is situated about 4 miles south of the village. Sufficient water for domestic purposes, but not for much gravel-washing, is obtained from shallow wells in Empire, Ophir, Kentucky, and Big gulches.

History—According to Raymond,* placer gold was discovered in the Greaterville district in 1874 by A. Smith. From 1875 to 1878, the placers were worked by 200 or more men.† The virgin gravels are said to have been so rich that each man recovered $10 or more daily by rocker with water packed in for 4 miles on burros and retailed at about 3 cents per gallon. After 1880, due to the richer gravels having

†Hinton, R. J., Handbook of Arizona, p. 213. 1878.
been worked over, activity in the camp declined, and by 1886 had practically ceased.

According to Schrader and Hill,* sluicing was carried on in Kentucky Gulch for a few months during 1900. In 1902, considerable ground was owned and operated by the El Oro mining company. By 1905, the Santa Rita Water and Mining Company had begun operations on about 2,000 acres of patented ground. Their hydraulicking equipment, which was extensive, included 8 or 10 miles of ditch and pipe line from a system of dams in Gardner and South canyons in the mountains. Profitable operations were conducted by them for a short time, but the death of the manager, Mr. Stetson, and of the financial backer, Mr. McAneny, caused a suspension of the work.

Further hydraulic operations† were tried by another company, at the junction of Kentucky and Boston gulches, with a 125-foot head of water brought through an 8-mile pipe line from the first canyon south of Gardner Canyon. Considerable sluicing of the creek bed is reported to have shown, however, that the gravels in the overburden there were rather coarse, and that the returns were too low to warrant further work.

Another company installed‡ a 1-ton steam shovel, screens, and a conical concentrating tank in Empire Gulch just below Enzenberg Canyon, but the pay dirt was not rich enough to warrant the removal of the 16 or more feet of overburden.

Production—According to Raymond,‡ the yearly production of the Greaterville placers from 1874 to 1883 was estimated at $12,000. Burchard§ places the 1884 output at $18,000. The total up to 1909 was estimated by J. P. Coyne|| at $7,000,000. From 1902 to 1924, the production of the district reported by the U. S. Mineral Resources, as shown on pages 14 and 15, totaled $39,453. The L. E. Jones Company, of Greaterville, reports¶ purchasing $67 worth of placer gold from the district during the last half of 1925, $182 during 1926, and $32 up to May 20 in 1927.

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†Schrader, F. C., op. cit.
‡Raymond, R. W., Mines and Mining West of the Rocky Mountains, p. 342. 1876.
§Burchard, H. C., Production of the Precious Metals in the United States, p. 46. 1884.
¶¶Oral communication.
Geology—The accompanying map (Fig. 9), after Hill* and Schrader† shows the general geology and the distribution of placer gravels in Greaterville vicinity.

The oldest rocks in the area are Devonian and other Paleozoic limestones, which outcrop 1½ miles southwest of Greaterville in a prominent ridge about ½ mile wide. These strata dip steeply southwestward, are overlain on the southwest by Cretaceous red sandstones and shales, and are bounded on the northeast, with fault contact, by Mesozoic or later granite.

Next younger than the Devonian are the Cretaceous rocks already mentioned, and a north-south belt, from 1 to 2 miles wide, of thin-beded, gray to maroon, arkose, sandstone, conglomerate, dolomite, and shale that outcrops west, northwest, and southwest of Greaterville. Hill regarded the age of these rocks as Cambrian, but it is probably Cretaceous. This belt is bounded on the west and southwest by younger granite, and on the east by outwash debris and gravel. It is intruded also by the granite porphyry of Granite Mountain, and by dense, light-colored rhyolitic dikes. In the northern half of the area mapped in Fig. 9, the strata dip from 5°-10° eastward, but, in the vicinity of Granite Mountain, the dip is at steeper angles away from the intrusive. In the vicinity of the larger intrusives, there has been considerable local metamorphism that is marked by sericitization and silification. Near Granite Mountain, the beds are strongly impregnated with quartz and sericite, together with some calcite, pyrite, and chalcopyrite. Here also are the gold-bearing quartz veins that probably gave rise to the placers.

The granite west of the Cretaceous belt was regarded by Schrader‡ as older than those sediments, and by Hill§ as pre-Cambrian. It was found by the writer to be intrusive into the Cretaceous, and its age, therefore, is Mesozoic or younger. This granite is coarse-grained to porphyritic, weathers light-brown to greenish-gray, and is somewhat sheeted and jointed. Under the microscope it is shown to contain deeply-kaolinized orthoclase and albite, quartz, and chloritized biotite. This intrusion had no obvious connection with the origin of the gold of the district.

Mesozoic or younger granite porphyry also intrudes the Cretaceous sediments, and, 1½ miles west-southwest of Greaterville, forms knob-

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‡Schrader, F. C., op. cit.
§Hill, J. M., op. cit.
Fig. 9. Geologic map of the Greaterville placer region, after Schrader and Hill, with certain alterations. Lode Mines: 1, Fulton; 2, Harshaw; 3, Mountain King; 4, Quebec; 5, Royal Mt.; 6, St. Louis; 7, Wisconsin; 8, Yuba. Devonian area includes other Paleozoic rocks.

like Granite Mountain, which rises to 5,500 feet above sea level. This granite weathers white, except where stained yellow or brown by alteration of impregnated pyrite, and is of granular to porphyritic texture. According to Hill,* it is made up of orthoclase, quartz, kaolinized, undetermined plagioclase, biotite, and magnetite. This granite porphyry

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*Hill, J. M., op. cit., p. 16.
seems to have furnished the mineralizing solutions for the gold-bearing quartz veins that were the source of the placers.

The outwash debris material east of the Cretaceous belt is made up of eastward-thickening, imperfectly stratified, very angular gravel and sand that has been derived by erosion from the Santa Rita Mountains. This material often has a matrix of clay or lime carbonate cement. It is dissected by many broad, deep, steep-sided gulches, and contains the gold placers of the district.

*Character and distribution of the gravels—Schrader* gives the following description of the gravels, based largely upon the work of Hill. The locations of the gulches mentioned can be seen on the accompanying map (Fig. 9).

"They (the placers) are irregularly distributed, chiefly in the bottoms of the present stream courses and gulches, where the principal diggings occur in shallow ground, and also upon the benches, slopes, and tops of the ridges, where some of them seem to represent deposits in old stream channels, examples of which occur just south of Greaterville 30 feet above the valley, on the crest of the ridge to the southeast, and on the north side of Hughes Gulch below the mouth of Nigger Gulch 15 feet above the bottom. They consist chiefly of a 2-foot bed of angular gravel which rests unconformably upon the bedrock of all the different older formations contained in the area, including the early Quaternary "cement rock." They are covered by 1 foot to 20 feet or more of overburden composed of later Quaternary and recent gravels and wash. In places, as in Kentucky, Ophir, and Empire gulches, the upturned, irregularly eroded edges of the underlying sedimentary beds form natural riffles, behind which the gold has been concentrated.

