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GOLD DEPOSITS NEAR QUARTZSITE, ARIZONA

United States Geological Survey, Bulletin 620-C

By Edward L Jones, Jr.

1915

Written in 1915, this report is the basis for much of the more recent information published about the Quartzsite area. Although the primary focus of the study done by Mr. Jones was on the Colorado River Indian Reservation, he covers in detail areas as far east as the Plomosa Mountains. His coverage of the local placers is particularly interesting.

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DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

GEORGE OTIS SMITH, DIRECTOR

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GOLD DEPOSITS NEAR QUARTZSITE, ARIZONA

BY

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GOLD DEPOSITS NEAR QUARTZSITE, ARIZONA.

By EDWARD L. JONES, JR.

INTRODUCTION.

This report is based on information obtained by the writer in April and May, 1914, while he was classifying the lands in the Colorado River Indian Reservation. The area considered includes the southern part of the reservation and the region extending eastward from the reservation to the Plomosa Mountains. The geology and ore deposits within the reservation were more particularly studied, the time allotted to the examination being too short to permit detailed work in the area farther east. For information concerning placers outside the reservation the writer is indebted to Mr. E. L. Dufourcq, who conducted the testing of placer ground near Quartzsite. Mr. W. W. McCoy, of San Bernardino, kindly furnished the early history of the La Paz district, and Mr. Edward Beggs, of Quartzsite, gave much useful information regarding the La Paz placers. In 1909 Howland Bancroft¹ made a geologic reconnaissance of northern Yuma County and much of the country around Quartzsite and farther west to the reservation line. In his report he mentions the La Paz district and briefly describes placers in the Plomosa Mountains and prospects on gold-bearing quartz veins in the vicinity of Quartzsite.

The map that accompanies the present report (Pl. IV) is compiled from the records of the General Land Office. The area within the reservation has been subdivided into sections; the land east of the reservation is unsurveyed. The mountainous areas in the reservation are indicated on this map by patterns showing the geologic rock formations; the mountains in the unsurveyed area are represented approximately by hachures.

GEOGRAPHY.

The topography of southwestern Arizona is characterized by small detached, generally northward-trending mountain ranges separated by broad aggraded desert plains. Quartzsite lies in the broad basin

¹ Bancroft, Howland, Reconnaissance of the ore deposits in northern Yuma County, Ariz.: U. S. Geol. Survey Bull. 451, 1911.

of Tyson Wash at the northern end of La Posa plain, in southwestern Arizona, between the Plomosa Mountains on the east and the Dome Rock Mountains on the west, at an elevation of about 850 feet. The distance between the Plomosa and Dome Rock mountains at the narrowest part of the plain is probably not less than 6 miles. Quartzsite is in the west-central part of Yuma County and is best reached by a daily automobile stage line, 25 miles long, from Bouse, Ariz., a station on the Arizona & California branch of the Atchison, Topeka & Santa Fe Railway. A road leading westward from Quartzsite traverses the southern end of the reservation and one leading southward traverses the broad stretch of desert to Yuma.

Most of the mountains in this region attain elevations not exceeding 2,000 feet above the surrounding desert. Ferrar Peak, 2,900 feet high, is the highest elevation near Quartzsite. The two small outlying ridges north of Tyson Wash rise not more than 800 feet above the surrounding bench lands, but the average relief is less than 500 feet. Gravel and wash covered bench lands slope gently westward from the Dome Rock Mountains nearly to Colorado River, where usually there is an abrupt descent of 100 feet to the river bottom lands.

