History of the Atlanta Mining Area,
Elmore County, Idaho

Victoria E. Mitchell
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INTRODUCTORY NOTE

The information presented here is from a number of published and unpublished sources in the Idaho Geological Survey's mineral property files. Where not otherwise noted, most of the mine operation data is drawn from the U.S. Geological Survey's (USGS) annual volumes on *Mineral Resources of the United States* (1882-1923) and the equivalent volumes produced by the U.S. Bureau of Mines (USBM) (*Mineral Resources of the United States*, 1924-1931, and *Minerals Yearbook*, 1932 to present). In addition, detailed information on the early operations of the district is drawn from reports on mining activities in the states and territories west of the Rocky Mountains published between 1867 and 1877 and from the reports of the Director of the Mint (DotMR) on the production of precious metals in the United States (1881-1893). Information on underground workings and mine equipment is generally from the annual reports of the Idaho Inspector of Mines (IMIR) published from 1899 to 1979. After 1974, the Mine Inspector's office was known as the Mine Safety Bureau, a section of the Idaho Department of Labor and Industrial Services. Detailed accounts of mine operations are, for the most part, drawn from the annual reports prepared by the companies for the State Inspector of Mines; these reports were required by law and the information contained in them formed the basis of the Mine Inspector's annual reports. More recent developments are taken from the Idaho Geological Survey's (IGS) annual reviews on the developments in mining and minerals in Idaho (from 1984 to present) or from similar documents produced by the Survey's predecessor, the Idaho Bureau of Mines and Geology (IBMG) from 1975 to 1984. *The Northern Miner* CD-ROM (1987-1997) was used to supplement other sources for the relevant years. Other published sources are referenced in the text. A complete bibliography is included at the end of this history. Where direct quotations are taken from source materials, the original spelling and grammar are preserved even in cases where they do not conform to currently accepted usage. Funding for this project was provided by the U.S. Environmental Protection Agency, Region 10.
History of the Atlanta Mining Area, Elmore County, Idaho

Victoria E. Mitchell

INTRODUCTION

The Atlanta district is in northeastern Elmore County near the headwaters of the Middle Fork of the Boise River (Figures 1 and 2). It is about 80 miles by road from Mountain Home and 56 miles east-northeast of Boise by air. Elevations range from about 5,300 feet near Atlanta to around 7,200 feet on Atlanta Hill (Figure 3). The mountainous country surrounding Atlanta and the winter snowfalls have, at times, been major obstacles in transporting supplies and equipment to the mines and shipping ore to market. Although the first discoveries in the area were made in 1863, goods and ore could only be transported by pack train until 1878, when a road from Rocky Bar was finally completed (Wells, 1983). This road ("Boiler Grade" on the Atlanta side of the divide) reaches an elevation of 7,727 feet where it crosses the divide between Rocky Bar and Atlanta.

Clayton (quoted in Raymond, 1877, p. 213) described this route:

The only line of approach to this mountainous region at present is from the southwest, by way of Rocky Bar, the county-seat of Alturas County. A fair wagon-road has been made from Rattlesnake Station (on the overland road to Boise City and Eastern Oregon) to Rocky Bar. From this station the road runs northeasterly across the range of lava and porphyry hills into Little Camas Prairie, and thence by the mouth of Lime Creek to the South Boise River, thence up the river 10 or 12 miles to a tributary that joins it from the north, thence

1 Idaho Geological Survey, Main Office at Moscow, University of Idaho, Moscow.
Figure 1. Index map showing the location of the Atlanta district (Anderson, 1939, Figure 1).
Figure 2. Topographic map of the Atlanta area and vicinity (U.S. Geological Survey Idaho City 1:100,000-scale metric topographic map).
Figure 3. Topographic map of the Atlanta mining area, Elmore County, Idaho (U.S. Geological Survey Atlanta East and Atlanta West 7.5-minute topographic maps). Most adit locations are from Anderson (1939). Mines and mills are plotted from the best available information, but locations for properties operated before 1900 and for those mines for which no maps exist are approximate.
up this northern branch and its side ravines to Rocky Bar, a distance of about 55 miles from Rattlesnake Station. Here the wagon-road practically ceases, and the remaining distance of 18 miles one follows a steep bridle-path, or pack-trail, over the mountain-range which lies between the South and Middle Forks of the Boise River. A wagon-way—not a road—has been made across this divide, by which heavy machinery has been hauled over, at great labor and expense, to Atlanta City, but all kinds of supplies that can be packed on mules are transported in the old Mexican style. A fair wagon-road could be made over this route at an expense of $15,000 to $20,000, but it would be useful only during the summer and fall months—say about six months in the year. From November to June the deep snow obstructs all communications, except an occasional messenger, who makes the trip across the mountains in Norwegian snow-shoes. Thus, six months of the year Atlanta district is shut out from the world, isolated and alone in the bosom of the grand old mountains. There is one possible outlet that will in time be made for this isolated district—the only one that can be made passable during the winter season—and that is down the cañon of Middle Boise. To build a road down this cañon, a distance of 30 miles, will require $50,000 or $60,000, but the importance of the mines of the district will warrant the outlay. This road could be kept open all winter to Boise City, and supplies of every kind would come from that city instead of the difficult and uncertain route by the way of Rocky Bear [sic]. Boise City can afford to make this road, independent of any outside help. If her citizens intend to consult their own interest, they must construct radiating lines of road into the important mining-district, so as to concentrate the trade of the interior and make their city the great distributing-point for the western part of the Territory.

Even in the late 1930s, transportation and communications for the mining area were not easy. According to Anderson (1939, p. 3-4):

Until September, 1936, the only road to the district extended from Mountain Home, but another from Boise was completed during the latter part of the month - giving the district an approach by two different routes. The road from Mountain Home is 80 miles long, part of it over mountain ridges, part of it along the South Fork of the Boise River. Between Rocky Bar and Atlanta it is blocked by snow for six months of the year, generally from December until late in June. During these months, the district has been cut off from the outside world, except by snowshoes and air plane. When the St. Joseph Lead Company began operations in 1931, a landing field was cleared along the Middle Fork of the Boise River a short distance from Atlanta. Since then, the district has had tri-weekly mail and passenger service from Boise from December until June. After the St. Joseph Lead Company had suspended mining operations, the plane service was changed to a bi-weekly schedule in December, 1936. The service was discontinued altogether in 1938. During the open season, the mail is brought in from Mountain Home by tri-weekly stage. Most of the food and mining supplies are trucked in during the open season although perishable foods are available throughout the year by stage in summer and plane in winter. The ore concentrates were stored during the closed season, but were trucked to Mountain Home during the summer and autumn. Mountain Home, on the main line of the Oregon Short Line (Union Pacific system), has been the source of freight and express for the district and shipping point for the concentrates, but all telegraphic and phone communications have been handled through Boise. The completion of the road from Boise at water grade along the Middle Fork of the Boise River has extended the trucking season and has made Atlanta accessible by road throughout the greater part of the year. This road is only a few miles longer than that from Mountain Home and has no steep grades. All mail now reaches Atlanta from Boise by the river road.

Access to the Atlanta area has not changed significantly since the late 1930s. Although the unpaved road from Boise to Atlanta is kept open during the winter, it is rough and
narrow. The 86-mile trip normally requires about three hours to complete (Kiilsgaard and Bacon, in preparation).

GEOLOGY

The ore deposits in the Atlanta area are epithermal gold-silver lodes (Anderson, 1939) in a northeast-trending fault zone that cuts biotite granodiorite of the Idaho batholith (Kiilsgaard and Hingley, 1989; Figure 4). The biotite granodiorite on Atlanta Hill is conspicuously porphyritic with large flesh-colored or light gray microcline phenocrysts (Anderson, 1939; Taylor, 1986). This rock is similar to the main body of the Idaho batholith in the surrounding area (Worl and others, 1991).

The Atlanta lode is about 2 miles long and ranges in thickness from 40 to 120 feet. The lode strikes N. 50° to 70° E. and dips steeply. The rocks in and near the lode have been argillically altered and locally silicified. The ore minerals were deposited concurrently with the silification (Anderson, 1939; Kiilsgaard and Hingley, 1989). Extensive gash veins intersect the lode obliquely and extend northwest and southeast away from the lode. The gash veins are in tensional fractures that formed from structural adjustments along the lode (Kiilsgaard and Hingley, 1989). Anderson (1939, p. 36-37) describes the lode in detail:

The Atlanta lode has been traced for nearly 2 miles across Atlanta Hill in a direction about N. 60° E. (fig. 2 [Figure 5]). Neither the lode nor the shearing are known to extend across the Yuba River and Montezuma Gulch. However, a faulted segment is believed to continue up Flint Gulch about 1,800 feet southeast of the saddle at the head of Montezuma Gulch and the bold quartz cropping of the offset has been traced northeast for more than half a mile. The strike of the lode varies somewhat from N. 60° E. On the surface, the extreme northeast part dips steeply southeast, but at shallow depth the dip reverses to steeply northwest and the average dip of the northeast third of the lode is of 70° to 80° NW. The middle part of the lode dips steeply southeast but the southwestern end dips steeply northwest at depth.

This lode is by far the largest in the district and is remarkable for its thickness, which ranges from 40 to 120 feet, 60 to 70 feet representing a fair average. However, the thickness also varies with depth just as the strike did. Unfortunately, only a relatively small part of the lode-filling is commercial ore. Commonly, the shoots range from 5 to 6 feet thick; exceptionally, they attain in 35 feet. They extend for distances of 250 to 800 feet on either strike or dip.

The general form of the lode is more or less tabular. Locally, it is joined by numerous gash laterals and it divides to form two major forks. The laterals which extend from the main lode, both N. 80° W. or S. 80° E., dip steeply northeast[,] They are usually less than two feet thick next to the main lode and not more than 3 to 6 inches thick, 50 to 100 feet away. Some of them have contained veins of very rich ore, particularly near the surface, but with depth they decrease in number and size, and disappear almost entirely in the lowest mining levels.

The branches of the Atlanta lode are very much larger. One extends from the Boise-Rochester ground across into the Monarch on the northeast half of the lode. The lode appears merely to widen where it branches, but the hanging wall branch gradually swings away from the main lode in a west-southwesterly direction, curving more and more to the west and within 500 feet it has become completely detached and in another 500 feet is separated from the main lode by 140 feet of unbroken rock and is striking west-northwest (N. 80° W.) at the same angle
Figure 4. Geologic map of the Atlanta area (Worl and others, 1991). Kqd = Cretaceous quartz diorite; Kgdk = Cretaceous potassium-rich hornblende-biotite granodiorite; Klg = Cretaceous leucocratic granite; Tqm = Eocene quartz monzodiorite; Tg = Eocene granite; Ta = Eocene andesite dikes; Tr = Eocene rhyolite dikes; Tb = Miocene basaltic dikes; Qhg = Pleistocene high gravels; Qm = Pleistocene glacial deposits; Qt = Pleistocene terrace gravels; Qa = Holocene alluvium; labels in smaller letters are dike rocks. Heavy lines are high-angle normal faults, dashed where approximately located, dotted where concealed; ball and bar on downthrown side. Scale approximately 1:125,000.
Figure 5. Topographic and geologic map of a part of the Atlanta district, showing the Atlanta lode and other veins (Anderson, 1939, Figure 2). Contours and claim boundaries shown by dashed lines are approximate.
as the oblique laterals. Its thickness is about 40 feet at that point. The lode branches again near the southwest end of lode nearly 4,000 feet from the first.

The shear zone, which contains the Atlanta lode, is complicated in detail and extends beyond the limits of the lode itself. The ore is confined to those parts of the shear zone where the country rock has been most intensively fractured, or brecciated. The shear zone is made up of a set of fractures having the same trend as the zone itself, but it also contains a fairly prominent set of west-northwest fractures. Not uncommonly a prominent northeast fracture or fissure, when traced to the southwest, curves to the west and merges with a west-northwest set, at the same time becoming much less conspicuous. The shear zone also contains subordinate nearly flat, fractures and other fractures of diverse trend, some of which were produced later, and are, therefore, not an actual part of the original zone of shearing. Some of these that trend northwest offset the main fracture zone.

The distribution of the fractures and the slickensides on the ore show that the movement which accompanied the fracturing was largely horizontal with a small vertical (normal) component, the northwest side of the shear zone having moved northeast with respect to the southeast side. With depth the west-northwest fracture planes, as well as the gash fractures of the same trend on the wall rock, became less conspicuous and apparently decrease in number and size. Only the fractures parallel to the shearing seem to persist.

The dominant mineral in the deposits was fine-grained quartz, accompanied by widespread, finely crystalline arsenopyrite and lesser amounts of pyrite. The ore minerals were gold, complex silver sulfosalts, and negligible amounts of lead, zinc, and copper sulfides (Anderson, 1939; Table 1, Figures 6 and 7). Most of the bonanza zones mined in the early days were characterized by silver minerals. These zones were found within 200 feet of the surface. By weight, silver was more abundant than gold, but the gold was more widely distributed both laterally and vertically. Most of the gold was in microscopic grains and, even in the richest ore, was not visible to the naked eye (Anderson, 1939). Clayton's (1877, p. 471-472) account of the deposits contrasts with many contemporary and later reports of the fabulously wealth and extent of the Atlanta lode:

The vein structure or gangue is quartz, with inclusions of granite in the form of "horses," some of which are very large. The structure of the quartz is somewhat granular and friable, very much like that in the Comstock lode.

The metallic contents are gold, native silver, ruby silver, brittle silver ore, and sulphide of silver. The brittle silver, or black antimonial silver, is the most abundant ore. Next in quantity and value is the ruby silver. The native silver and silver glance are found only in small quantities. The free gold constitutes from 20 to 40 per cent. of the total value. The other minerals are iron pyrites in moderate quantities disseminated through the granular, friable quartz, and the granite inclosures of the lode. I saw but little traces of copper, zinc, or lead. In fact, this lode carries the purest ores of silver that I have ever seen in any extensive mine.

Much of the quartz in this lode is comparatively barren. The rich streak of black sulphuret [sulfide] and ruby ore varies in width from one foot to six or seven feet, and alongside of it is a zone of pay rock equally as wide that carries a good percentage of free gold with silver ore disseminated through it, making the pay streak from two to fifteen feet wide, and extending in length underground in the Monarch and Buffalo claims nearly two thousand feet on the course of the lode.

No rich silver ore has ever been found on the surface outcrop of the lode; occasional bunches of rich gold-bearing quartz have been found, and the surface dirt along the entire
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<th>Table 1. Mineralogy of the Atlanta lode (from Anderson, 1939).</th>
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Table 1 (continued). Mineralogy of the Atlanta lode.

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<td>Sericite</td>
<td>H₂KAl₂(SiO₄)₃</td>
</tr>
<tr>
<td><strong>Sulfates</strong></td>
<td></td>
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<tr>
<td></td>
<td>Hypogene (?)</td>
<td></td>
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<tr>
<td></td>
<td>Gypsum</td>
<td>CaSO₄·2H₂O</td>
</tr>
</tbody>
</table>
Figure 6. Photomicrographs of polished sections of Atlanta ore, showing relationships between minerals (Anderson, 1939, Plate 3). A — Gold grain (Au) in third-stage comb quartz (dark gray), with an admixture of galena (g) and pyrargyrite (p) filling between quartz crystals. B — Gold (Au) replacing chalcopyrite (c), both filling between third-stage quartz crystals (black). C — Gold (Au) replacing third-stage pyrite (py). Galena grain (g) is also present. D — Gold (Au) in contact with pyrite crystal (py), and replacing light gray chalcopyrite (p) and darker gray tetrahedrite (T). All images magnified 115 times.
Figure 7. Photomicrographs of polished sections of Atlanta ore, showing relationships between minerals (Anderson, 1939, Plate 4). A — Gold (Au) replacing chalcopyrite (c) and tetrahedrite (T). B — Gold grain (Au) associated with pyrargyrite (p) and tetrahedrite (T). Tetrahedrite and pyrargyrite contain some elliptical grains of galena (g). C — Exploded bomb structure resulting from the replacement of pyrite (mineral with high relief) by tetrahedrite (T). Tetrahedrite is in turn replaced by chalcopyrite (p). D — Intimate relations of tetrahedrite and enargite (etched mineral of darker color, showing peculiar line pattern). All images magnified 115 times.
length of outcrop contains free gold. I could not find any distinct traces of chloride of silver anywhere on the lode. . . . In fact the croppings appear to have been impoverished by oxidation and leaching out of nearly all the silver above the water line. . . .

It does not follow that the lode carries rich silver ore below the water line throughout its whole length. If it did, it would be a remarkable exception to the general rule. The probabilities are that there are a number of rich chimneys in the lode, with poor or even barren spaces between them; but as the rich silver ore does not come to the surface, the position of the rich ore bodies can only be ascertained by underground explorations. As a rule, however, those portions of the outcrop that carry the most free gold will be the richest in silver below the water line.

Anderson (1939, p. 38-41) described the distribution of the orebodies and of the ore within the orebodies:

Although the mineralization is nearly as widespread as the shearing and fracturing, the shear and fracture zones are by no means uniformly or evenly mineralized, particularly with valuable ore minerals. Commercial ore is confined to more or less well-defined zones or shoots, apparently localized by structural conditions. The lodes contain numerous horizons of altered or partly altered country rock, zones of more or less massive quartz containing innumerable angular inclusions and phantom inclusions of silicified quartz monzonite, and also zones showing particularly intensive brecciation and fissuring, and containing veins of ore. Where the lode is as much as 40 to 80 feet wide, the mineable ore may be only 5 or 6 feet wide, and it usually lies along either the hanging wall or footwall, or both. Such shoots as are favorable to the occurrence of ore may be from 250 to 800 feet long. They are separated by areas of low-grade ore of equal size and may extend to depths of 300 to 800 feet. Those on the Atlanta lode are perhaps larger and more persistent than most of those on the oblique laterals.