"The gravels of the gold-bearing bed are generally small, the pebbles, as a rule, being less than an inch in size, though in many places cobbles 4 to 8 inches in diameter occur. In a few places the gravels are crudely stratified and slightly cemented, generally by lime. They are sharply angular and but slightly waterworn. The sand consists chiefly of angular fragments, and many of the particles of quartz and feldspar show well-preserved crystal faces. The coarse material consists chiefly of red and yellow sandstone, shales of various colors, arkose, a little dense white rhyolite, and granite porphyry. The gravels rest in most places in a red-brown clayey matrix which is handled without difficulty by hydraulic methods."

*Character of the gold—*"The gold, which is rather uniformly distributed throughout the bed, is mostly coarse. It ranges from flakes

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*Schrader, F. C., op. cit., p. 161.*
one-tenth of an inch in longest diameter, which was the size of most of the material recovered at the time of the visit in 1909, to nuggets worth a dollar or more. The gold of the early days was all coarse, nuggets ranging from $1 to $5 in value being common. Some nuggets brought into Tucson contained from $35 to $50 worth of gold, and the largest nugget reported from the camp weighed 37 ounces and had a value of about $630. The gold averaged about $17 to the ounce fine, and it was not difficult for a man to take out an ounce a day. The gold, like the containing gravels, is very angular, with many pointed projections, denoting that it is of local origin and has not traveled far. A little quartz adheres to some of it and seemingly also galena, both of which are reported to have been common in the large nuggets. The gold is mostly bright, but some of it is iron-stained and concentrates from panning contain considerable magnetic black sand."

According to L. E. Jones Company of Greaterville, a nugget worth $228 was found in 1924, and the average fineness of the 1926 product was about 813½.

*Productive gulches*—Schrader* says:

"The productive gulches were Boston, Kentucky, Harshaw, Sucker (Succor), Graham, Louisiana, Hughes, Ophir below its junction with Hughes, the upper parts of Los Pozos and Colorado, Chispa on the road from Enzenberg camp to Greaterville, and Empire below its junction with Chispa.

"Boston Gulch: In Boston Gulch, which heads in the col south and west of Granite Mountain and trends a little south of east, gold was found in paying quantities from its head a point about half a mile south of its junction with Kentucky Gulch at the Kentucky camp. In the upper 2 miles of its course the gold was found in a channel 5 feet wide on bedrock, at 2 to 4 feet below the surface. Below Harshaw Gulch the gold was still confined in a 10-foot channel in the valley bottom, 5 to 10 feet below the surface. Below the mouth of Kentucky Gulch the valley is wide, and for half a mile below this point the gold was distributed on bedrock at a depth of 10 to 16 feet for a width of approximately 50 feet.

"Harshaw Gulch: In Harshaw Gulch, a short, narrow tributary of Boston Gulch with steep bedrock sides, the pay streak, which in places was rich, was confined to the bottom of the gulch, about 4 feet wide.

"Kentucky Gulch: In Kentucky Gulch, which heads south-southeast

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*Schrader, F. C., op. cit., pp. 162-164."
of Granite Mountain and joins Boston Gulch at Kentucky camp, the gold occurs throughout its length on bedrock in a channel 6 to 10 feet wide. At the upper end of the gulch the pay streak lay at the surface, but the covering gradually thickened to 6 feet at the mouth of the gulch.

"Sucker Gulch: In Sucker Gulch, which has three small heads southeast of Granite Mountain, the gravels were productive to a point a little below its junction with Ophir Gulch. From its head to the mouth of Graham Gulch the pay channel was 6 to 9 feet wide and 3 to 12 feet below the surface. Between Graham and Louisiana gulches the pay channel averaged from 20 to 50 feet in width and the depth was from 12 feet at the former to 25 feet at the latter gulch. Below the mouth of Louisiana Gulch the gold was found distributed through the gravels on bedrock for a breadth of 100 feet. The overburden at the lower end was excessive, and therefore but little work was done.

"Graham Gulch: In the lower end of Graham Gulch, a short branch of Sucker Gulch heading southwest of the St. Louis mine, the pay gravel covered the entire bottom, about 100 feet in width, on bedrock at 12 feet below the surface. At the upper end of the gulch the pay streak was 10 feet wide and was covered by only 6 inches of soil. Some gravels 15 feet above the bottom of the gulch on the south side were also productive.

"Louisiana Gulch: At the head of Louisiana Gulch, which heads about a quarter of a mile south of Greaterville and joins Sucker Gulch a little more than a mile below, gold was found almost at the surface, but near the mouth of the gulch it lay at a depth of 10 to 12 feet. The average width of the pay streak was about 6 feet.

"Hughes Gulch: In Hughes Gulch, which heads 2 miles west of Greaterville, just south of the Yuba mine, and extends north of Granite Mountain, a narrow channel, rarely over 6 feet wide from its head to its mouth, was found productive at 2 to 6 feet below the surface.

"Nigger and St. Louis gulches: Nigger and St. Louis gulches, small tributaries of Hughes Gulch, the first named lying to the west and the second to the east of Granite Mountain, contain small gold-bearing gravel channels.

"Ophir Gulch: Ophir Gulch, which heads northeast of the Yuba Mine, contains no placer deposits above its junction with Hughes Gulch. Below Greaterville, however, a channel 200 feet wide was found to contain gold as far down as the mouth of Sucker Gulch. The bedrock is rather deep here and little work has been done.
"Los Pozos Gulch: Los Pozos Gulch, which heads about a mile northeast of Greaterville, contains workable gravels in the upper 3,000 feet of its course.

"Colorado Gulch: On Colorado Gulch, a short branch of Empire Gulch, half a mile north of Los Pozos Gulch, some gold was found at shallow depths through a distance of 2,000 feet in the upper part of its course, nearly to its head.

"Chispa Gulch: In the lower three-quarters of a mile of Chispa Gulch, a small branch of Empire Gulch heading southwest of Enzenberg Gulch, a 5- to 10-foot pay streak on bedrock at about 10 feet below the surface yielded very high returns and was being worked at the time visited in 1909. In the lower portion of an east branch of Chispa Gulch gold was also being obtained from gravels 3 feet below the surface. At the head of the western fork of Chispa Gulch, which is about a mile in length, pay dirt lay at the surface, but at the mouth of the fork the gold was contained in a 50-foot channel on bedrock with 10 feet of overburden.

"Empire Gulch: In Empire Gulch placer gold was found only along a mile and a half of its course below the mouth of Chispa Gulch. The gold occurs in a bed 2 feet thick resting on conglomerate bedrock and is covered by 16 feet of overburden. Near the mouth of Chispa Gulch the pay gravels were about 300 feet in width, but at the lower end of the pay belt they were distributed over a width of a thousand feet."