Many shallow arroyos or washes drain to Colorado River, but none of them carries surface waters. Of these, Tyson Wash and Arroyo La Paz are the most prominent. Tyson Wash, with a length of 50 miles, heads south and west of Quartzsite in several branches, which unite and drain northward to the north end of the Dome Rock Mountains, where the channel turns sharply westward and debouches on the Colorado River bottom lands. Tyson Wash carries an underground water flow at Quartzsite, where small tracts are irrigated from shallow wells operated by windmills or small gasoline pumps. Arroyo La Paz heads in the Dome Rock Mountains and for most of its course forms the southern boundary of the Colorado River Indian Reservation. The water supply in the vicinity of the placer camps is very scanty. Water of a rather inferior quality is furnished by Gonzales well, near the reservation line, and a small or uncertain supply is obtained from "tanks" or holes eroded in the bedrock of arroyos. Of these, Goodman tank is the best known and most accessible, but even this water must be piped from depths of several feet from the sands that fill the excavation. The placers in the Plomosa Mountains were supplied with water through pipe lines leading from the wells near Quartzsite.

The climate of the region is extremely arid. The mean annual precipitation at Parker,¹ near the north end of the reservation, is

¹ Bancroft, Howland, Reconnaissance of the ore deposits in northern Yuma County, Ariz.: U. S. Geol. Survey Bull. 451, p. 13, 1911.

only 4.27 inches, and the mean annual temperature for a period of 12 years is 70.9° Fahrenheit. The summer is intensely hot, and work in the open is then almost impossible, but the winter is delightful. The vegetation of the region is scanty and includes no trees suitable for use as mining timber: The bottom lands of Colorado River support good growths of willow and mesquite and a few cottonwoods; in the larger arroyos there are sparser growths of thorny shrubs, including ironwood, ocotillo, palo verde, and mesquite; and on the bench lands and hill slopes there are several varieties of cactus and small shrubs.

GEOLOGY.

Character of the rocks.—In this investigation detailed geologic work was done only in the part of the Dome Rock Mountains that is included in the reservation, but the general geology of the Plomosa Mountains and the southern part of the Dome Rock Mountains is described by Bancroft.¹ Igneous and sedimentary rocks in complex association compose these mountains, and they range from pre-Cambrian schists and gneisses to Tertiary or Quaternary volcanic rocks. The placer areas specifically examined in the Dome Rock Mountains and in that part of the Plomosa Mountains here referred to are composed of intrusive igneous rocks, some of which are of schistose structure and others of holocrystalline granitic texture. The ages of these rocks could not be determined from the geologic evidence nearby, although the schist is believed to be of pre-Cambrian age and the granite much younger and probably of Mesozoic age.

The ridges north of Tyson Wash are composed of intermixed schistose sedimentary and igneous rocks, into which are intruded narrow dikes of basic rocks, dikes and irregular masses of pegmatite and aplite, and an area of granite similar to that in the La Paz district. The metamorphosed sedimentary and igneous rocks are not differentiated on the map (Pl. IV). The rocks of sedimentary origin range from fine-grained silvery-white sericite schists to coarse-grained biotite schists with interbedded thin marble beds. Granite gneiss, amphibolite schist, quartz-epidote schist, and granite comprise the larger igneous masses in these ridges. Lava flows of Tertiary and Quaternary age occur throughout the eastern part of the Plomosa Mountains a short distance east of the area here considered.

Quartz-epidote schist.—A greenish-gray to black schistose porphyritic rock occupies the larger part of the Dome Rock Mountains within the reservation and probably much of the mountainous area east of the reservation. It forms relatively smaller areas of the ridges north of Tyson Wash. According to Bancroft it is the coun-

¹ Op. cit., pp. 22-36.

try rock in the vicinity of the New York-Plomosa placers east of Quartzsite. The rock is composed of quartz, orthoclase, and altered feldspars, some of calcic composition, more or less inclosed in an aggregate of epidote, sericite, chlorite, hornblende, and calcite. Locally magnetite is an important constituent. The rock exhibits varying degrees of schistosity, but large exposures show well-marked planes which trend from east-west to northwest-southeast and dip at an average of 30° to the north and northeast. The quartz-epidote schist is believed to have been derived from an intrusive igneous rock, probably a quartz monzonite or quartz diorite porphyry. This rock is of economic importance, for it contains the gold-bearing quartz veins in the La Paz district from which the placer deposits are derived.