Atlanta lode

Distribution and size
The Atlanta lode has six main ore bodies, or ore shoots (fig. 3 [figure 8]), named from northeast to southwest the Old Chunk, Central, Pettit, Monarch, Buffalo, and Idaho (Atlanta). These are spaced at irregular intervals over a distance of more than 5,000 feet along the lode and are separated by similar areas of "barren" lode material. These ore bodies range in stope length from about 250 feet to about 800 feet, and are distributed over a vertical range of about 1,000 feet. The individual shoot(s) have a known pitch length of from 300 to 800 feet. All but one reach the present surface.

The size of these ore bodies is variable. The Old Chunk contained mineable ore for a distance of 620 feet along the lode and to a depth of 400 feet, most of the ore being confined to a segment 600 feet long by 300 feet deep. The thickness varied somewhat, but mostly ranged between 3 and 6 feet. The adjacent shoot, the Central, failed to reach the surface, but extended to greater depth than any other, more than 100 feet below the next deepest. This ore body was 350 feet broad and had a pitch length of 570 feet. The thickness was from 3 to 5 feet, not differing much from that of the Old Chunk.

The largest shoot was the Pettit, about 300 feet southwest of the Central. It was productive over a maximum range of 800 feet both vertically and horizontally. A part of it was about 35 feet, but most of it was no more than 5 or 6 feet thick. The Pettit shoot, however, was not a single body, but a composite of three; one along the hanging wall of the lode, the largest along the footwall, and the third, a southeast oblique ore shoot, linking the hanging wall with the footwall. The ore body along the hanging wall actually lay along a major split in the lode and had ore for a distance of 400 feet over a vertical range of 600 feet. The shoot joined the footwall ore body at the top. Its average thickness was from 3 to 5 feet[.] The oblique ore shoot
connecting the hanging wall shoot with that on the footwall was stopped for a distance of 180 feet over a vertical range of 350 feet and for an average thickness of 3 feet. By far the largest shoot of the composite ore body was that along the footwall, in the main part of the lode, which was stopped 800 feet vertically over a maximum horizontal distance of 900 feet, its thickness ranging from 5 to 35 feet. The ore body as a whole was somewhat irregular and its upper half (footwall shoot) was twice as long as its lower half.

Although it was the most famous of the ore bodies, the Monarch is not the largest. It, too, was more or less composite and contained ore shoots along both the hanging and foot walls. Most of the shoots were less than 6 feet thick and extended along the strike for 850 feet. The shoots decreased rapidly in length less than 200 feet below the surface. Some ore was mined to a depth of 600 feet, but the larger part was more than 300 feet above or half way to the surface. The next shoot[,] the Buffalo, although the smallest of all, was mined to about the same depth. Its overall length was only 250 feet, and its thickness was about the same as that of the Monarch ground. In general, the ore was more abundant and the body thicker along the hanging wall than along the footwall.

The sixth and most westerly shoot, about 1,800 feet southwest of the Buffalo, had an overall length of about 600 feet and contained commercial ore to a maximum depth of 400 feet. Its thickness was from 3 to 4 feet.

Many of the oblique veins contained seams of rich ore near and at their junction with the main lode. Although productive near the surface, these veins only persisted to shallow depths, and, except for an oblique vein being mined by the Talache Mines, Inc., in 1938-39, in no case to the depth reached by the ore shoots along the main lode. On the other hand, the larger laterals have not been productive on or near the contact with the main zone, and have produced ore only on and near the surface, like the gash veins, they were impoverished at shallow depths.

Structural control

The distribution of the ore bodies appears to be rather closely associated with variations in the strike of the main lode. They are found in those parts of the lode where the strike diverges slightly eastward from the average trend of the lode (fig. 4 [Figure 9]). The zones of greater porosity have been produced by the movement of the walls along a curved shear zone.

As these zones with divergent strike were repeatedly reopened, each structural adjustment probably acted in the same direction as the earlier, and each was permitted to receive minerals during each pulsation of the mineralizing fluids. They were especially adapted to receive the third stage ore-bearing solutions, which apparently lacked the extensive penetrating power of the two preceding stages and was therefore destined to receive the commercial ore. Although the intervening zones were also broken during each structural movement and the earlier fillings more or less severely brecciated, the resulting pore space was apparently not so great as in the divergent zones and not as suitable for the deposition of the ore minerals. Such areas comprise the zones of "barren" or low-grade ore.

Although some ore bodies are notably thicker where the dip is steep than where it is flat, changes in the dip have played a minor role in the localization of the ore bodies. This increase in thickness is apparently a reflection of the small vertical component of the movement (fig. 5 [figure 10]).

Distribution of the ore

Although much of the lode is a filling and replacement of breccias, first of country rock and later of country rock and the earlier fillings, the ore itself is confined to the zones of most extensive brecciation in those parts which were more or less continuously reopened by the structural movements during the period of ore deposition, and in the same parts which later facilitated the introduction of calcite. The ore was deposited mainly as a filling in open spaces,
Figure 9. General plan of the workings along the Atlanta lode as of April 1935 (Anderson, 1939, Figure 4). Sections A through K are shown on Figure 10.
Figure 5. Cross sections of the workings and ore shoots along the Atlanta lode.

Figure 10. Cross sections of the workings and ore shoots along the Atlanta lode (Anderson, 1930, Figure 5).
either in fairly continuous strike fractures or in those of oblique trend. The sulphides were
deposited between the crystals of quartz combs and on the quartz druses. The gold itself was
apparently capable of penetrating and being deposited in the adjoining fragments and masses
of the earlier arsenopyrite-bearing quartz.

Much of the ore in the shoots has been in the form of overlapping lenses 4 to 12 feet
wide, overlapping on both strike and dip, which trend and pitch slightly oblique to the strike
and dip of the lode itself. The lenses were usually composed of a major layer of ore several
inches to several feet thick, which lies parallel to the long dimensions of the body, but the
shoots also contain minor veins and stringers. The layer of ore generally extended into a
southwesterly direction, and near the end of the lens curved to the west-northwest and
diminished in size. The ore then continues along an overlapping lens having the same
characteristics as the preceding. Some of the layers of ore contained more or less well-defined
streaks which were very rich and contained ore high in gold and silver. Ore lenses ended
above and below by pinching.

The ore was by no means uniformly distributed through the ore shoots, but was most
abundant and richest in the upper parts, largely in the form of streaks and bunches high in
silver and gold. The range of commercial deposition was, however, comparatively shallow. A
few hundred feet down the bonanzas were replaced by bodies of lower-grade ore containing
few streaks of high-grade. The commercial limits of the deposition were reached within 400 to
800 feet. Silver was much more abundant in the upper parts of the lode than at depth and the
content declined much more rapidly than that of gold. Silver did not have the horizontal
distribution of the gold and its minerals were most abundant in the upper parts of the Monarch
and Buffalo shoots and relatively absent in the Old Chunk and Central ore bodies.

Although the content of the metals was largely determined by the intensity of the
third-stage metallization, the ore bodies generally do not contain much quartz of the first
generation even though they do contain much larger amounts of the second-stage quartz and
arsenopyrite. The ore minerals are mostly in breccias and fissures in the arsenopyrite-bearing
quartz, and partly fill openings in the earlier quartz. The comb and drusy quartz is much less
abundant between the ore bodies. However, in places, it has permeated the brecciated zone and
almost closed the openings so as to leave no space for the deposition of the ore minerals. These
more or less “barren” zones usually contain much more of the early massive quartz and as
much of the arsenical-bearing quartz as in the ore shoots. These show the usual extensive
brecciation and the phantom inclusion of older fillings and country rock in the younger, but
show fewer open clefts and druses. The filling itself has not been as extensively broken by
post-ore movements as that within the main ore bodies. The thick layer of gouge, which lies
along the footwall of some of the ore bodies, is largely absent along the intervening “barren”
zones.

Zoning

The good ore, although confined to comparatively shallow depths, shows some
evidence of zoning, particularly in the distribution of the gold and silver. This zoning is
revealed by the fact that gold is distributed more widely and deeply than the silver. The silver
is restricted to the upper parts of the ore bodies in and near the Buffalo and Monarch shoots,
and is most abundant in the upper part of the Buffalo. For this reason, the district was better
known in the early days for the richness of the silver ores than for its gold ores. From the
Buffalo as a center, the quantity of silver declined outward in both directions along the lode.
Although it was still prominent in the Monarch and to some extent in nearby parts of the
Pettit, it did not extend to the Central and Old Chunk ore shoots. Similarly, its quantity
decreased abruptly with depth and silver minerals were of little consequence more than 200 feet
below the surface. Small amounts appeared here and there at greater depths. The range of gold
metallization appears to have been about twice that of silver, both vertically and horizontally.
Tenor of the ore

The tenor of the ore has varied greatly in the different ore shoots and in different parts of the same ore shoots, having been highest in the upper parts of each. Much of the ore mined prior to 1876 was rich enough to stand shipment by pack train and wagon to the railroad 230 miles away and by rail to smelters in Omaha and New Jersey. The value of many of these shipments averaged more than $700 a ton, some as much as $2,000 and small lots as much as $11,000. After the upper parts of the shoots had been robbed of their bonanzas, ore assaying several hundred dollars to the ton was milled. When the heads declined to $30 a ton, mining operations were no longer profitable because only a part of the value could be recovered by amalgamation. Later improvements in milling methods permitted ore of somewhat lower grade to be mined, but the tenor of the mined ore still remained notably high.

With current methods of processing large quantities of very low grade gold ore, much of the Atlanta lode is again of economic interest.

HISTORY OF THE MINES IN THE ATLANTA MINING DISTRICT

INTRODUCTION

Early accounts of the history of the Atlanta area are somewhat confusing. Perhaps the most complete account is in Wells (1983, p. 53-56):

A remnant of John Stanley’s prospecting party discovered gold near Atlanta after panning some inconsequential finds on a trip to Bear Valley, Cape Horn, and Stanley Basin before heading over the Sawtooth Range into the Middle Fork of the Boise. Arriving in Idaho City early in August 1863, Stanley’s party kept all its discoveries secret. Or at least the members tried to. Prospectors who wanted to conceal a substantial gold discovery often attracted attention anyway. Shortly after August 8, a great rush of miners set out to Atlanta in search of Stanley’s new placers. The Idaho City correspondent reported on August 12 to the Washington Statesman (Walla Walla) that

we have had quite an excitement about the new diggings on the Middle Fork of Boise, about 100 miles from here. Hundreds of miners have left on the report that the mines yield [sic] from 10 to 50c. to the pan.

The merchants here are reaping a rich harvest on their goods

“over the left.” Shovels retail at $2.20; picks with handles $2.50; beans 25c, bacon 35 to 40; Sugar 30 to 40; E.B. Syrup, five gallon kegs, 15 to $16, per keg, coffee 50c. Liquors are in large supply and selling at 3.50 to $5 per gallon; long legged rubber boots are retailing at $10 per pair. The only article in demand just now is flour: it however, only three weeks ago was selling for $20 per hundred, and within the past week it has been sold at $40 per hundred. This sudden rise will undoubtedly cause the shipment of large quantities not only from the Columbia River, but parties have gone to Salt Lake to bring forty or fifty tons. Some of my friends have left for the new mines, and by the next express I shall be able to give you definite information from there.

Within a week, a host of deserted gold seekers returned to Idaho City to tell of failing to find mineral wealth around Atlanta.
The stampede of miners of the Middle Fork of Boise, upon news of new
and rich discoveries there a short time ago, has resulted in stampeding back
again—false alarm. Proceeds of the trip: torn shirts and ragged
breathers—Most of the steamboated miners who returned, look too wolfish
to interrogate as to particulars of the journey. The reported rich diggings
were about 65 to 80 miles from Bannock. The very air is said to have been
blue with their curses, on the return trip.

A few good Middle Fork placer bars were noted later in August, but Stanley’s party
thus succeeded in keeping its Atlanta discovery secret after all. But when they got equipped to
return with a much larger party in 1864, their preparations caused a great deal of curiosity.
More by accident than design, however, their Atlanta find remained entirely confidential.
Unimportant finds around Stanley Basin obscured significant prospects around Atlanta. When
a substantial party set out for Stanley in April, 1864, a large group of miners tagged along to
participate in the hunt for new gold fields. That left Atlanta’s explorers free to search out
Idaho’s major gold lode in secrecy. News of mining prospects around Atlanta did not get out
for most of a year. Finally, after Yuba River mining district was organized on July 20, 1864,
Atlanta began to attract a little notice.

Placer mining of consequence got under way in the Atlanta region very late in
September or early in October 1864. About one hundred men were working by mid-October,
reported Charles H. Rogers of Happy Camp, a nearby South Boise community. Yuba River
claims were fairly good, and it was thought the river would pay $10 a day over its entire
fifteen-mile length. The highest rocker paid $30 a day, but the average, naturally, was much
less. There were some complications, though. Except for two bars, all the Yuba River placers
were in a deep canyon that was hard to work. Aside from some Frenchmen who had done
quite well, those who hoped to make their fortunes on the Yuba River were having trouble.
Most of the stream could not even be prospected adequately because of the swift current. It
was clear to all that the Yuba River was not a poor man’s stream. Only with considerable
effort and expense could mining be developed there.

An astonishing quartz discovery in November changed the prospects of the Yuba
River mines. Called at first the Eagle of the Light after the Nez Perce leader known primarily
for his utter opposition to white miners in northern Idaho, this discovery soon became known
as the Atlanta lode. This name, selected by Confederate refugees who predominated in the
early Yuba River mines, was chosen in honor of Confederate General John B. Hood’s reputed
great military victory over General W.T. Sherman in the battle of Atlanta that summer. Hood’s
self-serving public relations, in this case, had greatly exceeded his military success, and some
time was to pass before the correct news of Sherman’s triumph over Hood and his march to
the sea finally penetrated the mountain fastness of Yuba River. Even so, the name remained
the Atlanta lode, and eventually the major camp there was known as Atlanta also.

From the very beginning, the Atlanta lode looked big: “It is truly a mammoth ledge,
and in one place crops out about 60 feet above the surface, and is at least a quarter mile wide,
while thousands and probably millions of tons of quartz have fallen from its rugged sides and
scattered over the mountain.” A great rush to Atlanta on November 19, 1864, of some twenty
prospectors resulted in a rash of additional discoveries. Claims 200 feet long were taken up all
over the lode, although it was too late in the season to do much more than locate claims.

Preparing mainly for the next Yuba River placer season, about forty men spent the
extremely hard and long winter of 1864 and 1865 on Yuba River. The new mining season,
therefore, was late in starting. By June 1, C.W. Walker reported from Bedrock City—a
metropolis, apparently, of one cabin—that most of the mines were still not opened. But the
Cavanaugh claim which had been worked the previous fall was going as well as it had before.
Extensive ditches were under construction, the most ambitious of which was Mattingley’s; this

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ditch from the mouth of Quartz Gulch (later the site of Atlanta) around to Yuba River gained an elevation of 109 feet, 11 inches. Mattingley was building a large frame house where his ditch began, and that area was regarded as the best townsite available. Two earlier towns—Alturas City at the mouth of Yuba River, and Yuba City, upstream at the mouth of Grouse Creek near the Atlanta lode—already had been established, but neither amounted to much, though Alturas City boasted a store.

Yuba River placers proved disappointing in 1865. But about two hundred men were able to work on the Middle Fork near the mouth of the Yuba River during the season. The big attraction, however, was plainly the Atlanta lode [Figure 11]. Traced for 1/4 miles of length, it ranged from fifteen to thirty feet wide, or greater, depending upon the optimism of the prospector. William J. Libby decided that summer that Atlanta really needed a mill, and in anticipation of bringing one in, he began to work on a road from Rocky Bar. His mill, while nevertheless on its way across the plains, could not be expected to reach Yuba River until the road might be completed the next summer. Then in November, W.R. DeFrees discovered the Greenback about two miles from the Atlanta lode. Convinced that it had great worth, he rode out to California to obtain a sawmill and a stamp mill. Atlanta, therefore, was to be equipped with two mills in 1866.

Additional lode discoveries in the summer of 1866 brought increasing excitement to Atlanta. The Leonora in July looked the best. . . . A $230 nugget, found in Quartz Gulch between the Leonora and the Atlanta lode, also stirred some interest then.

Mills to test the mines were also reaching the country. M.C. Brown, who had taken over W.J. Libby’s pioneer stamp-mill project, got the original mill ready for operation in September 1866. Then W.R. DeFrees, whose stamp mill had left Chico on June 9, had his sawmill running and his stamp mill nearly completed in October. Another 1866 enterprise, that of J.W. O’Neal, started on a refreshingly different principle. He chose to develop his mine first, and then to bring in a mill if the ore to justify one proved to be available. O’Neal, who had learned from the Rocky Bar disasters, pointed out that if his enterprise, supported by capital from Reading, Pennsylvania, should fail, the only loss would be the expense of prospecting.

By the end of the 1865 season, Atlanta had developed to the point that serious quartz production might presumably start. The major deficiency in the arrangement then was that the ore was primarily silver, whereas the stamp mills brought in were equipped only to recover gold. The Washoe process, developed on the Comstock lode and already in use in Silver City, was suitable for Atlanta also, but it was not tried there until after 1869.

Extensive development by the current standards preceded milling experiments at Atlanta. Lessons learned across Bald Mountain Ridge at Rocky Bar in 1866 were put to use in Atlanta in 1867. Not just two or three but quite a number of companies ran tunnels and shafts and got something of an idea of what kind of ore they might expect before trying to mill it.

Their work led to a number of gold excitement. Nelson Davis found excellent examples in a new property near the Minerva late in 1866, only one of a number of major discoveries that fall which promised to do well in 1867. W.R. DeFrees found his part of the Atlanta lode to have a width of twenty-two feet and a depth of ninety feet, with an average value of $75 a ton. After Matthew Graham’s company had “spent a large amount of money” driving tunnels and shafts in the Lucky Phillips, they concluded that the property justified installing a twenty-stamp mill. Similarly William Clemens, who proved the Minerva to be rich, planned to bring in a mill in the spring of 1867. J.W. O’Neal, having thoroughly prospected his ledge, came to the same conclusion. All of these plans, formulated by the end of February 1867, promised an eventful future. The Atlanta lode, particularly, had great value. Two hundred feet in the fourth extension sold for $10,000 in gold coin, and the total development by February amounted to four thousand feet in length. Not only did some of the
Figure 11. Map of the Atlanta mining area, showing the mines in 1881 (Burchard, H.C., 1882, Report of the Director of the Mint upon the statistics of the production of the precious metals in the United States [1881], p. 175). Scale: 1 square equals 1 square mile.
assays from the Atlanta lode, ranging as high as $11,000 a ton, surpass those of the celebrated Poorman and Owyhee, but the lode itself was also incomparably larger.