Origin of the placer gold—Since most of the productive gulches head in the Cretaceous sedimentary belt that surrounds Granite Mountain, the placers very probably were derived mainly by erosion of quartz veins of that vicinity. These veins have been prospected in the Yuba (Inghram), St. Louis, Quebec, and other lode mines, and found to contain more or less free gold. Particularly in the Yuba, some beautiful wire gold has been found. That the gold of the placers has not been transported far from its ultimate source is proclaimed by the angularity of its flakes and nuggets.

Present operations—A small amount of placer mining is carried on intermittently in the district by a few men, chiefly Mexicans, who dig pits or shallow shafts to bedrock and gopher out the gold-bearing gravels. This material is then washed in rockers, but frequently the clay matrix of the gravels somewhat lowers the percentage of recovery that ordinarily can be made by rocking or by other known hand methods. Due to this clayey matrix, also, dry-washing is possible only in the loose sands of the washes, during the driest months of the year. Much of the known richer ground has been reworked one or
more times, and the floors of many of the gulches are literally pocked with pits, as illustrated in Fig. 11.

However, several of the best mining engineers who have examined the area estimate, according to Schrader,* that it still contains about $50,000,000 worth of gold. Due to such factors as overburden, clayey matrix, and lack of an abundant local water supply, this gold can be recovered profitably only on a large scale, by dredges or by certain adequate hydraulic methods, after ample water supply has been developed. Because of these facts, large-scale placering operations are contemplated by the Gadsden Purchase, Inc., and by the Greaterville Dredge Gold Mining Company.

Gadsden Purchase, Inc., which is the successor of the Santa Rita Water and Mining Company, has control of several thousand acres of ground in Hughes, Colorado, Los Pozos, Hefty, Ophir, Succor, Louisiana, Kentucky, Boston, Harshaw, and Fish gulches. This ground, according to M. E. Young,† contains from 40 to 60 cents gold per cubic yard. The company plans to bring water, from reservoirs in Cave, Gardner, and Sawmill canyons, through about 12½ miles of ditches, tunnels, and steel pipe lines. Hydraulic, drag-line, and dredge operations are contemplated, and it is said that production thereby will be started in 1927.

The Greaterville Dredge Gold Mining Company is reported to have control of 1,960 acres of ground, and to plan operating a special dredge with water pumped from wells 150 to 200 feet in depth. According to Root,‡ their workable ground averages 60 cents or more per cubic yard.

QUIJOTOA PLACERS

The Quijotoa gold placer district is situated in the vicinity of the Quijotoa Mountains of central Pima County, about 70 miles west-southwest of Tucson. According to Stephens.§ the placers in all cover probably 100 square miles, and Heikes∥ states that they extend north and south for some distance on both sides of the Mexican boundary.

The Quijotoa Mountains, which rise to about 4,000 feet elevation above sea level, or approximately 1,500 feet above the surrounding

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*Schrader, F. C., op. cit., p. 165.
†Oral communication.
plains, extend from Covered Wells on the north to South Mountain on the south, or to within about 20 miles of the Mexican line. This region has a very hot climate in summer, and there is no water supply except from wells and from earth or rock tanks. The mean annual rainfall is probably about 13 inches.

*History*—There is no record of how long these placers have been known, but, in 1774, according to Elliot's History of Arizona (1884), a Castilian priest named Lopez carried on extensive mining in an area about 6 miles north of the Quijotoa Mountains. It is said that Lopez utilized the docile Papagos for this work, and that the Mexicans who continued mining there until 1849 washed the gravels with water brought by Papago squaws from tanks in the valleys. For many years after 1849, there was little activity in the placers; but, in the early eighties, a very lively boom in lode mining attracted thousands of men to the district, and caused four or five towns to spring up. As this boom subsided, many of the men turned to placering, and there has been a small amount of activity ever since.

In 1906, the Imperial Gold Mining Company was said to own most of the productive ground, and to be leasing to dry-washers.

In 1910, a Quenner pulverizer and a Stebbins dry concentrator are said to have been installed by the Manhattan Company in the Horse-shoe Basin area, on the east side of the mountains, but, due to conditions being different from those that obtained where these machines had been successful, the experiment failed.

*Production*—Considerable gold was recovered from the Quijotoa placers during the early days, but there is no record of the amount. In 1899, Blake* was informed that "The placer mines in the near vicinity of Quijotoa, worked by the Papagos in their crude way, are producing annually between $6,000 and $7,000 worth of gold." As shown in the table on pages 14 and 15, the U. S. Mineral Resources record a production of $29,906 from the district between 1902 and 1913. Only a small amount per year has been recovered since 1912.

*Geology*—The Quijotoa Mountains, which are made up mainly of younger granite and lavas, contain numerous deposits of silver, gold, lead, and copper. Erosion of these gold-bearing rocks furnished, in the manner described on page 7, the material for the placers. In these placers, the gold occurs from the surface down into a stratum of cement-gravel or caliche, which carries more gold than does the

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Fig. 10. Nugget from Big Bug placers, nearly actual size. Photo by Bate.
Fig. 11. View of Ophir Guleh, 1/4 miles east of Greaterville, showing pits of older placer mining.

Fig. 12. Typical placer work on San Domingo Wash.
dirt above it. Much of the ground is said* to average over 80 cents per yard, and Stephens† states that the red colored dirt averages $5 a ton. This last figure, however, is probably too high for the area as a whole. In general, the gold is coarse.

Present operations—At present, as during several years past, there is but slight activity in the Quijotoa placer district. A few Indians and Mexicans work the dirt, and the softer, shallower portions of the caliche, which they pulverize by beating in rawhide bags, in very crude hand dry-washing machines. In the richer known areas, the surface has been thickly perforated by the pits and shallow shafts of this “coyoting” system of mining. The cemented nature of the richer gravels presents an obstacle to large-scale dry-washing operations that has not yet been overcome. Certain projects for building dams to collect the water of the rainy seasons for dredging operations have been contemplated, but, so far, they have not materialized.

LAS GUIJAS, OR ARIVACA, PLACERS

Las Guijas, or Arivaca,‡ placer district is situated in southern Pima County, in the vicinity of Las Guijas Mountains, about 50 miles southwest of Tucson and immediately northwest of Arivaca.

Las Guijas Mountains, whose rounded summits attain an elevation of about 4,300 feet above sea level, or about 1,000 to 1,300 feet above the surrounding plains, extend for about 8 miles northwest from Arivaca. Temperatures in the summer are high, and the mean annual rainfall is probably about 14 inches. The drainage of the district flows northwest to Altar Valley through Arivaca and Las Guijas creeks. Arivaca Creek, which occupies a large channel along the southwestern foot of the mountains, contains water in its upper reaches during all of the year, but Las Guijas Creek, along the northeastern foot, is much smaller and drier. The district depends for its water supply upon shallow wells along the creeks, and upon the flow of Arivaca Creek itself.