Granite.—North of Goodman tank a light-colored granitic rock occupies a considerable area in the main Dome Rock Mountains and occurs in smaller masses in the ridges north of Tyson Wash. The rock is commonly of a medium-grained holocrystalline texture, but in places is coarsely granular, approaching a pegmatite. The crystals of quartz and feldspar are commonly intergrown. Orthoclase, oligoclase, and albite comprise the feldspars. Ferromagnesian minerals are variable constituents of the granite; in some localities they are practically absent or consist of sparsely distributed biotite and chlorite; in other localities hornblende, biotite, and chlorite are fairly abundant. The granite intrudes the quartz diorite and other schistose rocks of the region, and, as shown by the absence of dynamic metamorphism, is of much later age. The granite gneiss differs from the granite in composition by the arrangement of abundant biotite crystals in flow lines. Amphibolite and some of the biotite schists probably are derived from diabase and diorite.

Quaternary deposits.—Between the Plomosa and the Dome Rock mountains lies the gravel and wash covered desert of Quaternary deposits. Flanking the mountainous areas within the reservation, with their eastern limits undetermined, are the bench lands composed of unconsolidated sands, clays, and gravels deposited by Colorado River in Quaternary time during periods of aggradation. This bench-lands formation is correlated with the Chemehuevis gravel, as described by Lee,¹ who noted it at many places along Colorado River. Rapid erosion of the mountainous areas under desert conditions has produced thick wash deposits in the gulches and alluvial fans that extend for short distances from the base of the mountain slopes over the bench-lands formation. This material is unassorted and consists of angular rock fragments and sand. In the reservation

¹ Lee, W. T., Geologic reconnaissance of a part of western Arizona: U. S. Geol. Survey Bull. 352, pp. 43-47, 1908.

this wash is unconsolidated, but placer operators report that on the eastern slopes of the Dome Rock Mountains a cemented wash is overlain by incoherent material, and Bancroft reports that the placer workings in the Plomosa Mountains are in a conglomerate of the older rock fragments cemented by lime carbonate.

The bottom lands lying in the flood plain of Colorado River are deposits of river silt. During floods the plain is rapidly built up by fresh silt deposited from the heavily charged river waters.

PLACER MINES.

History.—Placer mining in this part of Arizona closely followed the discovery of the La Paz diggings. Part of the early history of these workings, in addition to that given by Mr. W. W. McCoy, was obtained from the report of J. Ross Browne in "Mineral resources of the States and Territories west of the Rocky Mountains," published in 1868. In January, 1862, Capt. Pauline Weaver was trapping along Colorado River, and at times would stray off into the mountains on prospecting trips for gold. The Indians, with whom he was on friendly terms, gave him some nuggets and, after Weaver had organized a party from Yuma, conducted him to the source of the gold. The party picked up \$8,000 in nuggets within a short time, but had to return to Yuma, 150 miles distant, for provisions. A rush from southern California and Arizona points immediately started for these placers, and within a short time hundreds of miners were prospecting the country around the original location.

The town of La Paz was established at the base of the bench lands near the river, the houses being constructed of adobe bricks. La Paz soon became the supply point of the surrounding region, and maintained its population of about 1,500 until 1864, when, with the apparent exhaustion of the placers and the discovery of new diggings, large numbers left the district. From this time the population steadily decreased, until, with the creation of the additions to the Colorado River Indian Reservation in 1873, 1874, and 1876, which included much of the placer ground and greatly restricted mining, La Paz was practically deserted, and the site of the once flourishing town is now marked only by disintegrating adobe buildings.