Unlike Rocky Bar and Silver City, Atlanta resembled the Comstock in having a large lode rather than in consisting of a system of fissure veins such as those of Silver City. The Atlanta lode, moreover, was suitable for deep mining in the tradition established at the Comstock and tried unsuccessfully through the latter nineteenth century in numerous districts such as Rocky Bar, where the ore simply did not persist to great depth. Much of the error in estimating the potential of mining areas in these years came from assuming that rich values would extend to great depth, as they did at the Comstock. Moreover, after the Great Bonanza was struck at a depth of almost 1,200 feet in the Consolidated Virginia on the Comstock in 1873, miners all over the West anticipated similar finds. Atlanta did not have anything of the combined magnitude and value to match the Great Bonanza on the Comstock, as yet undiscovered in 1867, but Atlanta did have a lode containing an enormous quantity of ore amenable to the Washoe recovery process of the Comstock. On that account, large stamp mills could be employed there to greater advantage than in many other districts.

Atlanta suffered, however, by being even more remote than such isolated districts as Rocky Bar. A high ridge separated the two camps, and a long-projected water-grade road from Boise up the Middle Fork to Atlanta did not materialize until 1938. Stamp milling at Rocky Bar had suffered severe reverses by 1867, in part from the difficulty of transportation. Atlanta was decidedly worse off in that important respect. Ironically, this early southern Idaho camp, which had the great quantity of ore that might have been developed to supply a really large stamp-mill capacity, was located so unfavorably that mills could be installed and operated only with great difficulty. Places such as Rocky Bar, not quite as hard to get to, had large stamp mills but lacked the potential ore reserves of the Atlanta lode.

Actual stamp milling finally commenced in Atlanta in July 1867. At last the new lodes no longer had to depend upon arrestras which were already in operation.

One of the earliest descriptions of the Atlanta area is in Browne (1868, p. 520-521):

> No district in the Territory is more favored in respect to the supply of wood and water than the Middle Boise, or as it is now known, the Atlanta and Yuba, situated in Alturas county, 16 miles northeast of Rocky Bar, the county seat, on the Middle Boise river, at the junction of the Yuba. This district embraces the country lying in the forks of the two streams and adjacent. These streams afford magnificent water power for the propulsion of machinery. The new town of Atlanta is here situated on a gentle slope in the valley near the Middle Boise river. Along the base of a lofty mountain called Mount Forsyth, burst forth innumerable hot and boiling springs, throwing out large volumes of water, which, falling into the river, prevent it from freezing or closing with ice during the most rigorous winter. In this district is the Atlanta Ledge, already traced for miles in length, and from 15 to 25 feet in width. Selected ores from this lode assayed as high as $11,000 per ton in silver. In some places it is equally rich in gold. The Greenback Mining Company's mill, located at Atlanta, is run by water power, and is now working rock from this lode, although imperfectly, from want of proper appliances and skill. The result, however, is very satisfactory. In the immediate vicinity, and running parallel with the Atlanta, are other lodes which are thought by some to be quite equal, both in extent and richness; such, for instance as the John Bascom and Jessie Benton, the Lusa, the Optimus, the Lenora and Silver Moon, the Tahoma and Greenback on the Atlanta or northwest

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2 According to both Anderson (1939) and the 1936 IMIR, the road was completed in 1936.

3 Elmore County was formed from the western part of Alturas County in 1889.
side of the mountain. On the south or Yuba side are the North Star and Hard Times, continuations of the Atlanta, and the Sophia Tracy. For working the last three named there is an excellent 20-stamp mill, with modern improvements, now being put up on the ground by J. H. O'Neal and associates. Here also are the Minerva, Olive Branch and Confidence lodes, all of which give promise of value. In some of them gold predominates, in others silver. There are other claims which may, when further developed, prove valuable, but as little work has yet been done upon them no reliable opinion of them can be given. Mr. Graham, in co-operation with an English company, has a 20-stamp mill on the way up from San Francisco, intended to operate in this district. The field for working in quartz, and for exploration and development is extensive. The valley through which runs the Middle Boise river is four miles in length and three in width, and surrounded on nearly all sides by lofty, rough and craggy mountains, some of which are covered with perpetual snow. With the exception of this little valley, and another of lesser size on the Yuba side of Quartz mountain, the whole face of the surrounding country is rough and mountainous, so that the building of roads is a serious undertaking, and the want of them a great drawback to the development of the district. It is only within the past year that a wagon road has been opened. Heretofore, all freight had to be transported on pack animals. From this cause, less has been done in this camp, and it has attracted less attention than any other of equal value in the Territory. But now that it has become partially accessible, and demonstrated its richness by the working of its ores, it must soon become an important district.

The lower hills in the vicinity and surrounding country afford fine grazing for cattle, horses and sheep until the snows of winter, which generally commence in December and last till April. About 20 miles southeast runs the South Boise river, bordering on which are large bodies of bottom and table lands, level and rich, well suited for purposes of agriculture. Oats, wheat and barley in sufficient abundance for the consumption of a considerable population can be produced in this region. It is now covered with a luxuriant growth of grass, from which thousands of tons of hay may be cut. The depredations of Indians in neighboring districts, the mismanagement, the want of skill and proper knowledge of the business, and the incompetency of agents and superintendents, with the misapportion of capital, have done much to retard the development of the Atlanta mines. The regions north and west offer inducements for exploration.

In 1867, a successful, if somewhat eventful, trial of the Greenback mill and an impressive recovery from ore sampled from the Minerva were both good news for the district's miners (Wells, 1983). However, the district continued to experience its share of ups and downs (Wells, 1983, p. 56-60):

In the fall of 1867, when things generally looked good in Atlanta, an unexpected calamity befell J. W. O'Neal's twenty-stamp mill. The Alturas Mining Company, for which O'Neal had found a mill site and prepared to erect a building, had a twenty-ton mill well on the way to the lode. But the president of the company, an easterner with no background in mining whatsoever, reached Rocky Bar by the time that the mill had arrived at Junction Bar (modern Featherville), eight miles below. Although on his way to Yuba City, he "did not even visit the Yuba to see the mine or the location of the mill. Indeed, the last half gallon of Rocky Bar whisky which he swallowed rendered such an excursion impossible. Stupefied and maddened by the fiery poison which he had imbibed in enormous quantities, he rushed off declaring the country worthless." An incensed Rocky Bar observer on November 1, 1867, after reporting this incident, continued with the admonition: "Gentleman of the Alturas Mining Company, hurry and elect another president, and allow the present incumbent to subside into the position for which his tastes and talents best qualify him, viz: the presidency of a Pacific Street deadfall."
Disastrously for the mining operation, the inebriated Alturas Company president
gave directions that the teams and wagons hauling the mill were to be sold on the spot. The
mill itself was left to rust at Junction Bar, and the lumber for the buildings at Yuba City was
abandoned to exposure and ruin during the hard winter which was at hand. The
superintendent, J.W. O’Neal, an experienced California and Comstock miner, was to manage
a useless enterprise. Great complaints against the evils of eastern companies issued from
Rocky Bar, Atlanta, and Boise.

Construction of the Lucy Phillips mill employed almost half of the fifty or sixty men
at work in Atlanta by June 1868. But when the road could be reopened, so that the community
was no longer isolated by winter snow, it was expected that activity would pick up. Charles
Woodward had finished a new custom mill and was waiting only for some ore to work.

By now it was clear that although the Atlanta lode and many of the ledges were predominantly
silver, they had enough gold to be mined and milled profitably without regard to the silver.
Ore could be gotten out easily enough to process at $60 ton, and with the mills then in use,
much of it would return $100 a ton. The main drawback was that none of the mills was
equipped to recover more than the gold. Tailings were saved so that they could be processed
later for silver, but that kind of operation left much to be desired.

In the meantime, the development of mining at Atlanta was set back seriously [by the
developing Lucy Phillips imbroglio]. An Alturas correspondent on July 13 indicated that

The unfortunate trouble between Mat. Graham and the large English
Company, has, for the time, thrown a wet blanket over operations in Yuba,
but I am confident all will yet be made right, and our mines will prove that
the curse of failure does not rest with them, but with the bad management
or dishonesty of agents and others, who either know too little, or represent
too much, and who are sent here without mining experience, to do what
only practical mining men ought to be trusted to execute.

Compensating, at least in part, for the Lucy Phillips setback was important capital
investment from Indiana which boosted the development of Atlanta in the summer of 1868.

At the same time, other activity [at the Monarch, Minerva, and Leonora] kept up
interest in Atlanta. Altogether Atlanta still had excellent prospects, and Matt Graham’s
fine discovery adjacent to the Monarch, in February 1869, was still more encouraging. The
trouble was that no one had yet really solved the milling problem, although the Monarch
seemed to be making headway. By the spring of 1869, the Monarch had begun to employ the
Washoe process, and Atlanta was in a position to realize its early possibilities, providing that
someone would get around to building a road.

During the spring and summer of 1869, efforts to expand production at Atlanta
continued.

Water was high that spring, roads were bad, and not much work was going on.

Thus by the end of 1869, progress toward large-scale mining at Atlanta had made
disappointingly little headway. Test milling of gold ore in 1867 and 1868, and of silver ore in
1869, had shown that the district ought to be developed. Some occasional arsena operations
were still running at the end of 1869. Actual production, however, amounted to little more
than some sporadic gouging. Atlanta silver ore proved to be extremely refractory, and attempts
to process it only to recover the gold did not turn out to be economical.

Raymond (1870, p. 249) gave the following summary of the district’s first years:

Atlanta district is a mining field of greater promise than the developments of five
years seem to have fulfilled. Through unfortunate selection of machinery and arrangement of
mills the first tests of ores were far too expensive and generally unsatisfactory in result,
whereas, I think, many of them should have been remunerative. Another feature, seriously affecting the energetic development of mines here, and equally throughout the Territory, is unjust and narrow legislation. One provision of the law is, that no non-resident shall make locations. The effect of this absurd regulation, intended to force all outsiders to buy locations of the citizens of Idaho, has been, of course, to keep out prospectors and capital from other States and Territories. The home supply of capital following this channel of industry is naturally very limited. Considering that the mines belong to the United States, and not to Idaho, this legislation was as arrogant and illegal as it was palpably selfish and silly. As might be expected, its authors at the same time provided so inefficiently in other particulars as to enable men without capital or any intention of prospecting claims, further than to enable them to hold for speculative purposes, to make a large number of locations, and, without even doing the prescribed assessment work, to carry them year after year, thereby obstructing legitimate mining.

Nowhere more clearly than in Idaho is shown the desirability of a uniform national law, simple in its provisions, and applying to all our mineral territory, which shall extend to prospectors all reasonable guard and protection, and at the same time protect the mines from being locked up for speculative purposes without consideration to the public or the government. The law should prescribe a definite amount of work to be expended upon claims immediately following their location, and some reasonable amount every year thereafter. This would either demonstrate their value, or throw them open to other prospectors if the first discoverers did not choose to develop them.

The district continued to have its problems, despite the evident richness of the deposits (Wells, 1983, p. 60-63):

Even though all major attempts to work the great Atlanta lode had failed by the end of 1869, promoters had one indisputable advantage: rich ore suitable for large-scale development was available in quantity sufficient to promise a fortune to an investor who might back a successful company. London interests wishing to recover British losses in the original Atlanta investments sent out William Nancarrow to examine the situation in 1870. Incredibly high-grade samples convinced him that the Monarch looked better than anything to be found on the Comstock. Yet terms of purchase were never worked out during several years of negotiations. Meanwhile, the Monarch continued to mill a small amount of high-grade rock for its Indiana owners, with its water power turbine running during the winter and natural hot water used to prevent freezing. Other properties were still less productive.

Really good properties were being held by their owners pending a solution to the recovery problem. Less promising prospects, however, found a ready sale to investors—some British and others from the East, who invariably met disappointment during those years. Such promotional tactics damaged the reputation of the Atlanta mines severely. A resident of Atlanta complained on March 22, 1871:

This country has been infested with a set of 'bilks' as ever cursed any quartz country. They play themselves off on the hard working miners as capitalists who have, or control large sums of money, and bum their way into some wild cat, bogus quartz, then get a little provisions and tools, and leave the boys to work for them on jawbone, which is mighty current in this camp. They go on to New York and London, and try to foist their bogus stuff off on the market. These bilks bring our real resources into disrepute, and they have been a great drawback on the camp. Thank God, they have none of the good ledges in this camp, and they will not get them unless they can show something more substantial than jawbone.
Under these circumstances, only small operators gouging out a little of the highest grade ore were able to do anything at all. . . .

The alternative—milling in Atlanta—was equally unsatisfactory. Recovery rates were so low that tailings processed a third time were yielding more than they had during the first two attempts. Even when Atlanta began to revive in 1874, Rossiter W. Raymond noted the extreme disadvantage under which local miners operated:

The fact that nearly all the mine-owners are poor working men, unable to put the mines in condition for continuous working during the long and severe winters, the absence of facilities for transportation and of proper works for the reduction of silver-ores, together with the high prices for provisions and mining implements and materials, continues to be severely felt by the Atlanta people; but present indications prophesy that in spite of the drawbacks better days are in store for this district.

Improved transportation and technology were the key to profitable, large-scale operations in Atlanta. Neither would be achieved without expanded capital investment in the district. . . .

Atlanta had its early major building boom in 1876 when the Buffalo mill was being constructed and the Monarch lessees were beginning to operate. The two companies had sixty employees for construction and development primarily. These, together with quite a number of smaller gouging and prospecting enterprises, supported a community of about five hundred people. With Ralf Bledsoe's construction of a long-awaited Atlanta road from Rocky Bar in 1878, Atlanta was in a position to realize some of its early promise. Milling in Atlanta, while limited to high-grade rock, began to make a little headway after 1878. The extremely high-grade Monarch and Buffalo ore that was being hauled out for smelting at least could go out over a wagon road. Moreover, by 1878 ore was being peaked into Atlanta from Yankee Fork for processing in the Buffalo mill. Thus for several years, mainly from 1878 to 1884, the camp had considerable activity.

Yet the sad part of the story was that the costs of roasting and processing Atlanta ore were so great that only high-grade portions ($100-$300 a ton) of the lode proved to be worth milling locally. Renewed efforts by J.E. Clayton and other noted mining engineers did not begin to reach a solution for the large bodies of lower grade rock. (At this stage, Clayton and some of his associates reportedly arranged to sell the Monarch and Buffalo to August Belmont for $500,000; if they actually did so, nothing much seems to have come of the transaction.) . . .

Atlanta was plagued by a general economic collapse when one unpaid creditor [from the Tahoma default] sued another. Since the other mills also were grinding to a halt, the initial Atlanta boom came to an end. . . . By then most of the major Atlanta mines were bonded for sale again, because values less than $30 per ton could not be handled until improved recovery methods might reduce the cost of milling. By now, all available high-grade ore had been processed.

Several years of effort to sell a combine of the major Atlanta properties to London interests came to a head when V.S. Anderson reported a $3.5 million deal with London capitalists in early 1891. This sale proved to be decidedly profitable to their original owners, who could not figure out a way to work their properties any further. But the Atlanta Gold and Silver Consolidated Mines, Ltd., found that even after considerable expenditure for development (presumably in excess of $150,000 beyond the $650,000 purchase), the recovery problem for low-grade ores could not be solved economically. After a final attempt with new funds raised in 1894, the British company had to search for another investor who might try to work the major Atlanta properties. To some it looked as if worked-out mines had been peddled to unsuspecting British capitalists. Yet by far the greatest production from the lodes the British purchased was still to come. While the British were searching for a suitable recovery process,
the concentrating of Atlanta ores began on a limited scale in 1894, and the camp remained somewhat active until 1899. The Monarch fifteen-stamp mill resumed under new management for a time in 1902, and after another failure, the new owners undertook four years of Monarch development before installing a new electric-powered mill and tram in 1906. For the next several years the new company tried to figure out an economical recovery process which would allow the new mill to commence work on Monarch and Buffalo ore. In the meantime, the Minerva, which had less refractory ore, resumed production with an electric-powered mill. The Tahoma and a property eventually known as the Boise-Rochester also produced for a time. By 1912 all were shut down again, awaiting an efficient recovery process.

Finally after the Boise-Rochester managed to run for two years after 1915, the Saint Joseph Lead Company purchased the property and eventually solved the recovery problem. Gaining access to the Monarch ores as well, the Saint Joe started an amalgamation-flotation concentrator early in 1932. At this point, the problem of handling refractory Atlanta ore was solved after more than half a century of searching for an economical process. Modern production at Atlanta dates from that time. By far the greatest part of the $16 to $18 million Atlanta yield comes from the period of modern production after 1932. With construction of the Middle Fork road from Boise to Atlanta in 1938, another long awaited improvement in mining at Atlanta was realized, and the last of the old-time problems of that camp was solved.

The St. Joseph Lead Company worked the Boise-Rochester property from August 1931 until June 1936, at which time all known ore was exhausted (Anderson, 1939). The property was sold, and Talache Mines, Inc., began working the property in early 1937. In late 1939, Talache purchased the Monarch, Buffalo, and Last Chance properties, giving them control of the entire length of the Atlanta lode. Talache operated its mine and mill, either directly or through lessees, until 1966. The property continued to be explored by lessees. The most important of these projects is that by Atlanta Gold Corporation and associated companies, which started in 1985. Work has continued to the present to bring the property into production as a large-scale, heap-leach and/or underground operation.

Production from the Atlanta area is difficult to estimate. The early reports from the district are patchy and sometimes wildly inflated. Wells (1983) credits the Atlanta district with a total production of $16 to $18 million, while Kilsgaard and Bacon (in preparation) calculate a more modest (and probably more accurate) value of about $12.5 million. Accurate production data from before 1900 are almost impossible to find, and even the post-1900 data are flawed because production by lessees or from smaller properties may not have been recorded for every year. Table 2 summarizes the best available production information for the years 1901 to 1986.