History—There is no available record of the date of discovery of these placers. According to Bryan.§ they were being worked in Las Guijas Creek by Mexicans and Americans in the sixties and seventies, and probably suggested the name “Guijas,” which is Spanish for “rub-
ble" or "conglomerate," for this creek and for the mountains. Irregular, small-scale operations have been carried on for the past 50 years, by sinking pits or shallow shafts to bedrock. The few inches of richer material is then gathered up and treated in crude, hand dry-washers during the dry seasons, or in rockers after each rain. It is said that occasionally, between 1890 and 1900, as many as 100 placer miners were working in the district.

Several projects for large-scale operations have been contemplated, but, so far, none have been successful. In 1915, the New Venture Gold Placer Company planned to pump water from Arivaca Creek, 3 miles away, for a special agitating sluice. This company had control of 4,200 acres of land, and asserted that each acre carried about 4,800 cubic yards of gravel worth $1 per cubic yard.

Production—No records of the production of these placers are available, but the total amount was undoubtedly large. Most of this yield was prior to 1900, for placer activity in the district gradually died down to practically nothing by about 1915. The 1926 production that was purchased in Arivaca is said to have been about $30.

Geology—Las Guijas Mountains, which are made up of lava flows, Cretaceous sediments, and younger granite, contain gold-bearing quartz veins that were the original source of the placers. The placer gravels have accumulated both on the piedmont slopes or "mesas" and in the stream beds. Although the earliest placer mining in the district was mainly on the northeast side of the mountains, along Las Guijas Creek, it is said that gold-bearing gravels extend practically around the range. Duzrano, Pisquero, Yaqui, and Sangose are the most noted gulches.

The mesa gravels are said to contain some gold scattered throughout their maximum thickness of 15 to 20 feet, but, in both the mesa and stream gravels, the highest values are at bedrock, or at clay-cemented false bedrock. In the mesa gravels, the gold is more angular and unpolished than in the stream beds, and often contains attached particles of the original gangue minerals. In general, the gold is rather finely divided, but it is said that many of the nuggets were worth from $5 to $15, and that one nugget valued at $192 was found in 1893.

OLD BALDY PLACERS

The Old Baldy placer district is situated in southeastern Pima County, at the northwestern base of the Santa Rita Mountains, in the vicinity of Madera Canyon, about 30 miles south-southeast of Tucson. Of these placers, Schrader* says: "The Madera Canyon alluvial cone,

heading near the foot of the mountains at an elevation of about 4,500 feet, slopes northwestward toward Santa Cruz River and has a radial length of at least 5 miles. It is composed of gravels and sands discharged from the mouth of the canyon. These gravel deposits in places are probably over 100 feet in thickness and they all carry colors of gold. Toward the head of the cone an 80-foot shaft was sunk in them without reaching their lower limit. Below the road forks, however, the deposits are deeply trenched by recent gulches from 40 to 50 feet in depth, some of which cut through the deposits to the underlying bedrock granite, and here considerable gold placer mining was done with fair returns in the early days, mostly in the late eighties, water being brought from Madera Creek by ditch and flume.”

PAPAGO PLACERS

Some small placers are situated in the Papago mining district of southern Pima County, along Ash Creek on the Sunshine-Sunrise group of claims, about 30 miles southwest of Tucson. According to Allen,* “the area covered by the auriferous gravel is very small, but Mexicans working in the rainy seasons are said to make good wages by the use of rockers. There is ample water in the creek for the use of rockers then, and the remains of old diggings indicate that a considerable amount of work has been done there in the past.”

MARICOPA COUNTY

The principal placers of Maricopa County are in the Vulture, San Domingo, and Hassayampa regions. The annual rainfall of these regions is only about 10.5 inches, and the summer temperature sometimes is 113°. Their water supply during the dry seasons is from intermittent Hassayampa Creek or from wells, but the abundant, subsurface seep of the Hassayampa has never been known to fail.

VULTURE PLACERS

The Vulture placers are situated in northwestern Maricopa County, in the vicinity of the Vulture Mine, about 14 miles by road southwest of Wickenburg. North of these placers, the extensively dissected Vulture Mountains rise to elevations of 3,500 or more feet above sea level, or nearly 2,000 feet above the desert plain that adjoins the region on the south.

History—According to Mr. A. P. Irvine, who has been in the district for many years, these placers were first worked about 1867. At

times during the 5 or 10 years following, as many as 200 or more men were placering with dry-washers in the arroyos of the vicinity. Blocks of ground only 50 feet square were allowed each miner, but many men recovered from $25 to $50 per day each. By about 1880, the richest, readily-obtainable gold had been harvested; but some dry-washing, principally by transient miners or gambucinos, has been done every year after each torrential rain. Evidences of the early activity along the arroyos are still to be seen in the numerous old pits, piles of screenings overgrown with small brush, and decaying dry-washer machines. In the northern portion of the area, even some of the thin, hillside gravels were scraped up and dry-washed.

Geology—The principal rocks of the Vulture region consist of pre-Cambrian schists, dikes and irregular masses of granite, probable Mesozoic monzonitic dikes, and Tertiary andesitic and rhyolitic lava flows. Within this schist are the large, rich, gold-bearing quartz vein of the Vulture Mine, and many smaller veins. Practically all of these smaller veins carry visible free gold, and even the most minute drainage channels leading down from them contain placer gold.

The Vulture placer ground covers about 3 square miles in Red Top Basin, northwest of the Vulture Mine, and continues down Vulture Wash for about 2 miles southeast of the Vulture Mine. The placer gravels, which are composed mainly of medium to fine, angular pebbles of schist and quartz, are generally less than 10 feet thick, and rest upon schist bedrock. Considerable caliche cement is encountered in all but the thinnest gravels, and has limited dry-washing operations to the ever-narrow arroyos that are typical of this field.

Although some gold is distributed throughout these gravels, it is more abundant near bedrock. Several samples, taken from random localities at the time of the writer's visit, revealed abundant colors when panned. Even the old dry-washer tailings show fine colors upon panning, for those machines could recover only the coarser gold. The gold is mostly coarse and angular. During the early days, according to Mr. Irvine,* many $10- to $20-nuggets were found, and some worth $100 were reported.

The origin of the placer gold, in Red Top Basin at least, appears to have been the small quartz veins of that vicinity. In this connection, Carl Lausen* has observed that the gold of these veins, like that of the adjacent placers, is coarser than obtains in the Vulture vein.

*Oral communication.
It is possible, however, that the gold in the drainage below the Vulture Mine may have been derived in part from the Vulture vein.

Present operations—At present, the only placering done in this region is by gambucinos, who are said to make better than ordinary day’s wages after each heavy rain. Most of the ground is held as lode claims, as follows: Red Cloud Group of 6 or more claims, by A. P. Irvine; Red Top Group of 6 claims, by D. R. Finlayson; Banker Group of 4 claims, and Red Top Extension Group of 7 claims, by A. P. Irvine; Laguna and Regina groups of 9 claims, by A. P. Irvine and under option to W. E. Hanson; and the Vulture Group of 32 claims, by the Vulture Mining Company. Inasmuch as the early day dry-washers operated mainly along the arroyos, but not on the caliche-cemented gravels of the intervening ridges, a large amount of placer gold still remains in the Vulture region.