The old placer workings are in the gulches and on the western hill slopes of the Dome Rock Mountains, from 6 to 8 miles from La Paz. Water at the diggings had either to be hauled from La Paz or a small supply obtained from the Goodman tank. Mr. McCoy states that water packed from La Paz to the placers brought \$5 a gallon during the rush period. The gold was recovered entirely by dry washing in gold pans or wooden bowls called "bateas." Picks

and shovels were used to break up and handle the gold-bearing material, these implements being supplemented by Mexican miners by a steel bar 2 feet long. With such crude methods, it is apparent that only the coarser gold could be saved and only ground extremely rich would be payable. Nevertheless, it is estimated¹ that \$1,000,000 was recovered in the first year, and as much more in each following year until 1868. Since that time the production probably has been comparatively small. The gold particles or nuggets ranged in value from 5 cents to \$10, although \$20 and \$40 pieces were not uncommon, and the largest piece, or "chispa," taken out, found by Juan Ferrar, was valued at \$1,160. The production per man per day frequently exceeded \$100. With the introduction of the "dry-washer" machine, a few years after the district was discovered, greater quantities of material could be handled and a large saving of the gold effected, although by that time the richer ground had largely been worked over.

Dry-washer machines.—The machines used in "dry washing" are of several types, but probably the most efficient is that of the "bellows" type. In capable hands 6 cubic yards of material can be handled by a machine of the largest type by one man in eight hours, and the capacity of those of the smaller types, more commonly used, is 2 yards a day. The machine consists of a wooden framework, to which is attached a coarse screen, hopper, crank and gears, riffle board, and bellows. The material is passed through a screen having a quarter-inch mesh into a hopper having a capacity of 1 cubic foot, and then passes on to the inclined riffle board, 10 by 20 inches, which also is a screen surface with wooden riffles at right angles to its length. The pulsations of the bellows keeps the material in motion. Underneath the riffle board is a muslin cloth, stretched over the air chamber. The power for operating the bellows is a crank on geared wheels, and as the material passes over the riffle board the heavier particles are intercepted by the riffles and drop through the screen on to the cloth, while the waste material passes over the end of the board or is blown away by the air blast. The gold is obtained by panning the concentrates. It is apparent that the gold-bearing wash must run well above 50 cents per cubic yard in order that the operator may make miner's wages. Sporadic placer mining has been done with this machine by the miners at Quartzsite, but because of the variability of the gold content of the wash and the limitations of the machine no large areas have been thoroughly or continuously worked.

Areas of gold-bearing wash.—In the La Paz district the principal gulches or arroyos in which the gold-bearing wash occurs or to which

¹ Browne, J. R., Mineral resources of the States and Territories west of the Rocky Mountains, 1868.

the richest gulches are tributary are Goodman Arroyo and Arroyo La Paz, an arroyo at the southern boundary of the reservation. 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 piles of boulders and angular rock fragments, in exposures of bedrock where the wash was shallow, and in the deeper deposits by old shafts from which small drifts were driven in the hope of finding rich pockets. The thickness of the gold-bearing wash is variable, ranging from a few feet on the mountain slopes to an unknown measure in La Paz Arroyo 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. 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.

Character of gold-bearing wash.—The gold-bearing material consists of sand and clay inclosing angular rock fragments of greatly variable size. Tests indicate that about 20 per cent 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 substance readily disintegrates 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 concentrates, and boulders of magnetite, the largest weighing several pounds, are frequently found on the surface.

Present and contemplated operations in the La Paz district.—Occasional dry washing is done by miners within the La Paz district, and yearly assessments are maintained by parties who hope to gain title to placer tracts when the restrictions on mining within the reservation are removed. The most extensive preliminary work has been done by a California company, which, in addition to making tests, has leveled the top of a small hill for a reservoir site. This site, which stands at an elevation of 850 feet, is about 600 feet above the Colorado River bottom lands. Water for the reservoir could be obtained from wells near La Paz, which in an air line is but $4\frac{1}{2}$ miles distant. It is said that the company intends to hydraulic the gold-bearing wash from the smaller gulches and hillsides into the larger arroyos, where a dredge will be installed and the entire deposit systematically worked.