Detailed histories of the mines along the Atlanta lode follow. These include, from east to west, the Boise-Rochester Mine, the Monarch Mine, the Buffalo Mine, the Hill and Davis Claim, and claims along the west end of the lode (discussed collectively as "the Idaho Gold Mine and related properties"). Properties on lateral veins included the Last Chance and Minerva mines to the south of the Atlanta lode, and mines like the Silver Tide, Greenback, Paymaster, Jessie Benton, Big Lode, and Tahoma on lateral veins to the north of the Atlanta lode (Figure 3). Of these mines, the first three are the most significant, and they will be discussed in chronological order of the period of the most significant work on
<table>
<thead>
<tr>
<th>Mine (Years in Production)</th>
<th>Ore (tons)</th>
<th>Old Tailings (tons)</th>
<th>Gold (ounces)</th>
<th>Silver (ounces)</th>
<th>Copper (pounds)</th>
<th>Lead (pounds)</th>
<th>Zinc (pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boise-Rochester (1902-1963)¹</td>
<td>856,876</td>
<td>55,978</td>
<td>243,755</td>
<td>1,032,381</td>
<td>33,363</td>
<td>1,315</td>
<td>---</td>
</tr>
<tr>
<td>Monarch Mine (1902-1978)</td>
<td>55,458</td>
<td>---</td>
<td>10,567</td>
<td>81,315</td>
<td>---</td>
<td>330</td>
<td>564</td>
</tr>
<tr>
<td>Buffalo and Last Chance Mines (1935)</td>
<td>1,500</td>
<td>---</td>
<td>60</td>
<td>777</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Idaho Gold Mine (1902-1922)</td>
<td>379</td>
<td>---</td>
<td>751</td>
<td>5,657</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Minerva Mine (1905-1942)</td>
<td>65,234</td>
<td>2,681</td>
<td>17,357</td>
<td>43,912</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Big Lode Mine (1905-1949)</td>
<td>1,078</td>
<td>---</td>
<td>138</td>
<td>221</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Hazel Queen and Anna Claims (1921-1958)²</td>
<td>173</td>
<td>---</td>
<td>47</td>
<td>104</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Tahoma Mine (1905-1976)</td>
<td>190</td>
<td>---</td>
<td>169</td>
<td>2,636</td>
<td>---</td>
<td>400</td>
<td>---</td>
</tr>
<tr>
<td>Baltimore Lode (1901-1902)</td>
<td>131</td>
<td>---</td>
<td>317</td>
<td>251</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Jessie Benton Mine (1905)</td>
<td>50</td>
<td>---</td>
<td>77</td>
<td>59</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Washington and Gold Nugget Lodes (1936-1940)</td>
<td>92</td>
<td>---</td>
<td>50</td>
<td>49</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Paymaster Mine (1941)</td>
<td>2</td>
<td>---</td>
<td>5</td>
<td>3</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>981,286</strong></td>
<td><strong>58,659</strong></td>
<td><strong>273,657</strong></td>
<td><strong>1,177,868</strong></td>
<td><strong>33,363</strong></td>
<td><strong>2045</strong></td>
<td><strong>564</strong></td>
</tr>
</tbody>
</table>

¹The Boise-Rochester (Talache) Mine also produced 490,486 pounds of arsenic and 30,471 pounds of tungsten in 1942 and 1943.

²These claims are believed to be associated with the Big Lode Mine. No separate history is available for them.
the property. The remaining properties will be discussed in approximate geographic order from east to west and by distance to the north or south of the Atlanta lode. Recent operations have included most of the properties on Atlanta Hill.

BUFFALO MINE

The Buffalo Mine, discovered in 1864, was the site where precious metals were first found in the Atlanta district (Anderson, 1939). The mine is along the upper part of Quartz Gulch southwest of the Monarch (Figure 3). The Buffalo claim is 480 feet long by 100 feet wide, but it contained some of the richest ore on the Atlanta lode. Anderson (1939, p. 59) described the geology of the mine:

The Atlanta lode is from 40 to 60 feet wide where it crosses the Buffalo claim and dips steeply southeast. Its ore body appears to have been localized by a slight variation in the general trend of the lode. Its direction is about N. 60°E. slightly oblique to the trend of the lode as a whole. Although the ore body was one of the smallest on the Atlanta lode, its size was more than compensated for by the richness of its ores, especially on the upper 100 feet. The shoot has a maximum stope length of 250 feet and has been exposed to a depth of about 670 feet. Most of the rich ore was bottomed above the No. 5 level and that below was in small, more or less lenticular masses, which contained small amounts of high-grade ore.

The main ore body is reported to have lain along the hanging wall and to have averaged 2-1/2 feet thick. A smaller ore body occupied the footwall zone. In between these two bodies there were scattered seams and streaks, some of which were individually very rich and as much as 12 inches thick. The ore above the No. 1 level was mined for a length of 230 feet, on the No. 2 level for 260 feet. However, with increasing depth the length and richness of the ore zones decreased greatly and became scattered through increasingly greater amounts of low-grade.

Silver minerals were exceptionally abundant in the ore on the upper levels so that the silver comprised two-thirds of the gross value of the production. In 151 tons of ore shipped to the Omaha smelter, there were 16,871.58 ounces of silver to 88.30 ounces of gold, a ratio of nearly 200 to 1. Stephanite, pyragryite, proustite, and probably polybasite were notably abundant, but there were only minor amounts of argentite and native silver. The amount of stephanite and ruby silver decreased greatly with depth, although minor amounts appeared in high-grade veins even in the lowest workings. With depth the ratio of gold to silver increased mainly because silver declined, not because gold increased. It is reported that the smaller veins, which carried more ruby silver and stephanite than the larger, were less reliable than the larger because the silver minerals were not as uniformly distributed as through the larger bodies.

It is difficult to estimate the tenor of the ore mined. Some of the bonanza pockets near the surface are reported to have contained ore assaying $8,000 to the ton. That treated in the mill assayed $100 to $800 to the ton. Some of the shipments of the crude ore to the New Jersey and Omaha smelters yielded as much as $2,000 to the ton. When the grade of ore dropped below $20 to $25 to the ton, operations had to cease. Much of the low-grade is reported to have assayed $4 to $20 per ton.

Little is known about the earliest work at the mine. According to Anderson (1939, p. 58):
Its early history has not been adequately recorded. Discovered in 1864, it is reported to have produced 6,406 ounces of silver the following year. The first work was a crosscut and level 230 feet long near the surface. Later an adit 435 feet long was driven which intersected the lode only 70 feet below the upper level. The extraordinarily rich ore was shipped by mule to Kelton, Utah, 230 miles away, and shipped from there to Omaha for treatment. Later, when roads were built into the country, the ore was taken from Rocky Bar to Kelton by bull teams.

Ballard (1928, p. 31-32) stated:

In the late '60's and early '70's high grade gold ore, probably sorted, assaying $2000 per ton and upward, and amounting in all to $200,000, was shipped from the Buffalo workings on mule back to Kelton, Utah, the nearest railroad point, 230 miles away, and thence to Omaha for treatment. Later, roads were built into the country and bull teams were used to haul the ore to Kelton. Ore shipped during the late '70's netted close to $800 per ton. About this time a 5 stamp mill was built as the grade of ore was decreasing with depth and shipping costs became prohibitive. The first ore treated assayed from $25 to $100 per ton, but owing to its refractory character and to the fact that amalgamation was the sole process relied upon an average recovery of but $25 to $30 per ton was made. When the value of the ore late dropped below $20, operations ceased. This occurred in the late '80's and the property closed until 1902.

By 1869, the mine was idle (Raymond, 1870). Raymond's (1873, p. 204) description of a claim he calls the "Discovery" resembles the Buffalo and may relate what the property was like in 1872:

The Discovery claim is owned by Farras, Preston, and others [Table 3]. They have one tunnel on the vein, which gains about 70 feet in depth. On top the croppings are about 60 feet wide; at the end of the tunnel the vein measures 45 feet between walls. It carries two streaks of gold-bearing quartz, one on the north wall 2½ feet, and one on the south wall 1½ foot wide. The gangue matter is quartz and decomposed granite; the country-rock granite. Very nice specimens of ruby silver are occasionally obtained in the mine.

By 1874, the Buffalo was owned by A.O. Miller, and was leased to Doctor Marshall and S.S. Mattingly. Raymond (1875, p. 309) noted:

The claim adjoining the Monarch Company's ground, owned by Miller, comprises 480 feet, and is also worked under a lease, but the claim being entirely unopened, and the lessees lacking the necessary funds to properly open the vein, they have confined themselves entirely to working at or near the surface. In a depression of the mountain they have run an open cut across the whole vein, showing it to be 60 feet wide. They then run a level on a streak of ore close to the north wall of the lode, 44 feet long, which shows on an average 6 inches of good ore and a 2-foot streak of bluish quartz, carrying some gold and silver, but not enough to pay for working it. A quantity of the first-class ore taken out in running this level has been shipped to San Francisco, but I have not yet learned the returns, which, however, are expected to be not less than $500 per ton. This level has been run northeast from the cross-cut. On the northwest side there is a vein of ore 16 inches in width, which averages $100 per ton, but is not worked at present. A cross-cut tunnel has been run by the original owners 135 feet, which, when completed to a length of 300 feet, will strike the vein a little over 100 feet below the present workings; but lack of means prevents the lessees from availing themselves of the facilities thus given them to open the mine properly.

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Table 3. Companies and individuals operating at the Buffalo Mine. Dates in parentheses indicate indefinite or uncertain information.

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Officer</th>
<th>Date Incorporated</th>
<th>Charter Forfeited</th>
<th>Year(s) at Mine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farrar, Preston, and others</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>(1869)-?</td>
</tr>
<tr>
<td>A.O. Miller</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>(1874)-1875</td>
</tr>
<tr>
<td>Dr. Marshall and S.S. Mattingly</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>(1874)</td>
</tr>
<tr>
<td>(lessees)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buffalo and Idaho Gold and Silver</td>
<td>A. Allegewahr,</td>
<td>2</td>
<td>2</td>
<td>1875-1901 or</td>
</tr>
<tr>
<td>Mining Co.¹</td>
<td>Managing Director</td>
<td></td>
<td></td>
<td>1902</td>
</tr>
<tr>
<td></td>
<td>and Superintendent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atlanta Mines Company</td>
<td>F.H. Minard,</td>
<td>Delware</td>
<td>---</td>
<td>1901 or 1902-</td>
</tr>
<tr>
<td></td>
<td>President</td>
<td>registration trust</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>company (not</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>incorporated)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Property combined with the Monarch Mine (Table 4) after 1901 or 1902.

¹This company is probably the same as the "Buffalo Company" referred to by Raymond (1877).
²This information is not available in Idaho Geological Survey’s files.

Raymond (1877, p. 211) described the events of 1875:

The ground adjoining that of the Monarch Company's, formerly owned by A. O. Miller, and comprising 500 feet, was purchased in the spring by the Buffalo Company, which also bought the Silver Tide in Atlanta, and the Itasca in Rocky Bar, from Mr. Tillman. Up to the time of Mr. Wolters's visit, in September, operations had been confined to surface-work, in following up of small seams of rich ore in every possible direction. Since then the company has commenced to push the deep cross-cut tunnel toward the vein. The former owner commenced this tunnel and drove it 150 feet, 160 feet more being necessary to intersect the lode about 110 feet below the upper workings. At the point of intersection an air-shaft will be raised and levels run both ways, and then the mine will be ready for the cheap extraction of ore. Nearly all the surface-work has very little value for future operations. In fact, the finances of the company would no doubt be in a better condition if it had never been done, as the amount of ore extracted will cover only a small portion of the expenditures. The company has purchased and forwarded from Chicago a 10-stamp mill, which is now lying in Kelton and cannot be brought into Atlanta before July. The latter circumstance is, however, hardly to be

⁴Mr. A. Wolters, superintendent of the U.S. Assay Office in Boise, provided most of the material for the Idaho section of Raymond’s report.
regretted, as the mill will not be greatly needed before the spring of 1877. Even then the question will arise whether the machinery is adapted to the treatment of the Atlanta ore.

Clayton visited the district in 1876 and described the district (quoted from Raymond, 1877, p. 214-215):

No developments have been made of a permanent character, except on the Monarch and Buffalo claims. Both of these claims have been tapped by tunnels run from Quartz Gulch, cutting the lode about 100 feet below the surface and about 80 feet below the water-line. . . . The Buffalo claim adjoins the Monarch Mine on the west, and extends westerly on the lode 480 feet. This mine is opened also by a tunnel from Quartz Gulch, which cuts the lode near the center of the claim 100 feet below the surface. A level has been driven west about 100 feet, all the way in good ore. Another level has been driven east, following the rich-ore streak toward the Monarch a distance of over 100 feet at the date of my visit, (September, 1876). The grade of ore is about the same as that in the Monarch Mine, and is identical in character in every respect. The rich-ore streak varies from 2 to 6 feet, with large quantities of lower grades alongside.

There are no preparations for opening the mine below the tunnel-level, and no efficient means of reducing the rich ores on the ground. There is a 10-stamp mill in process of erection on the river below the town, to be driven by water-power, but no furnaces for roasting the ore. There is talk about putting up a Brucneer furnace next year. At present they ship their first-class ore, and are accumulating the second-class at the mine and the mill-site.

Wells (1983, p. 61-62) described the Buffalo and Idaho Gold and Silver Mining Company’s first years at the mine:

In the summer of 1874, investors from Buffalo, New York, acquired a substantial extension of the discovery lode. (The original Atlanta discovery lode, aside from this extension hereafter known as the Buffalo, went entirely undeveloped until July 26, 1877, when Ralf Bedsole finally started something more than surface assessment work on it.) With great effort, considering the lack of a decent road over the hill from Rocky Bar, the ten-stamp Buffalo mill [Figure 12] was freighted and packed into Atlanta in 1876. . . . Neither the Monarch nor the Buffalo mills, although equipped with the Washoe process for silver recovery, operated very efficiently at first. Their really high-grade ores (over $300 a ton) were still being packed out for shipment to Omaha or Newark. (In 1876, before the Buffalo mill was installed, twenty-seven tons of that company’s ore, taken to Newark at a cost of $900, yielded almost $19,000.) When the Buffalo mill started its trial run May 3, 1877, a 55 percent recovery was realized. Although this was far better than the twenty percent or so from the Atlanta mills in the past, the Buffalo management was still dissatisfied. A five-hearth furnace with a ten-ton daily capacity was added that summer. This improved recovery enough that high-grade Monarch, as well as Buffalo, ore was worked at least with partial success. . . . During the early productive years before 1884, $300,000 was reported to have come from the Buffalo mill.

Clayton (1879, p. 5-6) described the Buffalo in detail:

This mine consists of 500 feet on the lode adjoining and west of the “Monarch” ground.

It has been actively worked since the summer of 1876 by men of very limited experience in mining as a business. But the Managing Director and Superintendent,
Figure 12. The Buffalo Mill in 1877 or 1878 (Wells, 1983, p. 62).
A. Allegrewhr, of Buffalo, New York, displayed good sense and business capacity from the start. Profiting by the experience of the "Monarch" company, he first proved the mine by running a level across it in 1876, then following the rich ore zone east towards the "Monarch" line. In the meantime, the richest ore was sacked, shipped East, and sold, amounting to 151 tons, for which they received $114,654.

During this time active preparations were being made to erect a good 10-stamp mill, with ample power to drive 10 stamps in addition whenever needed. A dam was put in the river below the "Monarch" mills, and a canal constructed half a mile long to a convenient mill-site. Here the mill was erected and put in operation in 1877. Since that time the ores have been reduced in the Company's mill, thus saving the expense of shipping the high grade silver ores east to find a market.

The exploration and working of the Buffalo mine from which the rich ore has been taken, consists of: 1st, a crosscut and level near the surface, 230 feet long; 2d, a main adit, 435 feet long, that intersects the lode 70 feet below the upper level. This level is No. 2, and has been driven a total length on the lode of 328 feet. The richest section of the ore zone was found east of the point of intersection by the adit level. About 50 feet east of this point the ore zone divided into two distinct ore veins, evidently the same that are found in the "Monarch" workings. (see plan and section [missing from IGS's copy of this report. See Figures 8 and 9 instead]). In the longitudinal section will be observed the shaded ground east of the shaft. This represents the ground actually staked out, say 200 feet long by 75 feet high, from which 2,261 tons of ore have been taken out and worked, giving an aggregate yield of $306,527 in gold and silver bullion, and an average yield per ton of the ore shipped and milled of $135.57.

Taken separately, the account stands thus up to October, 1878:

1st - 151 tons of ore shipped gave a gross assay value of ........................................ $125,119
Coin value received for the ore in the eastern market ........................................ 114,654
or, $760 per ton net bullion.
2d. - 2,110 tons of second-class ore worked in the Company's mill gave a gross yield in bullion of .................................................. 181,408
or, $85.97 per ton.
It will thus be seen that the actual return in cash and bullion, received from 2,261 tons of ore, was .................................................. $296,062.

The explorations now in progress are a main shaft of three compartments sunk in the lode near the intersection of the adit level. (see plan [omitted from IGS's copy of this report]) This shaft is now down over 300 feet below the adit level. At a point 100 feet below the adit, levels have been started each way on the lode. In the meantime, the shaft was pushed down another 100 feet, and a crosscut run south, which, from last advice, had crossed a vein of very rich ore thirty inches thick. But no levels have yet been extended along the vein from this crosscut.

The main working-shaft will be pushed down during the summer to a depth of 500 feet, from which levels will be run each 100 feet on the line of the main ore zones, in order to keep the explorations of ore at least two years ahead of the mill.

Good hoisting machinery is in place over the shaft, with power sufficient to sink the shaft and work the mine one thousand feet deep.