GARCIA PLACERS

According to Carl Lausen,* some gold placers occur in the vicinity of the Garcia gold mine, which is about 9 miles east of the Vulture Mine. Considerable dry-washing was done south of the outcrop of the quartz vein of this mine soon after the Vulture placers were discovered.

SAN DOMINGO PLACERS

The San Domingo region is situated in northern Maricopa County, and surrounds San Domingo Wash, which is an eastern tributary of Hassayampa Creek, about 45 miles northwest of Phoenix. This sharply-and intricately-dissected portion of the western foothills of the Wickenburg Mountains is from about 2,300 to 3,300 feet above sea level. It is traversed by a few roads from Morristown, or Hot Springs Junction, a station on the Santa Fe Railroad.

History and production—The gold placers of this region were discovered many years ago, and some persons assert that they were known to the early Spanish explorers. It is said that the greatest activity in the region was between 1870 and 1880, when the towns of Old San Domingo and New San Domingo were maintained by the placer miners. About 1875, Old Woman Gulch, which is a southern tributary of San Domingo Wash, is said to have produced over $150 per day. New San Domingo, which stood on the mesa about 7 or 8 miles east-northeast of Morristown, is said to have had a population of 1,500 men in 1885.

Several projects have been planned for hydraulicking certain areas in the region. Several dams have been proposed to catch the torrential run-off of the rainy seasons, and it has been suggested that the sub-

*Oral communication.
surface water of Hassayampa Creek could be diverted. One dam was built across San Domingo Wash in 1910 by a Mr. Sanger, and sluicing was started; but the reservoir filled up with sand and gravel before operations had proceeded for one season. Dry-washing, or rockering when there was enough water, has been carried on in the region every year since its discovery, and has supplied a large proportion of the production of Maricopa County recorded on page 14.

Geology—The principal rocks of this region are pre-Cambrian granites, gneisses, and schists, Tertiary basalts, andesites, rhyolites, agglomerates, and sandstones, and various dikes. Quartz veins, probably of both pre-Cambrian and post-Cambrian age, have furnished the gold that erosion has concentrated in the placers.

The placers occupy a belt, 6 or 7 miles in length and of very irregular width, along the drainage system of San Domingo Wash. They are not confined to the stream beds alone, but are found also on some of the gravelly mesas that separate the gulches.

The gold itself is said to be angular, fairly coarse, and of 925 to 965 fineness. Several prospectors of the region state that, although much of the gold found was in pieces worth about $1, nuggets valued at $30 were common in the early days, and several containing $10 to $15 were found in 1925. The gold is reported to lie mostly near bedrock in the upper reaches of the gulches, but somewhat distributed through the gravels of the lower country, and to be associated with considerable black sand. Although the areas worked by the early-day dry-washers were rather rich, most of the ground is of too low a grade for such treatment. According to T. L. Carter,* part of the Lotowana Mining Company property along Rogers Wash was tested by over 200 holes, and an area of 300 to 350 acres, 2½ miles wide and 1,000 feet long, was found to range from 1 to 20 feet to bedrock and to average from 40 to 80 cents per cubic yard. Sanger Wash was sampled by Mr. A. P. Irvine† and found to average 43 cents per cubic yard.

Present operations—The San Domingo placers are still being worked to a small extent by dry-washers, or by rockers when there is enough water. Fig. 12 illustrates the type of mining necessary for such operations.

HASSAYAMPA PLACERS

Although some gold is present in the gravels and sands of the whole Hassayampa in Maricopa County, it is reported to be relatively most

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†Oral communication.
abundant for a few miles below the mouth of San Domingo Wash, which is about 7 miles southeast of Wickenburg. According to Mr. A. J. Kellis,* of Wickenburg, who sampled a portion of this ground several years ago, bedrock is from 50 to 70 feet at the mouth of San Domingo Wash, and the average gold content there is about 53 cents per cubic yard.

The Hassayampa Placer Gold Company, of Phoenix, has control of about 6,400 acres of ground in and below the Hassayampa gorge that begins about 6 miles south of Wickenburg. After considerable testing of this ground, the company reports planning the installation of a dredge.

PINAL COUNTY

CAÑADA DEL ORO, OR OLD HAT, PLACERS

The only known gold placers of importance in Pinal County are in the vicinity of Cañada del Oro,† in the Old Hat district. These placers, which extend also into Pima County, lie at elevations of over 2,600 feet above sea level, near the northwestern base of the Santa Catalina Mountains, from 4 to 10 miles south of Oracle postoffice and 16 to 29 miles north of Tucson.

The water supply of this placer region is chiefly from wells and from the intermittent flow of Cañada del Oro Creek. The mean annual rainfall at Oracle, which is 4,500 feet above sea level, is about 19.44 inches; but on the Santa Catalina Mountains, which attain 9,150 feet above sea level at Mt. Lemmon, less than 10 miles southeast of the placer area, much heavier summer rains and winter snows obtain. Cañada del Oro, therefore, sometimes carries torrential floods during the summer, and a steady, small flow from the melting snows in the spring.

History and production—These placers are said to have been discovered by the Spaniards, during the early days of Tucson. Numerous old pits, trenches, and tunnels indicate considerable early placer mining, and many thousand dollars worth of gold are reported to have been recovered. The production from 1903 to 1924, inclusive, amounted to $11,351.

Geology—The Santa Catalina Mountains are made up principally of pre-Cambrian gneiss, schist, and granite, Paleozoic sediments, post-Carboniferous granite, granite porphyry, diabase, and diorite, and Tertiary sediments and lavas. Gold-bearing quartz veins, such as occur

*Oral communication.
†Spanish for “Canyon of the Gold.”
in the vicinity of the Copeland, Kerr, Matas, and other prospects in the upper reaches of Cañada del Oro, were the probable source of the placer gold.

A description of the placers, based upon information from Capt. J. D. Burgess, is given by Heikes:* "An area of 25,000 acres, . . . covering nearly the whole of T. 10 S., R. 14 E., Gila and Salt River Meridian . . . is found containing valuable dry placer gravel, which has apparently been deposited at intervals by floods from the Santa Catalina Mountains so as to form a deposit of nearly equal value from surface to bedrock, there being no pronounced accumulation of heavy gold at bedrock except in the stream, Cañada del Oro Creek, which passes through the region. The bed of dry gravel is from 6 feet deep at the creek side to 252 feet at the summit, with an average thickness of about 150 feet. The deposit is in general a loose gravel, un cemented. There are, however, alternating strata of deep red, clayey material. These strata are of nearly uniform thickness of 3 to 4 inches and probably were formerly surfaces existing between floods, each being covered by a later flow of gravel from rainfall-eroded veins farther up the mountain. Shafts sunk on the hill-sides from 27 to 50 feet in depth show values from 10 to 42 cents per cubic yard. The average is difficult to determine, as the gold is not equally distributed. All the gold is found in well-rounded nuggets ranging from 50 cents to $5 in value. There is a tradition of a lump weighing 16 pounds with probably 40 percent of quartz, whose discoverers were found murdered in their camp 16 miles north of Tucson. The nugget had disappeared. In fineness the gold averages about 905. Generally the placer material is dug, screened, and hauled to the creek, and there worked by rockers, or sluiced when there is enough water. Many dry-washers have been tried, but most of the gold lies in the red clayey seams which apparently acted as bedrock for each period of deposition. Pulverizing this adherent material gives good results with the common bellows type of 'dry washer.' A boiler and pump were once used to throw water against the creek bank, but the water at that time proved insufficient for extensive operations."