Placers on the east slope of Dome Rock Mountains.—There are several placer tracts on the east side of the Dome Rock Mountains in the large branch of Tyson Wash, west of Quartzsite, and in low-lying ground traversed by gulches tributary to it. Of these the Middle Camp, Orofino, and La Cholla placers are outlined roughly on the accompanying map. These placers have been worked intermittently on a small scale since the La Paz placers were discovered, and several attempts have been made to handle the ground on a large scale, but thus far these efforts have proved unsuccessful. At the time the region was visited the Orofino tract, owned by the Catalina Gold Mining Co., was the only one on which work was being done, and this work consisted of testing the ground, partly to determine its gold content and partly to determine the advisability of working the wash with dry concentrating machines of large capacity. The following information was obtained on the ground, the data as to the gold content and like matters being supplied by Mr. E. L. Dufourcq, the engineer in charge. The placer ground owned by this company comprises 640 acres of land in which test holes were sunk every few hundred feet. The holes ranged in depth from a few feet to 30 feet. The material taken from each excavation was run through a small concentrator to determine its gold content, and the results showed that the gold content ranges from a few cents to over \$1 per cubic yard, the average being 38 cents. The colors run from less than 1 cent to 24 cents each and the gold is fine, being worth about \$19 an ounce. The gold-bearing material differs from that of the La Paz placers in that it consists of unconsolidated rock débris and an underlying cemented gravel. The loose material ranges in depth from a few feet to 12 feet, and the cement is of variable depth—at least 18 feet in places. The gold is said to be distributed through

both the unconsolidated and the cemented material. The machine used in making the tests was a Stebbins demonstration dry concentrator. This machine consists of a metal frame on which is a perforated steel table with riffles parallel to its length. Underneath the table is a fan which supplies an air blast that is conveyed in a tube to the table and passes out through the perforations. The dry wash is screened through a quarter-inch mesh at the head of the table, and as the material passes onto the table the lighter particles are blown away or worked over the lower side and the concentrates are collected at the end. The power is a small gasoline engine, which operates the fan and gives to the table a vibratory motion similar to that of a Wilfley table. Its capacity is about 1 cubic yard an hour.

The Middle Camp and La Cholla placer tracts were not visited, but their situation is similar to that of the Orofino tract, in the arroyos tributary to Tyson Wash. At the Middle Camp placer it is reported that a dry concentrating machine having bucket-dredge excavator and capacity of 1,000 yards per 10-hour day was installed, but proved a failure because of the moisture contained in the wash at depths of a few feet. In any dry concentrating process in order to attain maximum capacity and to make high saving of gold content it is essential that the material be absolutely dry, and even in this arid region some of the material holds sufficient moisture to greatly hamper the handling of large quantities of it. The bedrock of the La Cholla placer tract is reported to be schist derived from sedimentary rock. This schist is said to contain many small auriferous quartz veins, and the gold-bearing material is a hard siliceous cement that must be crushed before the gold can be recovered.

No survey was made of the placer ground on the east side of the Dome Rock Mountains, but the deposits are extensive enough to merit serious attention. It is believed that the deposits can be worked best by hydraulic methods, by means of storage reservoirs on one of the many small hills that overlook the placer ground. The water would have to be pumped from Colorado River with a lift of about 1,000 feet. The gold-bearing débris of the smaller gulches and mountain slopes could then be washed into the larger arroyos, where the entire deposit could be worked by dredge or by sluicing, although the slope of ground is rather low to permit easy disposal of the waste rock.

Deposits in the Plomosa Mountains.—Placer deposits on the southwestern slopes of the Dome Rock Mountains, 5 miles southeast of Quartzsite, have been worked intermittently on a small scale for many years. These placers were examined in 1909 by Howland Bancroft, and the following data are taken from his report.¹

¹ Op. cit., pp. 87-88.

Of the companies that own placer tracts in this area, the New York-Plomosa Co.—

has installed large machinery, laid a 7-mile water-pipe line without any expansion joints, and has got all ready to work the placers. For some reason only one run had been made prior to May, 1909, the results of which were not available. * * *

There has been installed on the property the following machinery: Three 100-horsepower boilers, one 300-horsepower Corliss engine, two Williams mills, two Huntington mills, and various accessories. The pipe line which furnishes the water used on the property is approximately 7 miles long and is about 5 inches in diameter, the difference in elevation between the two terminals of the line being approximately 400 feet.