The 1880 Report of the Director of the Mint (DotMR; p. 123) noted: "One of the most successful mines in the county is the Buffalo and Idaho Gold and Silver Mining Company in the vicinity of Atlanta. Mr. W. W. Miller, superintendent, speaks enthusiastically of the prospects of this company." During 1881, the Buffalo mill processed 1,701 tons of ore which yielded 102,378 ounces of bullion. This material
contained $56,101.36 in gold and $113,456.30 in silver, for a total of $169,557.66. The reported recovery rates for the mill were 92.79 percent of the gold and 97.20 percent of the silver (1881 DotMR). Strahorn (1881, p. 37-38) described the property in glowing terms:

Just west of and adjoining the Monarch is the Buffalo mine, consisting of 500 feet along the Atlantic ledge, and owned by the Buffalo Gold and Silver Mining Company, Wm. Miller, superintendent. The claim is well developed by six levels from 200 to 500 feet in length and a thorough system of cross-cuts across the vein—these have been advanced from wall to wall every fifty feet on each level. The main pay vein in the Buffalo is near the south wall, averaging two and one-half feet in width, and there are two others from eight to twelve inches wide. Much ruby is found in the smaller veins, but the large one, while carrying a lower grade of ore, is more reliable.

The Buffalo has proved one of the most steady producers on the Pacific coast. No satisfactory data concerning its yield up to 1874 is obtainable, although many thousands of dollars are known to have been shipped by its owners prior to that period. Since 1874 the yield has been uniformly $100,000 per year, one-third of this being gold and the balance silver. The product for 1881 will easily reach this previous annual average. Twenty men are regularly employed at the mine. They keep the company’s ten-stamp mill supplied with ore about two-thirds of the time (it does not run in winter on account of the difficulty of getting in supplies) and also do a vast amount of development work. The lower workings are flooded, and powerful pumping machinery is soon to be erected. This will not only enable the Buffalo company to prosecute work to a great depth, but will affect the Monarch people the same way by draining the entire vein for several thousand feet.

The Buffalo ores now being milled yield from $50 to $100 per ton, and 40,000 tons, worth $20 to $30 per ton, are blocked out in the veins awaiting the cheap transportation era soon to be ushered in by railroads. This vast reserve must be concentrated, and that cannot be done profitably under the present expensive conditions, all of which will be happily changed when the Oregon Branch of the Union Pacific crosses Southern and Central Idaho. But the Buffalo mine has richer streaks than would be indicated by the above, much of its highest grade ore having been shipped eastward for reduction.

The Buffalo continued its operations the following year. According to the 1882 DotMR, the mine had produced an average of $100,000 a year since 1874, with two-thirds of the output in silver and one-third in gold. The 1883 DotMR (p. 446) described the mine:

The Buffalo Mine, owned by the Buffalo and Idaho Gold and Silver Mining Company, has been continuously worked during the year, and is developed by a shaft 600 feet deep, opening 6 levels. The hoisting works, which had been under ground and were insufficient, are being replaced by new and more substantial ones on the surface. The company owns a 10-stamp dry-crushing mill with roasting furnaces, in which they work their ore as well as custom ores. This mine according to reliable information has yielded over a half million dollars since its discovery.

The 1884 DotMR (p. 259) summarized the mine’s development and production:

The latter company [the Buffalo and Idaho Gold and Silver Mining Company] began operations in 1876, but owing to the lack of reduction facilities, were obliged for a long time to

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ship the ore to Omaha, the nearest railway station being 260 miles distant. Later, a 10-stamp mill was erected, and up to this date they have extracted about a million dollars' worth of gold and silver, having reached a depth of 652 feet, with 500 feet of adit levels. Hitherto the company have milled only high grade ores running from $100 to $800 to the ton, all the low grade being left unworked, which from frequent assays is known to yield from $15 to $30 to the ton. The new steam hoisting works, with pump, is about complete, which will facilitate the working of the mine. The company's 20-stamp mill has been running for the past two months on ore exclusively from their own mine. Twelve men are employed at the mine, eight at the mill, and ten on the new hoisting works. The total yield for 1884 was about 6,406 ounces of silver.

The Buffalo apparently closed in 1884 or 1885, along with most of the other mines in the district. The property was purchased by T.N. Barnsdall in 1901 (1903 IMIR) or 1902 (Reigart and Nicolson, 1933) and combined with the Monarch and Last Chance. From then on, the three properties were operated as a unit. Kirby (1909, p. 1) compiled the following information on the Buffalo:

The Buffalo mine is part of the ATLANTA MINING COMPANY property, situated in the Atlanta Mining District, County of Elmore, Idaho. Its area is five hundred feet long and one hundred feet wide and its whole length is traversed by a true fissure vein being the same that continues through the MONARCH GROUP which is sixteen hundred feet in length.

This property has been worked in previous years by the Buffalo Gold & Silver Mining Company from whom the property was bought by the present owners, who opened up six levels to a depth of six hundred and thirty feet through a shaft.

At the present time this mine is drained to the third level by means of a tunnel 900 feet long which connects with the third level draining to that depth.

These old workings have not been opened up as yet on account of devoting our time and money in opening up the MONARCH mine and the following is from reports received from the former owners and operators of the extraction and work done by them on the Buffalo mine.

The former owners removed nothing but high grade ore which was treated on the ground by roasting process, yielding approximately $700,000, of which a third was gold: two thirds silver. Before installing the roasting process only 30% of the values were saved, but after introducing the roasting process they saved at least 95%.

Besides the above amount extracted from ore at the mine they shipped high grade ore to the smelters at Omaha and Newark from which they realized $120,000, after the charges were deducted.

In prospecting in the mine for high grade there was opened up large bodies of ore running in values from four dollars to twenty dollars and is the same character of ore as found in the MONARCH mine which is a continuation of the same vein.

The width of the vein between the well defined walls is from forty to sixty feet and dips the same as the MONARCH. Besides the low grade ore in the mine there is a dump estimated to contain 75,000 tons from which eighty samples were taken, being careful to take only low grade. These samples were sent to Denver and Baker City to be assayed who reported them to contain $5.20 and $6.12 per ton.

The above information was given by Wm. Miller of Buffalo on March 30th, 1909. Mr. Miller managed and was a stock-holder in the Buffalo Gold & Silver Mining Co. whose letters giving this information are in my possession.
Figure 13 shows the site of the Buffalo shaft as it appeared in 1994.

Total production from the Buffalo Mine is not accurately known. Production after 1901 was not reported separate from that of the Monarch Mine, except for 1935. In that year, 1,500 tons of ore, which yielded 60 ounces of gold and 777 ounces of silver, was produced from the Buffalo and Last Chance properties. This material was apparently produced by lessees. Anderson (1939) credits the mine with at least $1,200,000 from its discovery until the mid-1880s.

**MONARCH MINE**

The Monarch was one of the first mines located in the district. It is about 1½ miles south of Atlanta near the head of Quartz Gulch (Figure 3). The mine has two main ore shoots, separated by a zone of “relatively barren” ground. The main ore shoot was the Monarch, which had a stope length of 850 feet and a maximum height of 850 feet. Anderson (1939, p. 56) described the ore from this shoot:

> The ore in the Monarch body was noted for the abundance of silver in the upper workings, particularly pyrrhotite, pyrrhotite, stephanite, and polybasite, as well as subordinate amounts of argentite and native silver. Although the value of gold was greater than that of silver, the silver minerals made up most of the bonanza veins. The amount of ruby silver and other primary silver minerals declined greatly with increasing depth. Some small amounts persisted to the lowest level. The ratio of gold to silver thus became greater with depth.

> Some of the earliest ore mined was exceptionally rich and netted as much as $800 ton even after the costly haul to Kelton, Utah, and shipment to New Jersey and to Omaha smelters. As the grade of ore decreased with depth and shipping costs became prohibitive, the ore was milled.

The other major source of ore was the Foot Wall orebody of the Pettit ore shoot, which extended into the Monarch ground from the Boise-Rochester Mine to the east. In the Monarch Mine, this orebody extended about 400 feet from the east end line, averaged 350 feet high, and ranged from 5 to 20 feet thick. In addition, a lateral vein known as the Dump Raise orebody yielded high-grade ore (Anderson, 1939).

Production began at the Monarch soon after its discovery. By 1865, an arrastra was being used to process the ore (Anderson, 1939). Clayton (1879, p. 8) discussed the mine’s first years:

> This mine was the first located in the District, and was the first one worked in a crude way with arrastras for the free gold found in the croppings near where it crosses Quartz Gulch. In 1866, the original claims, aggregating 1,600 feet in length, were bought by a party of men from Indianapolis, and organized into a stock company called “The Monarch Gold and Silver Mining Company [Table 4].”

Wells (1983, p. 58) gives a slightly different account of the purchase:
Figure 13. Site of the shaft for the Buffalo Mine in 1994. Extensive road building in this area, related to ongoing exploration projects, has obliterated the Buffalo workings (photograph by Virginia S. Gillerman, Idaho Geological Survey).
Table 4. Companies operating at the Monarch Mine.

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Officer</th>
<th>Date Incorporated</th>
<th>Charter Forfeited</th>
<th>Year(s) at Mine</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Monarch Gold and Silver Mining Company</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1866-1882</td>
</tr>
<tr>
<td>Lantis &amp; Company (lessees)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1874-1878</td>
</tr>
<tr>
<td>Atlanta Mining Company</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1882-1901 or 1902</td>
</tr>
<tr>
<td>Atlanta Mines Company</td>
<td>F.H. Minard, President</td>
<td>Delaware registration trust company (not incorporated)</td>
<td>1</td>
<td>1901 or 1902-1939</td>
</tr>
<tr>
<td>Atlanta Leasing Company (lessee)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1915-1917</td>
</tr>
<tr>
<td>Last Chance Mining Company (lessee)</td>
<td>C.F. Phippen, President</td>
<td>July 18, 1936; reinstated: 1939(?)</td>
<td>1938; 1943</td>
<td>1936-1939</td>
</tr>
<tr>
<td>Hooper, Kimball and Williams, Inc.</td>
<td>Lindsey Hooper, President</td>
<td>1</td>
<td>1</td>
<td>1939</td>
</tr>
<tr>
<td>Talache Mines, Inc.</td>
<td>A.H. Burroughs, Jr., President and Manager</td>
<td>name changed from Armstead Mines: June 8, 1922</td>
<td>November 30, 1966</td>
<td>1939-1966</td>
</tr>
</tbody>
</table>

Property combined with the Boise-Rochester and other holdings of Talache Mines, Inc. (Table 5), after 1939.

1Information not available in Idaho Geological Survey’s files.
Compensating, at least in part, for the Lucy Phillips setback was important capital investment from Indiana which boosted the development of Atlanta in the summer of 1868. The Monarch Company purchased 775 feet of the Atlanta lode for $45,000 in gold coin and $230,000 in stock. At least 175 feet of this purchase was regarded as singularly valuable, even by a crude milling and recovery process then available, $250 to $500 per ton could be produced. With better technology, this part of the lode would soon seem to offer prospects superior to the Poorman and Owyhee [in the Silver City area in Owyhee County]. The company pledged that a ten-stamp mill would be in operation by the fall of 1869, and that pledge was met.

Clayton (1979, p. 8) evaluated the early operation of the company’s mill:

At great expense and labor the company constructed a ditch of about two miles in length to convey the waters of the Boise River to a suitable mill-site near the mouth of Quartz Gulch. Here they erected two small mills of 10 stamps each for working their ore, neither of which was suited for the work, and as a consequence, could not save one-half the metal the ore contained. This fact, and the want of skill in adapting the machinery to the work required, brought about the natural result, a failure to make the operation pay for the enormous outlay necessary to get started, and carry on operations in such a distant and then isolated district. Operations were suspended, and finally the mine was leased for three years from July 1st, 1874 to July 1st, 1877.

Several significant events took place at the Monarch property in 1869 (Wells, 1983, p. 58-59):

The Monarch [mill] started up that month [January 1869] too, handling a test run of six tons. Recovery of 1,200 pounds of dry amalgam—a rate of about $500 per ton—showed the possibilities of the Atlanta lode. Because the ore was almost entirely silver, efforts to recover silver as well as gold at last seemed to have started. . . . By the spring of 1869, the Monarch had begun to employ the Washoe process . . . .

The Monarch Company purchased the old Farnham mill [in early 1869], which had failed at Rocky Bar four years before, and later in the season acquired the Greenback mine in Atlanta for $300,000. Mining operations, however, continued to be limited. In the spring, only one mill was running, the Monarch on Atlanta ore.

Raymond (1870, p. 248-249) described the mine as it appeared in 1869:

The only active company in the district is the Monarch, an organization of Northern Indiana, having a claim of 1,400 feet upon the Atlanta lode. This lode is quartz, incased in granite, with a strike of 79° east and dip of 80° to 85° north, where I could observe it.

A ravine crosses the Monarch mine some 300 feet from its west end. The eastern portion rises some 200 feet in vertical height above the bed of the ravine. The first development made was from near the center of the location by driving east upon the outcrop into the face of the hill, where a small seam of good ore was found. This was extracted from the drift up by overhand stoping, and that part of the mine was then allowed to cave.

The developments at the time of the visit of Mr. P. S. Buckminster, to whom I am indebted for this account, were a drift commencing some 75 feet east of the ravine, and

5This date differs from that given in other sources. Anderson (1939) puts the Monarch sale in 1866.
running east upon the lode some 125 feet. At this point the drift forks, one branch bearing a little to the right, the other to the left, and both extending some 75 feet further. Neither drift has developed any selvage or country rock, and as there are 15 or 20 feet of quartz between them at their ends, the lode is shown to be quite wide at this point. The right hand drift shows in face, and along its top for some distance, a very rich seam of ore, from one to four inches wide, composed of native silver, silver glance or sulphuret, and antimonial silver, (apparently pyargyrite), comparatively little quartz being intermixed. On each side of this seam is a low grade of ore, containing the same minerals, accompanied with considerable iron, mostly in the form of sulphuret. The full width of the pay vein will average nearly two feet. The left-hand drift has developed a seam and vein similar to the right, but wider; the rich seam is from one to six inches, and the whole pay vein nearly or quite three feet in width. A very small amount of gold is shown by assays to accompany the silver. These developments are some 100 feet lower (vertically) than the old workings first mentioned, to which, doubtless, one of the ore veins extends. Four miners were employed at the mine at the time.

The company has a mill with one French burr, one cast-iron grinder, two Varney pans, and one settler, all run by water-power. Connected with the mill is a roasting furnace. Two men were employed at the mill.

The Monarch operated for six months during the year which ended June 1, 1870, and produced $50,000 (Raymond, 1872). According to Anderson (1939), operations were suspended in 1869. The company attempted to sell the property in London to an English company (Anderson, 1939), and the appearance of a prospectus in an English paper was cited as confirmation that the sale had been made (Raymond, 1872). However, the deal was apparently never completed.

Raymond (1873, p. 204) described the Monarch workings (under the heading of "The Atlanta") in 1872:

It runs east 17° north, dips north near the surface, but changes in this respect at a slight depth, and dips then southerly. There is one tunnel on the lode, 380 feet long, gaining a depth of 180 or 190 feet. At the end of the tunnel a shaft has been sunk 43 feet deep, under a lease, which gave the working party all the ore taken out in sinking it. This ore yielded from $60 to $70 per ton in a stamp mill. The tailings were worked over again and yielded from $30 to $40 per ton, and it is believed that they contain now as much as was taken out in the reworking.

The following year, Raymond (1874, p. 247) noted:

The best known and perhaps the most valuable lode of the district is the Atlanta. No work has been done on it since my last report, until this fall, when a lot of 30 to 40 tons of ore was taken out and worked at the mill, paying at the rate of $50 per ton. At the time of Mr. Wolters' visit the mine was in very bad condition, there being no reserves worth speaking of, and it will require considerable development to put it in good working order for steady production. It has been bonded for the last three or four years to parties who have been endeavoring to dispose of it in the English market. The price asked is said to be large. On account of the expected sale of the property the proprietors probably have not cared to expend any money in opening new ground. Operations have been confined to robbing the lode of all

A. Wolters was the superintendent of the U.S. Assay Office at Boise. He provided much of the Idaho information for Raymond's report.
the good ore in sight; and owing to this system of mining, the mine is now in such a shape that
a stranger, unacquainted with its early history and the extraordinary richness of its ore, would
be puzzled to account for the high estimate of its value put forward by its owners.

The company’s mill was water-powered and had eight Varney pans. In 1874, the Monarch was leased to Lantis & Company (Raymond, 1875). The lessees began working the mine immediately, with encouraging results. Wells (1983, p. 61) noted:

In the summer of 1874, for example, a rich surface discovery revived the Monarch: 5,500 pounds of selected Monarch ore was packed out to Rocky Bar, freighted to Kelton, Utah, and finally shipped by rail to Salt Lake City. Purchased in Atlanta for $5,000, this small lot brought $11,000 when smelted. Warren Hussey, the buyer, thus made a comfortable profit. But that kind of operation could do little to develop the district.

Raymond (1875, p. 309) described the year’s events in more detail:

The former [the lessees at the Monarch] struck a very rich vein of ore right at the surface, and two men have been kept steadily at work there. The ore-vein consists of a 2½-inch streak of very rich ruby-silver-bearing ore, and another streak of ferruginous quartz, impregnated with native silver, about the same width as the other. At the present time they are reported to have over 10 tons of this ore on hand, which will no doubt yield from $1,500 to $2,000 per ton by proper treatment. The intention of the lessees was to ship this ore late in the fall to San Francisco for reduction, but winter setting in nearly a month earlier than usual, and preventing transportation, this could not be carried out, and had to be deferred until spring. For the same reason they, as well as others, were caught by the first heavy snow-storm without a sufficient supply of mining-supplies to last them during the winter, and being unable to procure them afterward, they had to stop work on the deep tunnel, which they were running to strike the lode 100 feet below the present lowest levels.

No work has been done in the level on the north wall, which is still in barren rock, but that on the south wall has been extended 50 feet, and a small streak of fair milling-ore has been developed. It is to be regretted that difficulties existing among the owners prevent a vigorous and legitimate working of the property, as the lode is most certainly a remarkable one as far as size, extent, and richness of ore are concerned. Under sound and economical management, backed by sufficient capital to open the mine properly, and to erect works suitable for the beneficiation of the ore, the reputation of the Atlanta lode as being inferior to only very few lodes in the world would be speedily and easily established.