Present operations—At present, a little panning and rocking is carried on by a few individuals. Some development work is being done on the Gold Channel placer group. This group, which contains 3,280 acres of Townships 10 and 11 S., R. 14 E., is held by Mr. P. Contzen, of Tucson, and bonded to Mr. W. N. Neal.

ARIZONA GOLD PLACERS

COCHISE COUNTY

In Cochise County, the best-known gold placers are found in the Dos Cabezas and Teviston districts. Other placers, of less economic importance, are known in the Huachuca and Bisbee districts, and a silver-gold placer occurs at Pearce.

DOS CABEZAS PLACERS

The Dos Cabezas placers are situated in north-central Cochise County, in the vicinity of Dos Cabezas village, at elevations of 5,000 or more above sea level. Allen* states that these placers were discovered in 1901 by some Mexican prospectors, but, although this discovery induced considerable local excitement, only a small amount of gold was recovered. During 1906, according to Heikes,† water was plentiful in the district for a number of months, so that considerable placer ground was worked by several companies and by a number of Mexicans. Many of the latter made from $4 to $6 per day with simply a gold pan. Some gold has been recovered from the Dos Cabezas placers practically every year since their discovery. The most productive years, as recorded by the U. S. Mineral Resources, were 1906, with $1,939; 1911, with $115; and 1914, with $228.

Practically all the gulches in the vicinity contain gold-bearing gravels. These gravels are rather thin in the canyons a short distance north of the village, but, toward the south and away from the mountains, they thicken rapidly. Sufficient clay is said to be contained in the placer material to handicap extraction. The abundant gold-bearing quartz veins and stringers that occur in the Mesozoic and older rocks of the Dos Cabezas Mountains appear to have been the original source of the gold.

TEVISTON PLACERS

The Teviston placers are situated in north-central Cochise County, on the northeast side of the Dos Cabezas Mountains opposite the Dos Cabezas district. Of these placers, Heikes‡ says: “During the wet season dry-placer ground in the Teviston district yields a small quantity of gold yearly. About 300 acres have been reported valuable to a depth of from 3 to 10 feet, the latter being the greatest depth prospected. Bedrock is from 50 to 75 feet in depth. Most of the gold is

coarse, and the ground by tests has yielded from 3 cents to $28 per cubic yard. The largest nugget found was valued at $375. Some cement or caliche has been found in prospecting the ground, but values have been found in the gravel beneath.”

**HUACHUCA PLACERS**

Blake* states that “Placer gold is found in the Huachuca Mountains. It is reported that placer miners are constantly at work near the Harper Mine, and making good wages.”

Of the placer activities in the southeastern Huachuca Mountains, a few miles north of the Mexican line, during 1919, Heikes† states: “The placer operations near Garces produced a little gold. These placers are in the vicinity of mineral veins containing tungsten, and some scheelite has been recovered from the placer gravels in addition to the gold. It is reported that a nugget of gold weighing 8½ ounces was recently found in the Old Timer placer in Ash Canyon, where about 50 ounces of gold were recovered during the year.” A little placer gold production was reported from the Huachuca Mountains during 1921 and 1923.

**GOLD GULCH PLACER, BISBEE DISTRICT**

Of the Gold Gulch placer, which is situated about 4 miles southeast of Bisbee, Ransome‡ says: “Small quantities of placer gold have been obtained from the upper part of Gold Gulch. This gold has been derived from the Glance conglomerate, and concentrated in the sand and gravel of the present arroyo. It is not present in sufficient quantity to be of economic importance.”

**PEARCE PLACER**

Some interesting information upon the placer at Pearce, central Cochise County, has been furnished by Lewis A. Smith.§ This placer, which lies at the eastern and western margins of Pearce Hill, furnished, in 1895, the first carload of ore from the district. Further shipments, made between 1917 and 1927, have brought the total production of this placer to $8,700. The material, which has been derived by weathering of the quartz veins of Pearce Hill, is made up largely

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§Oral communication.
ARIZONA GOLD PLACERS

of boulders from a few inches to over 3 feet in diameter. It had a maximum thickness of 25 feet at the eastern margin of the hill and 15 feet at the western margin. The eastern margin averaged about 12 ounces in silver and $1.25 in gold per ton, while the western averaged 57 ounces in silver and $15 in gold. These values were contained in manganese-stained, sugary quartz, and were present mainly as cerargyrite, embolite, and free gold.

GREENLEE COUNTY

MORENCI PLACERS

Gold placers occur in the Morenci, or Copper Mountain, district of central Greenlee County. Nothing is known of the early yield of these placers, but from 1907 to 1924, inclusive, they produced $8,879.

According to Lindgren,* the gravels of the Gila conglomerate, resting in front of the older rocks on lower San Francisco River and Eagle Creek, are sometimes gold bearing, although the metal usually occurs only as very fine flakes. The late Quaternary bench gravels along the San Francisco above Clifton contain gold in a somewhat more concentrated form, and at Orvville (3 miles above Clifton) attempts have been made to work them by the hydraulic method, but the results were not encouraging. This gold is probably derived from a system of veins outcropping on lower Dorsey and Colorado gulches, a few miles north of Clifton on the west side of San Francisco River.

According to Blake,† a large sum of money was expended on a pipe line for the hydraulicking project near Orvville, but the want of adequate fall and space for the tailings caused the abandonment of the enterprise.

Gold Gulch, 2 or 3 miles west of Morenci, was worked for placer gold about 1884. Lindgren‡ believed the origin of this gold to be limonitic, auriferous pockets in narrow, irregular quartz veins that cut masses of limestone and other sediments included within the diorite. He also states§ that the Gila conglomerate south of Morenci contains a little finely divided gold, which is concentrated in Morenci Canyon, about 4 miles below the town, and in shallow gullies.

The best-known placer districts of Santa Cruz County are Oro Blanco, Patagonia, Harshaw, Tyndall, Nogales, and Palmetto.

**ORO BLANCO PLACERS**

The Oro Blanco placer district is situated in the Oro Blanco Mountains of southwestern Santa Cruz County, in the vicinity of Ruby and Oro Blanco, about 25 miles west-northwest of Nogales and a few miles north of the Mexican boundary.