The ground has been prospected by a great many small tunnels with frequent openings to the surface and an occasional larger adit tunnel run along the bed-rock. The vicinity had previously been prospected by "dry washers," and consequently the underground work resembles a network of small burrowings, some of which a man can scarcely drag himself through. * * *

In certain old drainage channels which led away from the southwestern part of the Plomosa Mountains is found an auriferous conglomerate of granite, schist, and quartz fragments cemented by lime carbonate. In thickness this conglomerate or "cement rock" varies from a few inches to a great many feet. * * * It was evidently the intention of the company to work the cemented material in mills.

A recent communication from Mr. Beggs states that these placers are again receiving attention, and that a dry concentrating plant, costing \$60,000, is to be installed. Numerous tests have been made and a large area of ground has been blocked out, which is said to run 50 cents per cubic yard. Water in sufficient quantity for the needs of the camp was obtained in a well at a depth of 300 feet.

GOLD QUARTZ VEINS.

The auriferous quartz veins in the vicinity of the La Paz diggings were probably discovered at the same time as the placers, for in places they form conspicuous outcrops with abundant float. The decomposition of these veins has produced the placer gold for the largest areas of gold-bearing wash are found along the more persistent quartz veins on which mining has been done. These veins are generally distributed through the metamorphosed pre-Cambrian igneous and sedimentary rocks, although they are more numerous in the country rock of the La Paz placers than in the sedimentary schists. The veins are of two types—those that lie in the planes of schistosity and those that cut across them. In the La Paz district the veins of the first type are comparatively large and persistent, trending from east-west to northwest-southeast, and those of the second type consist of numerous north-south trending gash veins. On the west ridge north of Tyson Wash two large quartz veins of east-west trend cut

across the schistosity of the inclosing rocks, and other smaller veins trend in various directions. The larger veins of east-west trend have been mined or prospected, but those of the gash vein type, although reported to be gold-bearing, are too small for exploitation. The failure to develop these veins more fully is due to their remote situation and the inability of the owners to acquire title under the mineral laws, for all the prospects here described except one are within the reservation.

MINES AND PROSPECTS.

Goodman mine.—The Goodman mine is on the Goodman vein, which trends from northwest-southeast to east-west and can be traced for 3 miles, its eastern limits of outcrop being the wash-filled arroyo traversed by the Quartzsite-Ehrenberg road, and the faulted portions of its westward extension being traceable to the bordering bench lands about a mile south of the Goodman tank. The vein varies greatly in width, ranging from a mere seam to a vein 40 feet wide and averaging in width probably 10 feet. It occupies a shear or fault zone in the quartz-epidote schist. It dips generally to the north at angles ranging from 30° almost to 90°. The development consists of several inclined shafts sunk on the vein and connecting tunnels. One incline is 120 feet deep with connecting tunnel 140 feet long and 120 feet of drifts; another tunnel is 240 feet long. The vein material is a massive iron-stained quartz containing small cavities resulting from the weathering of pyrite, which is distributed through the vein but is usually more abundant along the walls and for a short distance in the inclosing wall rocks than elsewhere. The gold is contained in the pyrite and can at many places be seen in the oxidized ores. About \$40,000 was obtained from the Goodman mine prior to 1900, and since that time Mr. W. E. Scott, of Quartzsite, has mined ore to the value of \$9,000, the average tenor of which was \$65 per ton. The ore was hauled 15 miles to Quartzsite and there treated in a small amalgamation mill. The mine is not worked at present, although yearly assessments are maintained.

Golden Hope claims.—The Golden Hope claims are on the Goodman vein near the east reservation line. The workings consist of two shafts, each about 30 feet deep, and two tunnels, 30 and 70 feet long, respectively, which cut the vein at shallow depths. In a recent communication Mr. Beggs stated that a large shoot of milling ore running \$30 per ton in gold had been opened in these workings and that the company owning the property was contemplating the erection of a mill to treat the ores.