Concerning the lessees’ operation, Clayton (1879, p. 2-3) stated:

The lessees started in with a capital of $8,700 cash, refitted one of the mills for working the second-class ore, mainly for the free gold it contained, of which they could save nearly one-half, and also took the precaution of constructing reservoirs to retain the tailings for reworking.

The first-class ore was carefully assorted, sacked, and packed on mules over the mountain to Rocky Bar, 18 miles, thence by wagons 310 miles to Kelton station, on the C. P. R. R., thence east to Newark in part, and later, to the smelting and refining works at Omaha, realizing over seven hundred dollars per ton.
The first workings by the lessees were mainly through levels No.1 and 2, driven on the lode from the west face of the hill east of Quartz Gulch. Later on they ran an adit level, 400 feet long from the north, and cut the lode 120 feet lower, making the 3d level, which they extended east along the lode 700 feet (see map and profile [omitted from IGS's copy of this report]), at which point a raise was made, connecting with the two levels above, as shown on the longitudinal section and profile [omitted from IGS's copy of this report].

The two zones or streaks of rich pay ore, hereinbefore mentioned, were connected with these different levels by crosscuts, and all the richest portions of the lode have been stope out between them by the aforesaid lessees of the mine.

The lessees continued their work at the Monarch in 1875 (Raymond, 1877, p. 211):

Mr. Lantis has been working the Monarch Company's ground steadily, and with results exceedingly creditable to his energy and ability. Operations were commenced without available capital, and the utmost economy was necessary, but everything has been done in the most substantial manner, and not only with a view to present, but also to future wants. In the summer of 1874 a very rich vein of ore was struck at the surface, on which work has been continued ever since. At the same time the deep crosscut tunnel [Lantis tunnel of Anderson (1939)] which was in about 400 feet reached the vein, and has since been extended 300 feet. An air-shaft has been raised to the surface and a contract let for 1,000 feet of levels, which, when completed, will put the mine in good condition for the steady production of a large amount of ore. During the year 40½ tons of first-class ore was shipped to Omaha, which yielded over $160,000. Besides this, a large amount of second-class ore was treated in the company's mill, which yielded from $40 to $50 per ton. Encouraged by these excellent results, the owners instructed Mr. Lantis to put on a force of 50 men during the winter, but owing to the advanced season the necessary supplies for such an increased force could not be obtained, and there are only a dozen men now employed. At present from 30 to 40 tons of first-class shipping-ore are on hand, and the mill is kept running at full capacity on second-class ore.

In 1876, J.E. Clayton described the Monarch (quoted from Raymond, 1877, p. 214) as follows:

No developments have been made of a permanent character, except on the Monarch and Buffalo claims. Both of these claims have been tapped by tunnels run from Quartz Gulch, cutting the lode about 100 feet below the surface and about 80 feet below the water-line. The Monarch tunnel gains depth below the cropping as it runs east along the lode into the high ridge toward Montezuma Gap. At the east end of the Monarch ground the level will be 300 feet or more below the surface.

The width of this great lode between the walls is from 40 to 100 feet, and near the point where it crosses the summit toward Yuba Creek it is much larger, but its exact width at this point has not been ascertained by any direct cross-cuts. The metallic contents are gold, native silver, ruby silver, brittle silver, and sulphide of silver or silver-glance. The brittle silver, or black sulphur, is the most abundant ore; next in quantity and value is the ruby silver. The native silver and the silver-glance are found only in small quantities. The true gold constitutes

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5The No. 2 level is believed to be the same as Anderson's (1939) Atkins level.
6The material quoted by Raymond (1877) contains similar information to Clayton (1877) and may be an early draft of that article.
twenty to forty per cent. of the value. The other minerals are iron-pyrites in moderate quantities, disseminated through a friable granular quartz gangue and a cabbly, softish granite, which seems to be a part of the lode, as intercalated seams and masses between the layers of quartz. I saw no traces of copper, zinc, or lead. In fact, this lode carries the purest ores of silver that I have ever seen in any extensive mine.

The Monarch Company’s ground consists of 1,600 feet in length on the lode, beginning at a point some 300 to 400 feet southwest of Quartz Gulch, and running east across the gulch into Montezuma Hill. A tunnel has been run from the northwest nearly parallel with the gulch until the vein was cut at a point near the west end of the claim; then it turns east, following the lode under the gulch and into the high ridge or hill above mentioned.

The rich seam of black sulphuret and ruby ore varies in width from 1 to 6 or 7 feet, but alongside of it is a seam of pay-rock that carries a good percentage of free gold with silver ore disseminated through it. This ore is milled without roasting, but not with good results. The yield in bullion rarely exceeds 40 per cent. of the assay-values. The rich brittle sulphuret and ruby ore is assorted from the mass and shipped East for reduction. I could not learn the amount of ore shipped up to date—common report says five or six hundred tons, that assays from $800 to $2,000 per ton. Judging from what I saw, I should place the average at about $1,000 per ton. The lower grades of ore are taken to the company’s mill, just below Atlantic City, a distance of about two and a half miles from the mine. The second-class ore is said to have an average value of $150 per ton, but whether that sum is the product in bullion or is the assay-value, I did not learn. The ore I saw hauled to the mill during the week of my stay in the district appeared to be much richer, I should say not less than $300 assay-value.

The work at the mine should be thoroughly surveyed and a shaft started “to the deep” with hoisting-works and pumps to put it down 1,000 feet, and at each 100 feet levels should be run each way to open and drain the ground. In the second place, a good 40-stamp mill should be erected, with furnaces and appliances of the best patterns to reduce all the ores on the ground, and stop the folly of sacking and shipping the ore 2,000 miles to be reduced. A wagon-road should also be made down the river to Boise City, so that the bullion could be sent out daily by stage all the year round.

According to Wells (1883), the Monarch began producing steadily around 1877. At the same time, improvements in milling techniques were reflected in minor increases in the mill’s recovery rates (Wells, 1883, p. 61-62):

At the same time [around 1877], the Monarch (leased to some trustees for most of two years beginning January 1, 1876) began to make some steady high-grade production after six years of delay. . . At this point [with the Buffalo mill able to recover more than 55 percent of the values in the ore], Warren Hussey tried to sell the Monarch to San Francisco investors, but met with no success. . .

Perhaps . . . $400,000 was milled in Atlanta by the Monarch [before 1884]. Yet fully $1 million of the $1.4 million in Monarch recovery for these years came from extremely high-grade ore (primarily 1,000 tons from the rich surface discovery of 1874) handled by the Omaha smelter.

Lantis & Company’s lease expired in 1878. Because the lessees had found the mine so profitable, the owners refused to renew the lease. Instead, they resumed operating the mine themselves (Anderson, 1939).

This date disagrees with all other sources.
When Clayton evaluated the Monarch in 1879, he included information on the production to date, inventoried the improvements on the property, and estimated the ore still available (Clayton, 1879, p. 3-4)

There yet remains in this block of ground large quantities of low grade ore, and numerous small seams of rich ore that can yet be extracted and worked profitably. It is difficult to give accurate estimates of the amount of workable ore in the old stopes and unworked portions above the 3d level, but as a matter of judgment, based upon my knowledge of the ground, and the manifest interest of the lessees to extract only the rich ore, I think it is fair to assume that there is remaining not less than 5,000 tons of ore that can be extracted and worked with a fair margin of profit under a more comprehensive and economical system. (I will here state as a fact well demonstrated, that ore in large quantities, that can be easily mined, and that will yield ten dollars per ton in free gold, can be made to pay handsome profits, working for the free gold alone, as has been demonstrated in California, Black Hills, and other places.)

The facts in this case are, that more than one-half the values in the low grade ores of the “Atlanta” lode are free gold, and as about 10,000 of ore have been taken out of this block of ground, that gave an average yield of about $100 per ton, I think the estimate of 5,000 tons of low grade ore still remaining is a very conservative one. Now, if we place the gross value at $25 per ton, we have remaining and still available, in the old workings, about $125,000 gross values—say $75,000 net.

The estimated values of the 2d class ore on the dumps—the ore that can be recovered from the waste dumps, and tailings from the rich ore worked at the Mill, are $145,000, or about $5,000 in net making a total of $160,000 net still available from the small block of ground covered by the old works, as shown in the longitudinal section [omitted from IGS’s copy of this report].

The following statement of the bullion extracted from this same block of ground will give a fair idea of the great wealth of the “Monarch” mine.

1st. — Bullion yield prior to 1874 ........................................... $250,000
2nd. — Taken out by lessees as to July 1st, 1877 .......................... 394,000
3d. — ” ” since expiration of lease ..................................... $400,000
        Total bullion product ........................................... $884,000
4th — add total gross values still remaining in the block of ground, the dumps, and
        in the tailings—say ........................................... 270,000
        Total ........................................... $1,154,000

Making a total gross yield in bullion of more than $1,000,000 from a block of ground on the lode of less than 400 feet square.

It cannot be stated with certainty that the block of ground, 800 feet long by 300 feet high, still remaining east of the old workings, will yield as much, for it has not been thoroughly explored; but good ore has been found in the croppings, as far as 300 feet beyond the east end line of the “Monarch” ground, and the entire surface ground, or soil, along the out-crop to the east line, is rich enough in free gold to pay for placer washing. The conclusion is, therefore, irresistible [sic] that this eastern block of ground is exceedingly valuable, if not as rich as the portion already worked. I, therefore, estimate that the new ground above the level of the Lantis tunnel, or 3d level, and east of the old workings, is worth net, at least . . . $300,000

Add the estimated net value still remaining from the old workings ........................................... 160,000
and we have the estimated net value above the lowest level of ........................................... $460,000

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10 This number is believed to be incorrect. This bullion would have had to be produced in a period of, at most, 22 months. The value needed to make the addition balance ($238,000) is more consistent with the $394,000 produced by the lessees in the previous three-year period.
The improvements and other valuable properties belonging with the "Monarch" mine are briefly as follows:

Two 10 stamp mill[s] and one saw-mill ........................................... $ 40,000
One canal and water-rig[s] with two mill sites .................................. 50,000
Boarding-houses, blacksmith shops, assay office, ore houses, and other improvements [Figures 14 and 15] ......................................................... 10,000
Total, exclusive of the Mine .............................................................. $100,000

Add estimated net values in the mine above the 3d level .......................... 460,000

Gives total net values in sight ............................................................ $560,000

This brings us to the consideration of prospective values. These consist mainly in the probability of the rich ore extending to the deep. It has already been shown that this is a great "true fissure lode" of unusual power, carrying rich ore in the surface workings through the "Monarch" and "Buffalo" claims, a distance, by actual workings, of nearly fifteen hundred feet in length, and as no such lode has ever failed to carry its ores to the deep, we are justified in estimating its value to a depth of at least one hundred feet below the 3d level of the "Monarch" mine, and in assuming that the ore will be equally as rich as that worked above that level. This assumption has been actually verified at one point by sinking a winze on one of the ore seams to a depth of 100 feet below the Lantis tunnel on a splendid body of ore; but having no machinery to keep the water out of the way, the lessees discontinued the work in this winze.

The Monarch was active for the next few years. The 1881 DotMR noted that all the ore produced up to that date had been mined from within 150 feet of the surface. In that same year, Strahorn (1881, p. 36-37) published glowing accounts of the mines in the Atlanta area, including the Monarch:

The Monarch was the first quartz claim developed in the district (discovered in the summer of 1864), and is probably the best on the vein. It consists of 1,600 feet along the vein and is owned by the Monarch Mining Company, of Indianapolis, Ind. There are over a mile of openings in the shape of tunnels, crosscuts, shafts, etc., to prove the assertions of these celebrated mining engineers. The greatest depth is 400 feet. There are several veins of paying ore, from a few inches to ten feet wide, distributed throughout the ledge, carrying ruby silver, black sulphur, silver glance, native silver and native gold. At the point of discovery a veritable treasure-box of ruby silver was found, which in the small space of 20x50 feet yielded $200,000. In 1876, 1877 and 1878, 1,000 tons of ore were shipped to Omaha, which returned $700,000, probably the largest average yield per ton ever produced from such a large shipment by one mine in this country. Probably the best day's work ever done by one man in a quartz mine was that accomplished a few years ago in the Monarch, when one miner in ten hours broke down $50,000 worth of ore. The product literally sparkled with ruby and native silver worth $3 per pound. From a block of the Monarch vein, 300 feet deep and 400 long, $1,100,000 worth of ore has been extracted, and there are at least 10,000 tons of $50 ore in sight. The entire working force has averaged only twelve men for several years. This small force has, during the past eighteen months, taken out $130,000 while carrying on a great amount prospecting and "dead work."

A small cabinet of Monarch "specimens," weighing, probably, 250 pounds, in possession of Mr. W. H. Petit, superintendent, is well worth traveling hundreds of miles to see. Many of the pieces are almost pure silver, in the form of sheets and wires, and there are a number of quartz nuggets of almost as pure gold as our royal currency. Gold sulphur, assaying $50,000 per ton; masses of blood-red ruby, fifty per cent pure silver, and a box of small masses of native silver, worth $50 per pound, are among the treasures which are being added to daily from the workings of the rightly-named Monarch mine.

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Figure 14. Monarch mine camp, with large stacks of timbers waiting to be used in the mine (Wells, 1983, p. 59).
Figure 15. Cookhouse in Quartz Gulch that served the Monarch Mine (Wells, 1983, p. 58).
Rich as it is the Monarch has been worked only spasmodically by an eastern company which made the apparently fashionable (in Idaho) mistake of erecting costly mills to crush their ores by the wet process, when it is found that the ores must be roasted. The company is being re-organized and is arranging to rebuild the mills and push development on the mine as the great property deserves. The company is now compelled to pay $30 per ton for working its ores in a custom mill at Atlanta.

The 1882 DotMR (p. 199) described the mine as follows:

The Monarch is an old mine, having been located nineteen years ago. The property consists of 1,600 feet, running east from the center of Quartz Gulch. The ore was formerly worked with a wet-crushing, 10-stamp mill, but the result was unsatisfactory, and the company owning the mine leased it until 1878. Since that time it has been operated by the company, the lessees having found the mine so profitable that the company refused to renew the lease.

The mine is opened by three tunnels, the upper one being in 500 feet, the second 800 feet, and the lower 1,800 feet. Cross-cuts are run every 50 feet. The vein as exposed is large in places, upwards of 50 feet in width, with well-defined walls. The ore runs in seams of varying width and of extreme richness. The clay seam on the hanging wall contains kidneys of ore, yielding in some instances as high as $2,000 per ton.

Although the mine has been advantageously worked by tunnels, a shaft has also been sunk, now nearly 250 feet in depth, with two working compartments and an additional one for pumping. Fine hoisting works have been in process of erection during the year, which have a capacity to sink to 1,000 feet. The engine is of 60 horse-power, double-acting, and all the appointments are first-class and of the best material. The mine is the property of the Atlanta Mining Company, who contemplate erecting a new 20-stamp mill early in 1883.

The new hoist was put into operation around the beginning of 1883. The shaft was about 400 feet deep. The mine had three levels, about 100 feet apart and connected with raises. The new stamp mill was completed during the summer. The 1884 DotMR stated (p. 259):

The Atlanta [Monarch] mine has good hoisting works and a 3-compartment working shaft down 500 feet. The mine is well opened to that depth, and shows continuous ore-licks the whole distance. A 15-stamp dry crushing mill has been working since December 16, 1884. The ores are silver and gold, in quartz, and are milled by dry-crushing and roasting. Eight hundred tons of ore have been extracted during the year, yielding $70,000.

In late 1884, the neighboring Tahoma Mine failed to meet its payroll. Over the next few months, the Tahoma default triggered a general collapse in Atlanta's economy (Wells, 1983). Little work was done the following year in the district, and most of the more developed properties were up for sale. The Monarch was among the mines affected by the district’s economic problems, and Wells (1983, p. 62) noted:

Even W.H. Pettit's new fifteen-stamp Monarch mill, which had commenced operation on December 15, 1884, ran only occasionally.

Of the work at the mine in the early 1880s, Anderson (1939, p. 54) reported:
As most, if not all, the ore had apparently been mined above the Lantas level the owners were forced to sink a shaft, which by 1882 had reached a depth of 250 feet. During the next year, the shaft was sunk to 400 feet and three levels 100 feet apart were opened and connected by raises. A 20-stamp mill was also completed during the summer months. Within the next two years the shaft was sunk to a depth of 600 feet and another level run on the 500. Considerable ore was mined and milled, but the recovery was low. The grade of the ore became lower with depth so that mining became unprofitable and the company, the Atlanta Mining Company, suspended work.

F.J. Conroy reopened the Monarch in 1901. At that time, the mine had about 3,500 feet of workings. T.N. Barnsdall purchased the property in 1901 (1903 IMIR) or 1902 (Reigart and Nicolson, 1933). Barnsdall also purchased the Last Chance and Buffalo Mines. Daniel Kirby was put in charge of the work at the mines. According to Farish (1908), the mines were in such poor condition that it cost more to reopen the workings than it would have cost to mine the area if it had never been worked at all. Anderson (1939, p. 54) described the work needed:

A 1000-foot tunnel was driven to the Buffalo and Monarch, part of it for 200 feet alongside the footwall (North) ore body at about the No. 1 level. The No. 2 level was entirely reopened, the No. 5 for 900 feet, but the No. 3 and No. 4 remained untouched. Most of the reopening was completed by 1906.

In 1905, a crew of twenty men worked to block out ore at the Monarch. At the same time, the company conducted milling tests to find the most economical process for treating the ore. According to the 1905 IMIR (p. 58-59):

The Monarch is the central feature of the great Atlanta Mother Lode, whose total production is conservatively estimated at $5,000,000.

The Monarch Mine has an immense tonnage of ore blocked out and a good deal of it is high grade. This powerful lode is contained in a formation of porphyritic granite. It has been more or less developed continuously for a distance of over two and a half miles.

An aerial tram was ordered, and plans called for it to be used initially to handle mine supplies.