The Oro Blanco Mountains, which attain in Montana Peak, at Ruby, an elevation of 5,500 feet above sea level, or about 1,500 feet above the deepest gulches, receive approximately 15 inches of rainfall per year. However, there are no perennial streams in the region, and the local water supply comes from reservoirs or from shallow wells.

**History and production**—These placers are said to have been worked since the time of the early Spanish explorers. According to Mr. J. S. Andrews,* of Tucson, former storekeeper at Ruby, about $2,000 worth per year was produced from 1896 to 1904, but this activity died down after 1907. Of the activity in 1899, Blake† says: “Most of the placer mining is carried on in a desultory way, often with a small and wholly inadequate water supply, and in certain places with dry-washing machines worked by hand. The returns are small, but the miners manage to get their living, especially where they can get water.” An attempt at sluicing was made in 1906 by Kelly Brothers; but their earth-fill dam washed out and caused the enterprise to fail. In 1911, only two properties were productive, and there has been very little activity in the placers of the district since 1915.

**Geology**—The Oro Blanco Mountains, which are made up principally of pre-Cambrian granite, Cretaceous sediments, Tertiary lavas, and various minor intrusives, contain numerous gold-bearing quartz veins and stringers. Consequently, placers were formed in most of the gulches that issue from the mineralized areas. According to Blake,‡ “In almost every ravine or gulch, gold can be found by panning, and even on the hillsides and on the surface generally, especially where the soil is reddened by decomposed pyrite, gold can be obtained by dry washing.” Alamo and neighboring gulches, south and southwest of

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*Oral communication.
‡Blake, W. P., op. cit.
Ruby, contained the richest gravels. Mr. Andrews states* that the placer gold was not very coarse, but ranged from flour up to one nugget worth $8. The fineness of the gold bought by Mr. Andrews from Old Oro Blanco was about $10 per ounce, and from Alamo Gulch about $16. The average fineness from the whole district was only about $12 per ounce, and the whiteness of the material containing this relatively high content of alloyed silver suggested the Spanish name "Oro Blanco" (white gold) for the district.

PATAGONIA PLACERS

The gold placers of the Patagonia district, Santa Cruz County, are situated on the eastern slopes of the Patagonia Mountains, about 9 miles south of Patagonia and 6 miles north of the Mexican boundary, at an elevation of from 5,200 to 5,800 feet above sea level. Of these placers, Schrader† says: "Placer gold occurs in the Patagonia district in the Quaternary stream gravels in the piedmont portion of Mowry Wash and its tributaries, being present on the main wash at the east border of Guajolote Flat about 1½ miles southwest of Mowry, on a south-side tributary gulch about 1¼ miles south-southwest of Mowry, and on two north-side parallel tributary gulches about 1½ miles southeast of Mowry.

"The production is small, as the deposits are worked only by Mexicans when in need of money. The average earnings are about 75 cents a day for each man. The placers at the Guajolote locality were being worked by dry-washing at the time of visit (1909). The deposits at this place seem to be about 5 feet thick. The known production in 1909 was two ounces of gold. In 1906, when, after the closing of the Mowry Mine, many unemployed men were in the country, the production was about $200."

HARSHAW PLACERS

According to Schrader‡ "The only placers known in the Harshaw district occur about 2 miles southwest of Patagonia, between Sonoita Creek on the northwest and Alum Canyon on the southwest. Here the Quaternary gravels underlying the mesa-like area, which is about a mile square, contain placer gold and are workable under favorable conditions. They are said to contain also native lead. They were

*Oral communication.
‡Schrader, F. C., op. cit. p. 279.
worked by A. J. Stockton and other pioneers by jigging in the early
days."

TYNDALL PLACERS

Schrader* says: "Placer gold occurs in the Tyndall district, and
some was produced in the early days 2½ miles southwest of Salero
and 1 mile south of Mount Allen, at the southwest base of Grosvenor
Hills, on each side of the township line, in the S. W. ¾ Sec. 35 and
adjoining ground, in the open basin-headed canyon which is tributary
to Ash Canyon."

NOGALES PLACERS

According to Schrader,† "Gold placer deposits occur in the north-
eastern part of the Nogales district on Guebabi Canyon, which drains
into Santa Cruz River from the northeast at a point about 6 miles north
of Nogales. The canyon extends southwestward through a large area
which is commonly known as the Guebabi district but which, except
along the canyon, is barren of ore deposits . . . . Along the course
of the stream gold placers of considerable extent are reported to occur
in the Quaternary gravels. . . . The placers produced considerable gold
in early days, and were being worked to a moderate extent in 1909."

PALMETTO PLACERS

The Patagonia Placer Mines Co., which has control of 320 acres
in the Palmetto district, plans to recover placer gold from the Quat-
ernary gravels at a point about 2½ miles northwest of the Three R
Mine, and 6 miles by road southwest of Patagonia. This company
has installed a sluice and a drag-line excavator adjacent to the bed of
the main arroyo, and plans to develop water by shafts, and by pits in
the arroyo bed.

MOHAVE COUNTY

CHEMHEUEVIS PLACERS

The Chemehuevis placers are situated in southwestern Mohave
County, at the southwestern foot of the Chemehuevis Mountains, about
5 miles from the Colorado River and 30 miles southeast of Needles,
California. These placers have been worked in a desultory way by
dry-washers since the sixties, and are said to have yielded fair returns.

According to Hedburg,‡ the placers occupy an old channel about one

*Schrader, F. C., op. cit., p. 220.
†Schrader, F. C., op. cit., p. 355.
1909.
mile wide, 3 to 5 miles long, and 10 to 30 feet deep. The gravel, which he believes to have come from the Chemehuevis Mountains, consists largely of gold-bearing quartz, porphyritic debris, and volcanic material, and is cemented with lime carbonate. On the basis of samples obtained from 10 pits, 20 feet deep, Hedburg estimated that these placers average $2 per cubic yard.

OTHER MOHAVE PLACERS

In late 1920, plans were being made for sluicing in Jumbo Wash, about 80 miles northwest of Kingman, with water pumped from the river; but there is no record of the outcome of this enterprise.

Some placer mining is said to have been done in the vicinity of Vivian, which is about 2½ miles southwest of Oatman.

A small yield of placer gold from the Owens district, which is southeast of Yucca, was reported by the U. S. Mineral Resources in 1923.

The sands and gravels of the Colorado River, downstream from the mouth of the Grand Canyon, contain finely-divided gold that has encouraged several unsuccessful, large-scale enterprises. One of these efforts is mentioned by Heikes* as follows: "The large dredge built in 1909 on Colorado River, near the Arizona side, opposite El Dorado Canyon, Nev., was of the suction type and rated at 7,000 yards daily, but this is probably a high estimate. It was built to work the sand bars and failed on first test to extract the fine gold. It was subsequently carried from its moorings by high water and wrecked during the spring of 1910."

GILA COUNTY

GLOBE PLACERS

Placer gold occurs in the Globe region along Pinal Creek, Lost Gulch, Gold Gulch, and some of the Richmond Basin gulches. A little mining of these placers has been carried on by individuals since the seventies, but most of their production was during the early days.