The west end of the Goodman vein is covered by claims located by Mr. Beggs, who stated that he obtained an assay of \$200 per ton

in gold on ore taken from a small discovery hole sunk on the vein. The vein at the west end is of irregular shape; in places it is 40 feet wide but in a short distance pinches to a mere seam or is cut out by faults. The inclosing wall rocks are crumpled and folded quartz-epidote schists.

Mariquita prospect.—This property was not examined by the writer but is described as follows by Bancroft:¹

The Mariquita prospect is located about 6 miles west of Quartzsite, the road leading to it branching from the Ehrenberg stage line some 4 miles out of Quartzsite. It is situated 2 miles north of the stage road, at an elevation of 1,100 feet on the southeastern side of a saddle which occurs midway in the Dome Rock Mountains.

Medium to fine grained quartz-mica schists, apparently intruded by much younger fine to medium grained granites or quartz monzonites, are the rocks in the immediate vicinity. The schists strike northwest-southeast and dip 20° NE., and they contain, besides the quartz and mica, much epidote and chlorite, with a large percentage of orthoclase feldspar and some unaltered but contorted biotite crystals.

A fairly large vein of quartz, carrying a little copper and gold, which has been roughly prospected, is the source of the ore extracted from this property. The vein strikes S. 20° E. and dips 20° NE., and lies in a slip or fault between parallel schist strata. In width the vein varies from a few inches to several feet, is fairly persistent in length, and apparently is lenticular. As the workings on the property are old and not very extensive, little accurate data on the size of the ore body were obtained.

Dan Welsh prospect.—The Dan Welsh prospect is on the summit of a ridge near the south boundary of sec. 32, T. 6 N., R. 21 W. Little work has been done on it, and it was deserted at the time of the writer's visit. The development consists of a shaft 12 feet deep and several open cuts and short tunnels, which explore a quartz vein whose average width is 2 feet. The vein trends east-west, dips from 60° N. to vertical, and can be traced 1,000 feet, pinching to a mere seam on the west side of the ridge 400 feet from the shaft and disappearing beneath outwash deposits on the east side of the ridge. The inclosing wall rocks are a sandy mica schist of sedimentary origin and granite gneiss and amphibolite schist of igneous origin, all of pre-Cambrian age. The schists trend about north-south and dip 20° E., and the fracture filled by the quartz vein cuts squarely across the schistose structure. The vein matter is a massive vitreous, iron-stained quartz containing plentiful disseminated pyrite cubes from an eighth to a quarter of an inch square or crystal aggregates an inch or more in diameter. The oxidized portion of the vein, which extends to the bottom of the shaft, contains cavities from which pyrite has been weathered. The iron oxides contain here and there specks of gold and along the fracture planes in the quartz there are

¹ Op. cit., pp. 81-82.

dendritic flakes suggesting secondary deposition. The ore is apparently of high grade; its exact tenor is not known. A stack of 50 sacks of ore was found in the gulch leading down from the prospects on the west slope of the ridge, and another pile of 20 sacks, with several tons of unsacked ore, was found at the shaft. It was reported that the owners of this prospect packed the ore to Colorado River, 6 miles distant, and there treated the ore in an arrastre with mercury to recover the gold, but they were not allowed to continue operations.

Mammoth prospect.—The Mammoth prospect is in sec. 12, T. 5 N., R. 21 W., near the base of an eastward-trending ridge. An old incline, now inaccessible, but probably several hundred feet deep, is sunk on a faulted quartz vein of variable width, which trends about N. 70° E., and is traceable to the west for 1,000 feet, mainly by abundant float. At the shaft the vein is 10 feet wide. No work has been done here in recent years, but in 1914 the prospect was relocated and is now known as the Apache No. 2. The country rock is a dark schistose porphyry containing prominent feldspars inclosed by biotite, chlorite, and epidote. The vein matter is a massive white quartz slightly stained with iron and copper salts, with sparsely disseminated pyrite. The ore is said to be valuable only for its gold content, but its tenor is not known.