The following year saw a number of additions to the mine. The 1906 IMIR (p. 56-57) described this work:

The central and choicest section of the great Atlanta lode is owned by the Atlanta Mines Company, of which T. N. Barnsdall, Esq., the well known Pittsburgh capitalist, is the principal owner, and Mr. Daniel Kirby is general manager and under whose personal charge the property has been extensively reopened and developed during the past four years through a vertical shaft, six hundred feet deep, with long levels and one hundred foot intervals in the shaft, and also a long surface adit.

This great lode traversing this property, which is locally better known as the Monarch mine, is from fifty to one hundred feet wide, of altered porphyritic gangue in granite walls and carries two defined ore veins of shattered quartz separated by an intrusive dike of basic igneous rock. These quartz veins invariably carry a wide border on one or both walls of
distinctly blue quartz in which the better values are contained. Based on values of five dollars per ton, this property now has developed and in sight, through its shaft works together with the long adit tunnel fully one million tons of ore.

The pronounced pay borders, however, on these big veins that range from five to thirty feet wide contain average values of ten to thirty dollars per ton and quite an extensive reserve of this class of mineral is available. The proportion of values in the ores range about sixty per cent gold and forty per cent silver.

The ores carry traces of antimony and arsenical pyrites and coarse yellow sulphurets of iron, the latter very rich in gold. The mineral is rather difficult to treat and for this reason the mine has not produced largely since the early days, when its enriched surface horizons are said to have yielded secondary ores of very high value that were the chief source of the district’s output.

This mine has been fortunate in falling into such strong financial hands. Extensive and repeated tests of large lots of the ore have been submitted to expert metallurgists during the course of the recent development of the mine with the result that a year ago a new mill and other large mechanical equipment was decided upon. These are now all on the ground and are rapidly being placed in position. They consist of a new aerial tramway a mile and three-quarters long which was completed in November and successfully tried out. It has a carrying capacity of twenty-one tons an hour and when in full operation develops forty-two H. P. for use elsewhere. It is of the latest design and carries some important mechanical attachments by which a speed can be governed to a nicety. This tram extends from the Monarch mine, near the summit of Atlanta ridge to the new mill on the Boise River.

A dam has been built across the Boise River (Figure 16) and an electric power plant installed capable of developing six hundred H. P. This will supply power to run the air compressor and hoist at the mine, and will also furnish the necessary additional power required to run the mill and leave some for sale to other companies.

The mill (Figure 17), which is now nearly completed, is of one hundred fifty tons daily capacity, and is adapted for testing the ore by amalgamation, concentration and cyaniding, which method has been found to give the highest results of extraction.

With this plan completed and in full operation together with other enterprises under way in the Atlanta district, Elmore County is destined to make one of the most important advances in gold production of any county in the State, and the county is to be congratulated in securing the liberal class of investors and practical operators who have recently become interested in this and other of its mining resources.

The mill was expected to go into operation in the fall of 1907, but this was postponed because of delays in shipping needed equipment to Atlanta. The 1907 IMIR (p. 93) noted:

The mill on this property which is owned by the Atlanta Mines Company is now completed (Figure 18). It embraces some of the most modern and up-to-date milling appliances adapted for this class of ore, and was designed and constructed under the direction of Mr. W. T. Sherman of Park City, Utah, whose reputation for the recovery of elusive mineral values is world-wide. This mill has a capacity of 150 tons of ore a day, and will be put in commission about the first of April. It embraces a wet crushing method of amalgamation and fine concentration and cyanide treatment for the tailings. The ore is rather refractory and contains a light dissemination of sulphides of iron, arsenic and antimony, together with rich silver minerals in the form of argentite and ruby silver in shattered quartz gangue. Extensive preliminary tests on carload lots of the ore were made before the mill was designed, and the management are very confident of extracting a high percentage of the values. The plant is to be
Figure 16. Atlanta Mines Company's power dam under construction on the Middle Fork of the Boise River below Atlanta (Bell, R.N., 1907, Eighth Annual Report of the Mining Industry of Idaho for the Year 1906, opposite p. 57).
Figure 17. Monarch mill and aerial tram, under construction in 1906 (Bell, R.N., 1907, Eighth Annual Report of the Mining Industry of Idaho for the Year 1906, opposite p. 56).
Figure 18. Monarch mill in 1907 (Bell, R.N., 1908, Ninth Annual Report of the Mining Industry of Idaho for the Year 1907, opposite p. 96).
run by electric power developed at a magnificent power site on the Boise River near the mill, owned by the company, and the mill is connected with the mine by an aerial tram a mile and a quarter long. [Figure 19 shows the lower terminal of the tram.]

The ore resources of this company embrace the old Monarch and Buffalo mines on the famous Atlanta lode, which are reputed to have yielded shipping ores from their surface horizons to the value of $5,000,000. Their present development is through a vertical shaft 600 feet deep, with 6 extensive levels, in which there is now disclosed new ore resources estimated at $5,000,000 in gross value, that carry gold and silver at the rate of from $5 to $30 per ton, while extensive pay streaks of mineral, containing the higher values mentioned, are in sight in the mine. The ratio of values runs about 60 per cent gold and 40 per cent silver, and the property can be depended on to ultimately become an important dividend payer. Mr. T. N. Barnsdale of Pittsburgh, Pa., is sole owner of this splendid property, and it has been undergoing steady development for 6 years under the management of Mr. Daniel Kirby.

The mill was tested in 1908, but it could not treat the Monarch ore adequately. Farish (1908, p. 5-6) examined the mill:

The mill consists of a large Monarch crusher, with a crushing capacity of 500 tons per day, from which the ore passes to a first set of rolls, passing through which it is sized, the coarser passing through a second set of rolls, the whole being elevated 42 feet where the ores are sized by Callas sizers. The coarser ores are then run through three Huntington mills (Sherman type) which grind material to a 40-mesh, which material passes over very short copper plates which are inadequate for the successful amalgamation of the free gold. From thence it runs over another set of sizers which size the material for each table, after which the coarse material is again ground in Huntington mills to an 80-mesh, when it again passes over concentrators.

The power for running the mill is obtained from the Boise river and is conveyed to the millsite by a ditch upwards of a mile long, where it is discharged into two Derenmer waterwheels under a 96-foot fall, giving 150 horsepower with 1,000 inches of water the entire year.

Farish's (1908, p. 6-7) recommendations for treating the Monarch ore included:

A good portion of the ores—er, rather, in certain parts of the mine, there occurs a great deal of ruby and silver glance in the ores. This character of ore is very hard and never has been successfully concentrated to a high percentage of its values, and where it predominates in this property, in connection with other metals, a total saving of over 60 per cent should not be expected. In other parts of the mine there is little or none of this character of ore at which places a total saving of 80 and upward per cent can be confidently relied upon. I have no doubt that with experience in treating the ore that a general average saving will ultimately be accomplished of at least 80 per cent of the value of the ore. I have been reliably informed that at the Bagdad Chase property ores running from $5 to $8 per ton successfully amalgamate 28 per cent of their values (freegold); on ore running $12 per ton a saving of from 30 to 40 per cent is made, and on ore running $20 and upwards a saving of 48% is made, and that their total saving, including concentrates, is about 83% of the assayed value of the ore. This ore coming from the same vein upon which your properties are located and the most of it being extracted near your east end line, I see no reason why, with experience and the proper machinery installed in your mill both for amalgamating the freegold and the concentration of the ores, an equal savings cannot be made upon your ores.

The Bagdad Company crush their ores through a stamp mill to 40-mesh, discharging upon copper plates where the freegold is amalgamated. The pulp then passes over Frue
Figure 19. Lower terminal of the Monarch tram, with the mill in the background (Idaho Historical Society photograph).
vanners, after which it is sized, the coarser material being reground in a tube mill to 100-mesh, when it is again run over Frue vanners and concentrated, obtaining a total saving of values as stated above.

In your mill ample copper plates for amalgamating the freegold should be provided for each of your Huntington mills. The present concentrators are defective in their mechanical construction and absolutely useless, excepting for saving the very finest material in the slimes produced in grinding and crushing the ores. While running they make an excellent saving in this respect, but, as stated, they are defective. Other and more improved concentrators should be placed in your mill, when, no doubt, results equal to those that I have mentioned (60% to 80%) will be obtained.

A series of tests have been made for the reduction of the concentrates upon the ground by thoroughly roasting with salt the concentrates and eliminating the sulphur, thereby converting the silver contents into a chloride of silver and freeing the gold from other metals. They then are treated by cyanide, by which process, I am told, they obtain 95 per cent of the gold and silver contents. After roasting the ores the gold and silver contents can be saved by pan amalgamation. Both of the above processes should be thoroughly experimented with before going to any expense in building the furnaces or erecting other works for the treatment of concentrates. If it is found that the tailings from the concentrators cannot be treated by cyanide (which can as easily be determined, as you have the vats and a cyanide plant in your mill, capable of reducing 150 tons of ore a day, all ready for use) they should be deposited in some safe place on your millsite, as there is little doubt that some cheap method will be found by which the greater amount of values they contain can be recovered.

The ores from your mines carry from 2 to 3 per cent of sulphurates to the ton, and will probably average about 2-1/2 per cent. In the adoption of either of the above methods for treating the concentrates, I would recommend the erection of a reverberatory furnace. To make your reduction works complete it will be necessary to put in an ample number of the most improved concentrators and Demick canvas tables, and to each Huntington mill should be added sufficient copper plates for catching the freegold as the ore is crushed, and the building of a reverberatory furnace of ample dimensions for roasting the concentrates, thus preparing them for treatment either by pan amalgamation or by cyanide.

With the above improvements or additions made to your mill, I have no doubt that an average saving, to commence with, of from 65 to 70 per cent of the values contained in the ore, can be had, and with experience gained in treating the ore, I anticipate a further saving of from 15 to 20 per cent.

The mine also generated its own power (Farish, 1908, p. 5-6):

I take great pleasure in stating that all the machinery upon the property, with the exception of the concentrators, so far as I am able to judge, is first-class in every respect, and is erected or placed in a most substantial manner.

The power plant for generating electricity is located about 1 1/2 miles below the mill and at a short distance below the junction of the Yuba and Middle Boise rivers. It consists of two Westinghouse alternating-current generators of 180 kilowatt, 67 amperes [ampereas], 2200 volts, with estimated horsepower of 300 each, those driven by 16' Laffel powerhouse wheels (Samson models), under a pressure of 46 feet. In order to obtain this power a crib-dam is built across the river to the height of 46 feet at the upper end of a narrow canyon [canyon or canyon], through which the river flows. The crib is 60 feet wide at the bottom and continues that width to a height of 30 feet, when it is reduced to 40 feet the balance of distance. Its length at the bottom is about 40 feet, and is 100 feet at the top. It is filled with rock and dirt, and is thoroughly and strongly built.
The water is taken from the dam by a 6' x 5' flume to the penstock, a distance of about 100 yards, where it is discharged on the water-wheels under the pressure, as stated, of 46 feet.

The machinery is of the latest make, and is set up in a most thorough manner. The foundations are all on solid rock.

The powerhouse is 32' x 70', set also in solid rock.

The penstock is 10 feet deep, 12 feet wide and 71 feet long . . .

Your company owns the right to 8,000 miner's inches of water flowing in the Boise river.

There is also a 100-horsepower electric motor to take the place of water power should any accident or stoppage in its work occur.

Bell (1908, p. 177) noted:

Adjoining the Pettit mine to the west, on the same lode, is the Monarch mine, owned by the Atlanta Mines Company. This property is developed by a 600-ft. vertical shaft with six extensive levels, and has an ore reserve aggregating about $5,000,000 in estimated value, of about the same grade as that of the Pettit. This property has a new milling plant of 200 tons daily capacity nearly completed, and will follow the same lines of treatment as the Pettit plant. This property has also installed a hydro-electric plant of ample capacity for its own use. It is expected that this mill will be completed and producing within the next 90 days.

The mill was remodeled the following summer, and a small shipment of bullion was made from the material used for the mill tests. According to the 1909 IMIR (p. 55):

The mill, which has been remodeled this summer, will be put in operation in the spring. The plant consists of 20 stamps and cyanide plant, electric driven, with hydraulic auxiliary. The mine has been kept timbered, but no attempt has been made to develop ore during the past year, owing to the fact that immense reserves of ore are awaiting a mill suitable to handle the ore, which is rather refractory and contains a light dissemination of sulphides of iron, arsenic and antimony, with rich silver minerals, such as argentite and ruby silver in a shattered quartz gangue.

During 1909, the company shipped a small amount of bullion, which was obtained from the mill tests conducted in 1908. Mill tests continued in 1910, and the company marketed bullion, which contained a high percentage of silver, from May until the end of the year. Lack of timber and winter supplies forced the company to close the mine. There was no production from the property from 1911 through 1914.

The Atlanta Leasing Company worked the Buffalo, Monarch, and Last Chance dumps from 1915 to 1917. The ore was treated in the mill, which had five 5-foot\(^{12}\) Huntington mills, rolls, and concentration tables. Treatment consisted of plate amalgamation, table concentration, and roasting and cyanidation the concentrates. According to Reigart and Nicolson (1933), Atlanta Leasing reprocessed 36,546 tons of dump material at a profit of $27,000. The overall recovery rate was 86 percent, with 47 percent recovery from amalgamation and 53 percent from concentrating the amalgamation.

\(^{12}\)The diameter of the drum in which the ore was crushed.
tails, roasting the concentrates, and then cyaniding the roasted concentrates. The 1915 IMIR (p. 100) noted:

In the same district the veteran operator, Mr. Daniel Kirby, persisted in his further efforts to solve the local metallurgical problems by the operation of the Monarch Mill on Monarch Dump ore, and is confident of successful and profitable results in the near future. The Monarch vein has an extensive reserve of well developed ore and a shipping record of rich secondary surface ores amounting to $5,000,000 in gross value.

The 1916 IMIR (p. 34-35) sounded an even more optimistic note:

These old mines [the Monarch and the Buffalo], in the middle section of the Atlanta lode, were the principal source of its former rich ore production, from which old shipping records are available of values ranging from $800 to $1,000 per ton in car load lots. These old properties were taken over by T. N. Barnsdale, of Pittsburg, fifteen years ago, have been under the direction of Mr. Daniel Kirby of Boise, under whose management they have been extensively developed at depth and proven to contain an immense resource of primary ore values of $8.00 to $10.00 per ton in gold and silver.

Expensive milling equipment was installed and a large amount of money was spent in an effort to treat these values, which, however, proved unsuccessful by reason of their complex nature. It remained for a local Idaho metallurgist, Mr. Marcus White, formerly of Silver City to successfully solve the problem. This old property carries a dump ore resource embracing the leavings of former operations, mixed with a great deal of dead waste development material and averaging $4.50 per ton in gold and silver. Mr. White made use of the available machinery in the mill and has successfully operated on these dumps for the past two summers on a scale of 120 tons a day with an extraction of 92 per cent of the gold and 70 per cent of the silver values in the ore, which is an increased yield of fully 30 per cent over any former results obtained in efforts to treat this big resource of valuable mineral.

Mr. White’s success has been through the careful roasting of the concentrates from the ore and its subsequent treatment by cyanide methods. His success in this direction makes available the big tonnage resource of the property of much higher average value than the dumps and it seems likely that the enterprise will be revived with the addition of modern crushing machinery and flotation to the mill, and afford a big scale operation and a very valuable addition to the precious metal output of the State in the near future, and, combined with the Boise-Rochester enterprise and the numerous other splendid evidences of ore channels on adjacent properties, that in some instances, carry quite extensive development, combines to promise a very permanent and prosperous camp for the old Atlanta district that is likely to discount its former splendid record of production.

Bell (1916, p. 784-785) restated this hopeful opinion:

The most important advancement of the year in this district, exceeding in permanent value the rich ore disclosure on the Boise-Rochester property, has been made by the manager of the Atlanta Mines Co. This property embraces 2,200 ft. of the main lode to the west of the Boise-Rochester and includes the most important area of the old-time development and production of the district, when it was extensively mined under separate enterprises known as the Monarch, Last Chance and Buffalo mining companies.

These properties were acquired and consolidated by T. N. Barnsdale, of Pittsburgh, Penn., during the Thunder Mountain boom of 14 years ago and have since been lavishl
supplied with capital for mining, development and milling equipment. During these years the enterprise has been in charge of Daniel Kirby, an experienced Colorado mining operator who has developed a large amount of primary milling ore, estimated at fully 500,000 tons of about $10 a ton.

While developing the old mines to greater depth, Mr. Kirby has employed some of the best metallurgical talent available in several specific attempts to treat the ore on the ground, but has been unsuccessful beyond an extraction of 40 to 50% of the contents. These milling efforts embrace amalgamation, fine concentration and cyaniding, succeeding the old pan-process methods employed in the early days, which proved too expensive on the primary ores available. These efforts have resulted in the accumulation of a milling plant of 150 tons daily capacity which, within the past year, has been turned to excellent account by a local metallurgist, Marcus White, of Silver City, Idaho, who in conjunction with Mr. Kirby is now operating the property under lease on dump ores and making a big success in extracting the low-grade contents available.

The 1917 IMIR (p. 91-92) contained another enthusiastic report on the property:

The leasing operations on the adjacent Atlanta Mines Company’s property were carried on throughout the Summer and a daily treatment of 125 tons of low grade dump ore made with a handsome season’s yield in gold and silver bullion that was decidedly profitable to the lessors. This enterprise, at its milling end, was handled by Mr. Marcus White of Boise, who has quite definitely solved the problem of the complex ore treatment which this district involves and whose milling results promises to make available the extensive resources of this mine that are demonstrated by tunnel and shaft development to an estimated capacity of something like half a million tons, with values around $9.00 per ton in gold and silver, and negotiations were in progress for the re-opening of this property and the treatment of its extensive ore resources on the modern milling lines that have proven so successful in the treatment of the low grade dump ores during the past two or three years.

In spite of these optimistic predictions, the property was idle for the next decade. Figure 20 shows the mine in 1918.