According to Carl Lausen,† most of the placer mining along Pinal Creek was done upstream from a point about 1 mile southeast of the railway depot. Nuggets worth from a few cents up to 25 cents were found, and a few worth $5 were reported.

A little placer gold has been recovered from Lost and Gold gulches, about 4½ and 10 miles west-northwest of Globe. Blake‡ states that

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†Oral communication.
‡Blake, W. P., op. cit., p. 66.
"Placer deposits of considerable extent and value have been worked for years in Lost Gulch, Globe district. These deposits appear to have been supplied by the disintegration and erosion of a multitude of small veins traversing the . . . region." The U. S. Mineral Resources report a production of $127 worth of placer gold from Lost Gulch in 1907.

According to Carl Lausen,* some placer gold probably was recovered from many of the small stream channels that drain westward from the Apache Mountains through Richmond Basin, north of Globe. This basin is noted for its rich placers of horn and native silver.

PAYSON PLACERS†

Considerable rich float from the gold-bearing veins of the Payson district, northern Gila County, was picked up during the seventies and eighties.

Although the quartz veins of the district show free gold at the surface, placers are not common. One short tributary of the East Verde River drains the region in which most of the gold veins occur; yet the prospectors of the district state that no placer gold has been found in it. Placers, however, have been worked in a small way for a number of years below Ox Bow Hill, but only during the rainy season when water is available. These gravels are only worked sporadically, and yield but a few dollars per day. On the slopes of Ox Bow Hill immediately below the outcrop of the vein, Mr. Boozer panned about an ounce of gold. Some of this gold consisted of rather coarse, flat nuggets up to a quarter of an inch in length. These nuggets are of a deeper color than the vein gold, and probably contain little or no silver. Mr. Boozer states that any pan of the dirt from the slope will show a few colors.

OTHER GILA PLACERS

Small gold placers occur in the Dripping Spring and Banner districts of southern Gila County, and in the Mazatzal district of the northwestern part of the county. The U. S. Mineral Resources report a small production of placer gold from the Dripping Spring and Mazatzal districts during 1910, and from the Banner district during 1914.

*Oral communication.
†Lausen, Carl, and Wilson, E. D., Gold and Copper Deposits Near Payson, Arizona: Univ. of Ariz., Bureau of Mines Bul. 120. 1925.
Although no placer gold production has been reported from Apache, Coconino, and Navajo counties, the Triassic Chinle* formation of the Painted Desert in northeastern Arizona deserves mention as a low-grade gold placer that is of spectacular interest from a geological rather than a practical point of view. This formation, which was known as the Shinarump prior to 1917, consists largely of mauve to variegated clays. It underlies the major portion of northeastern Arizona north of the Little Colorado River, and outcrops as shown on the Arizona Bureau of Mines geological map of Arizona.

An account of the gold in the Chinle clays has been given by Lawson†. According to him, these clays, when examined microscopically, appear to be composed almost wholly of a colloidal substance with a very small admixture of fine silt and some concretions of lime carbonate and iron oxide. When immersed in water, the clays swell enormously, break down rapidly, and run like milk. The mixture is in such a fine state of division that it passes freely through filter paper. Lawson found that these clays averaged 5 cents in gold per cubic yard at Paria, Utah, and states that they “appear to be similarly auriferous at Lee’s Ferry . . . ; and it is probable from the extreme uniformity in the physical characteristics of the formation wherever it has been observed that it is similarly auriferous throughout its extent.” The gold is probably in a very finely divided condition.

In Arizona, the Chinle underlies, with a maximum thickness of 1,182 feet, an area of approximately 12,000 square miles, and outcrops over approximately 4,000 square miles. If the average gold content is .5 cents per cubic yard, and the average thickness be taken at 500 feet, or less than half of the maximum, then the total gold content of the outcropping areas of Chinle in Arizona is over 103 billion dollars, and the total for the whole formation in the State is over 309 billion. Lawson‡ states, however, that “The value of the ground is very problematical. If a method of successful hydraulicmining and recovery of the gold be developed it will only be after a long period of experimentation, at large expense, at a few favored localities, where a vast yardage of the clays is free from overburden, and where abundant water may be had cheaply.”

Hundreds of placer claims have been staked out upon the Chinle formation, and offered for sale at large figures, but thus far all attempts at hydraulicking the ground have been ineffective.

**DRY-PLACER MACHINERY**

A great number of hand and power dry-concentrating machines have been devised to recover the gold from Arizona placers, and large sums of money have been wasted on many such machines, since the designers often were neither skilled metallurgists and experienced placer miners. However, according to T. G. Chapman,* Professor of Metallurgy at the University of Arizona, several of the standard makes of dry-concentrating machines possess decided merit, provided the material fed to them is rather dry.

For general information upon the subject of dry-placer machinery, the reader is referred to the following authors:


*Oral communication.
MAPS OF ARIZONA

The Arizona Bureau of Mines now has available for distribution four different maps of the State, as follows:

1. Base map of Arizona in two sheets on a scale of about eight miles to the inch. This map is strictly geographic, with the positions of all towns, railroads, rivers, surveyed lands, national forests, national parks and monuments, etc., indicated in black, and the location of mountains and other topographic features shown in brown. It also indicates where the various mining districts are situated, and is accompanied by a complete index. It was issued in 1919 and is sold, unmounted, for 35c, or mounted on cloth with rollers at top and bottom for $2.50.

2. A topographic map of Arizona in one sheet, on the same scale as the base map. It shows 100-meter contours, and there is a meter-foot conversion table on the map. It was issued in 1923, and is sold, unmounted, for 50c, or mounted on cloth with rollers at top and bottom for $2.50.

3. A geologic map of Arizona on the same scale as the base map, printed in many colors. It was issued in 1925, and is sold both mounted and unmounted for the same prices as the topographic map.

4. A relief map of Arizona on the same scale as the base map, printed in various shades of brown, black, and blue. It was issued in 1925, and looks exactly like a photograph of a relief model of the State. This map was prepared by the U. S. Geological Survey, and is sold by the Survey for $1.00. Unmounted copies may be obtained from the Arizona Bureau of Mines at the same price. The same map mounted on cloth with rollers at the top and bottom is sold by the Bureau for $3.00.

POSTAGE IS PREPAID ON ALL MAPS.

SERVICE OFFERED BY THE BUREAU

The Arizona Bureau of Mines will classify free of charge all rocks and minerals submitted to it, provided it can do so without making elaborate chemical tests. Assaying and analytical work is done at rates fixed by law, which may be secured on application.

The Bureau is always glad to answer to the best of its ability inquiries on mining, metallurgical, and geological subjects; and takes pride in the fact that its replies are always as complete and authoritative as it is possible to make them.

All communications should be addressed and remittances made payable to “The Arizona Bureau of Mines, University Station, Tucson, Arizona.”