Ballard (1928, p. 33) described the milling process that was used before 1920:

The ore from the Monarch mine was carried by aerial tram to the company’s mill located along the South Fork of Boise River about half a mile below Atlanta. This plant, now idle, has been dismantled, to some extent. The mill has a capacity of 100 tons or more per day, depending upon the character of the ore. Both water power and electric power were used to operate the mill and mine; the former was developed from a ditch above the mill; the latter from the company’s plant on the South Fork of the Boise about two miles below Atlanta.

An outline of the treatment process last used is as follows;—The ore passed from bin to gyratory crusher, thence through the coarse and fine rolls to Huntington mills, screened to grind to 40-mesh. The Huntingtons discharged on amalgamation plates, pulp going thence to Johnson vanners. The concentrate was roasted in an Edwards reverberatory furnace, salt being added at the feed end. The roasted concentrate went to the cyanide department. The tailing from the vanners was classified, the sands going to leaching tanks and the slimes to a canvas plant. The strength of cyanide solution used was one pound per ton of water with an occasional increase in the strength of this upon the appearance of copper in the feed. Precipitation was done with zinc shaving. The precipitate was treated and melted into bars at the plant. Some of the bullion was high in silver averaging only $8 in gold, or a ratio of silver

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Figure 20. Monarch Mine in 1918 (Wells, 1983, p. 58).
to gold of about 2 to 1. This was sold in San Francisco. The bullion recovered by amalgamation usually exceeded $14 in gold per ounce and was sent to the U. S. Assay Office at Boise.

The St. Joseph Lead Company (owner of the adjacent Boise-Rochester Group) acquired a lease and option to the Atlanta Mines Company's properties in the latter part of 1929; the price for the mine was $500,000 (Anonymous, 1932). Provisions and supplies were brought in, and development work was started on the property. In late 1929 and early 1930, St. Joseph Lead reported doing 1,292 feet of tunnel work on the Monarch property. This work probably involved extending the No. 6 level of the Boise-Rochester Mine to the Monarch shaft, which was completed before July 1930 (Mining Truth, September 3, 1931). Apparently, St. Joseph Lead's lease on the Monarch was then allowed to lapse.

The legal situation in the next few years was quite complex. According to a memorandum in the IGS's mineral property files (Anonymous, 1932, p. 1):

Phippen has option from Barnsdall Corporation calling for purchase price of $200,000 payable in the form of 10% royalty and the Barnsdall Corporation is willing to allow Phippen 10% commission if he sells the mine for them.

Nicholson, who interested the Goldfield Consolidated Company in the property, offered to allow Phippen $40,000 additional with monthly payments of $250 and agreed to employ Phippen's two brothers. He also agreed to allow Stenna, who holds option from Phippen, $30,000 but no cash payments were to be made during the first year. During the first year Nicholson agreed to spend $25,000 in development work, but apparently the foregoing deal did not go through.

Minor amounts of production were recorded from the Monarch for each of the years between 1931 and 1934, all credited to one or more of the Phippen brothers.

Reigart and Nicolson (1933, p. 12-13) described the property as it appeared in 1932:

There is a three compartment shaft on the Monarch mine, known as the Monarch shaft, located in what is called the Monarch ore shoot. This shaft is timbered with square timber and is 600 feet in depth. The three compartments consist of a ladder and pipeway, and two cage-ways, in which the cages operate in balance. The mine water drains out on the fourth level via the St. Joe mine, so that the bottom 200 feet is under water. The shaft is in good shape, and will require nothing but a few minor repairs to be used. The elevation of the shaft collar is given as 7,614.93 ft. above sea-level.

The accompanying vertical longitudinal section [omitted from IGS's copy of this report; see Figure 8 instead] gives the clearest idea of the development and mining done on the property. It will be noted that the mining in the upper horizon was carried on through the Kirby and Atkins tunnels, chiefly to the east of the shaft. The Kirby tunnel [apparently the unlabeled tunnel above the Atkins tunnel on Figure 8] was, approximately 550 ft. long, leaving about 600 ft. to the east line of the Monarch property with, approximately, 300 ft. of overlying ground, wholly undeveloped. Ground above the elevation of the Kirby tunnel, on the adjoining St. Joe property, was mined for a horizontal distance of between 320 and 350 feet, and up to surface, a distance of about 300 ft. This was the upper portion of the "Pettit Ore
Shoot” on the Boise-Rochester mine, and undoubtedly this “Petit" shoot extends over on to the Monarch mine.

The Atkins tunnel is at an elevation 40 feet lower than the Kirby tunnel and was driven to within 435 feet of the east property line. A part of the “Petit" shoot should lie within this 435 feet of unexplored ground.

Six levels have been opened up from the shaft and mining has been carried on from the upper five, chiefly on the east side of the shaft. The St. Joe Company is now mining the “Petit" shoot from their No. 6 tunnel, which connects with the fourth level on the Monarch mine, which means that this shoot extends continuously from surface, a distance of 850 feet, and that the extension of the Petit shoot should be encountered on the Monarch mine for this same vertical distance (850 ft.), for an undetermined horizontal distance.

Between the east extremities of the six levels and the Petit shoot, a large area of ground remains to be explored and developed. West of the shaft, mining was pursued chiefly from the third and fourth levels, for a distance of 150 feet. Some scattered stopes appear to have been mined from the four upper levels, but ground west of the shaft remains to be developed and mined.

Approximately 600 feet west of the Monarch shaft was the Buffalo Mine shaft, 500 feet deep, and sunk on the “Buffalo” ore shoot. Six levels were developed from this shaft, ranging from 200 to 500 feet in extent. The Monarch and Buffalo shafts were at one time connected on the third level. No definite information has been obtained on the exact extent of this shoot, but from the extent of the levels, given above, it must have occupied almost the entire Buffalo claim, which is 500 feet in an east-west direction. From Prof. Clayton's report, it is seen that the character of the ore was the same as that of the Monarch mine, and that the lower portion of the sulphide zone must be almost intact.

This shoot then offers very excellent possibilities of developing tonnages of ore, especially below the elevation of the third level, west of the fourth, fifth and sixth levels. The ground between this shoot and the Monarch shoot is also largely unexplored and undeveloped.

The Last Chance Mine also had a shaft on it, which was down 345 feet in depth and cut the vein at 340 feet. The vein at this point was 3 feet wide and assayed $150 per ton. This mine has several levels viz: Upper level (a tunnel level), the Blacksmith tunnel level, No. 1 level, Pomeroy tunnel level, (also the second level) and the Third level. The third level is, approximately, 300 feet from surface, and the vein is worked out above this level, but no mining has been done, at all, below this level.

The showing in the shaft, mentioned above, indicates that there are still excellent possibilities left for this branch vein below the third level elevation.

Reigart and Nicolson (1933, p. 26) also noted:

There are several piles of dumps and tailings, which have been estimated at various figures, but a conservative estimate of the dumps is 50,000 tons with an average assay value of between $3.50 and $4.00 per ton, and of the tailings piles, 30,000 tons with an average value of around $3.00 per ton. These piles are not of sufficient importance to be considered with regard to purchasing the mine, but after operations are established they may be worked into the mill feed at such small cost, that at least $1.00 per ton profit should be derived from their treatment.

In 1934, after leasing the Monarch, St. Joseph Lead transferred most of its operations to that property. The Boise-Rochester No. 6 level was advanced to the Buffalo shaft, and drifts and raises were run into the orebodies that crossed from the Boise-
Rochester into the Monarch ground. The ore in these areas was mined between 1934 and 1936. In addition, the Monarch dump and old mill tailings were milled. In late 1935 and early 1936, the No. 6 drift was driven 3,045 feet beyond the Monarch shaft to explore the company's Atlanta claims (Anderson, 1939). Anderson (1939, p. 54) summarized the work done by St. Joseph Lead:

The St. Joseph Lead Company did not, however, exercise an option to buy the mine, but instead secured a 10 per cent royalty lease and in 1934 began extensive development on the Pettit ore shoot, which in the upper levels had crossed into the Monarch ground. The 1,450 intermediate and the 250 were extended westward from the Boise-Rochester and were joined by raises from the No. 6 level. Crosscuts had previously been driven from the No. 6 level every 100 feet to explore the lode between the Boise-Rochester ground and the Monarch shaft, and this practice was continued in 1934 in extending the No. 6 to the Buffalo shaft. The work was carried over into early 1936. No good ore was opened in the Monarch shoot.

The St. Joseph Lead Company discontinued operations in the Atlanta area in 1936. Atlanta Mines leased out blocks of the Monarch property, and the lessees operated the mine for the rest of the year. The Last Chance Mining Company produced some ore during the latter half of 1936 and installed a flotation mill with a capacity of 50 tons per day (tpd). The mill was completed in December, but the weather prevented the company from operating it until the following spring. According to the 1936 IMIR (p. 172):

A 50-ton mill on the Monarch Mine near Atlanta, is nearing completion. The property is being operated by C. H. Phippen, Atlanta, and associates, organized as the Last Chance Mining Company. The Monarch property is owned by C. F. Phippen and was operated under lease by the St. Joseph Lead Company, during the time that company operated the Boise-Rochester Mine. Work was carried on through the Boise-Rochester workings and a considerable portion of St. Joseph production is stated to have come from the Monarch.

In 1937, Last Chance shipped high-grade gold ore to a smelter. In addition, the company recovered a considerable amount of gold from the Monarch dumps, and the tailings from the Monarch mill were reprocessed, apparently by another lessee. The 1937 IMIR noted (p. 159):

Tentative arrangements between the Last Chance Mining Company and eastern interests were reported to have fallen through so the company is operating on its own account. The road up Quartz Creek to the Monarch Mine was widened and put in shape for the transportation of ore to the company's 50-ton mill. The power shovel used in this work will load the dump trucks with ore for the mill instead of transferring the mill feed by tram.

Leasing operations are in progress at the mine under the direction of Matt Hovick, while Marcus White is superintendent of the mill. C. F. Phippen, Atlanta, is president of the company. 200 ft. of new development work was reported at the property during the year.

In 1938, Last Chance treated about 8,000 tons of gold ore by amalgamation and concentration and shipped several hundred tons of rich gold ore for smelting. The 1938 IMIR (p. 153) contained the following information:
The Last Chance Mining Company, E. F. Phippen, Atlanta, president, worked the Monarch with success during the year. The mill feed was furnished from open pit and dump material which was transported by truck to the 50-ton mill at Atlanta. Matt Hovick is in direct charge of mining operations including several leasers working underground in the Monarch mine. Marcus White is mill superintendent. It is reported that a deal is pending for sale of the property to out-of-state interests.

The following year, Last Chance produced about 8,500 tons of ore, which was treated by amalgamation and concentration, and 273 tons of rich gold ore, which was shipped direct to a smelter. The 1939 IMIR (p. 200) reported:

For the past year the Monarch mine has been operated by the Last Chance Mining Company under the direction of Hooper, Kimball and Williams, Inc. of Boston, Mass. Lindsey Hooper is president of the firm. Under the supervision of A. A. McLeod the company opened up good surface showings to a width of 40 feet. Stopes on the 100 ft. level produced commercial ore that was trucked to the Monarch mill at Atlanta. A crew of about 50 men was employed. It is reported that this property has been taken over by the Talache Mines, Inc., to be worked in conjunction with the Boise-Rochester mine. In addition to a lease and option on the Monarch, the deal included the hydroelectric power properties of the Atlanta Power Company and the Kirby power site on the Middle Fork of the Boise River below its confluence with the Yuba River.

Talache Mines, Inc., owner of the adjacent Boise-Rochester Mine, acquired the Monarch in November 1939. From that time, the Monarch was operated as part of Talache’s holdings, although it was apparently leased separately in the mid-1970s and reported minor production in 1978. Figure 21 shows the Monarch Mine site in 1986.

Total production recorded for the Monarch from 1902 to 1978 is 55,458 tons of ore. This material yielded 10,567 ounces of gold, 81,315 ounces of silver, 330 pounds of lead, and 564 pounds of zinc. Inaccuracies in these totals include the reprocessed dumps and tailings that were reported as ore in some years and the probable absence of records for shipments made by some lessees at various times. Production from the early years, when the mine produced its best ore, is too fragmentary to tabulate. However, Anderson (1939) estimates that $1,200,000 worth of ore was produced between 1865 and 1886, and suggests the total production through 1936 was in excess of $2,000,000.

BOISE-ROCHESTER MINE

Introduction

The Boise-Rochester Mine covers the northeast end of the Atlanta lode from the east crest of Atlanta Hill to the bottom of Montezuma Gulch (Figures 3 and 5). In the early days, this part of the lode was divided into the Old Chunk, Stedman, and Lombard properties. These properties were later combined as the General Pettit (or Pettit) Mine.

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Figure 21. Overview of the Monarch Mine site (1986), showing the open pit. The Monarch headframe is in the lower center (photograph by Earl H. Bennett, Idaho Geological Survey).
Other names by which the property has been known are the Bagdad Chase, the St. Joe, and the Talache (although Talache Mines' holdings included most of the Atlanta lode). Anderson (1939, p. 47-52) described the geology of the property:

Although the Atlanta lode crosses the Boise-Rochester ground in a northeasterly direction, its trend is not uniformly the same but varies somewhat on either side of a general N. 50° E. line. Such variation in strike is significant for the main ore shoots lie along those parts of the lode that strike more easterly or westerly than the lode as a whole. The dip of the lode across the property is everywhere northwest at a relatively steep angle, mostly about 70° to 80° N.W., except in the upper part of the Old Chunk ore shoot where the dip is steeply southeast (fig. 5, sections J and K [Figure 10]).

For most of the explored length the lode appears to be from 40 to 60 feet wide, locally as much as 80 feet, but the entire shear zone is not uniformly mineralized and includes much fractured rock which contains little ore, or is but little altered. Both the shear zone and lode tend to pinch and swell along the strike and dip, and the intensity of the pre-and-post-mineral fracturing likewise varies from place to place, being most intense in and along the commercial ore zones. The numerous gash veins which lie adjacent to the lode, especially along the hanging wall, trend west or west-northwest. Although they may be as much as 2 feet thick where they join the main lode, they generally narrow to 4 inches or less within a hundred feet. Many are reported to be fairly large and conspicuous in the upper workings, but they are small and inconspicuous on the No. 9 and few may be recognized on the No. 6. At the 950 crosscut, the lode widens and splits, the footwall branch continuing on in the southwesterly direction, the hanging-wall branch gradually curving toward the west away from the footwall.

This branch changes to an independent shear zone, which, on the Monarch, becomes a member of the west-northwest lode system. After the 1,450 crosscut, however, the hanging-wall shear zone is linked to the footwall by a prominent oblique southeastward-trending fissure, developed as a gash fracture produced by differential movement between the two walls and having the relations of other gash fractures of north-northwest trend.

A lamprophyre dike lies in or near the shear zone, in places crossing the lode at an oblique angle in a general westerly direction and passing outward into the hanging wall. The dike has been considerably altered and fractured in and along the lode. Although intruded so closely after the mineralization as to have been affected by all post-ore structural adjustments, it is post-ore. In parts of the ore zone, the dike has been so extensively brecciated and so admixed with shattered ore fragments that it has been mistaken for a pre-ore intrusive. This dike or others similar to it were uncovered along many parts of the lode during mining operations.

Distribution of the ore

The lode is complex. The ore seams generally trend in the direction of the strongest and most persistent fractures, which are usually those parallel to the direction of the shear zone. Numerous seams also extend obliquely toward the hanging wall in the manner of gash veins, but they do not persist far and are not as large as those which parallel the shear zone.

Most of those which lie parallel to the shear zone eventually curve toward the west and become oblique seams which soon pinch and become low-grade. The ore is continued along the lode in other overlapping seams similar to the first.

In some places, the more intense mineralization lies within the shear zone or lode, elsewhere it lies along one or both walls. The ore occurs in lenticular shoots, which are made up of some large as well as small lenses. In places, these lenses form bodies 4 to 12 feet wide, which tend to dip toward the walls of the lode, but they do not actually extend to the wall. The ore is in part distributed in the form of lenticular pockets in the more highly mineralized parts
of the lode, usually along the wall. As there is no clear line of demarkation between ore and waste, the limits of all ore bodies must be determined by assay.

The stops afford little information on the distribution and manner of occurrence of ore lenses. They merely indicate the zones wherein the lode material could be profitably mined. As pointed out elsewhere, the shoots persist from 300 to 800 feet on the strike, from 400 to 800 feet on the dip, and range from 4 to 8 feet in thickness, locally as much as 35 feet. All of the quartz is not ore, and occasionally massive quartz extends for many feet beyond the limits of the shoots. The distribution of the ore shoots has been determined by zones of special porosity and permeability, which in turn have been dependent on variations in the strike of the zone of shearing itself, namely, along those parts of the lode where the strike is more easterly than for the lode as a whole. In those localities the horizontal shearing stresses, which have acted essentially parallel to the zone of shearing, have tended to move the walls apart, increasing the relative amount of pore space while decreasing the space available for ore in the parts between. Gash fracturing or zones of gash fractures oblique to the zone of shearing have also favored ore deposition and commercial ore zones because of the increased amount of pore space available for ore. The Old Chunk, Central, Footwall, and perhaps the Hanging Wall, ore bodies are examples of ore shoots localized by changes in the direction of strike; the Southeast ore body by gash fractures of oblique trend.

**Ore shoots**

The Pettit is by far the largest of the three main ore shoots on the Boise-Rochester ground. The Old Chunk and Central ore shoots are simple, single ore bodies, but the Pettit is a composite of three separate ore bodies, the Hanging Wall, the Foot Wall, and the Southeast... **Old Chunk**

The Old Chunk, the most easterly of the ore bodies along the Atlanta lode, was one of the larger... Except where its extreme northeast corner outcrops, the ore body seems to be untouched by erosion. The longitudinal section (fig. 3 [Figure 8]) shows that much of the ore was less than 200 feet above the No. 6 level and that very little occurred below it. The ore body appears to be the most shallow of any along the Atlanta lode. Above the No. 6 level the ore body dipped southeast, but, below it, steeply northeast (fig. 5, cross sections J and K [Figure 10])....

The strike of the ore body is about N. 55° E., or slightly oblique to the general trend of the lode at either end (fig. 4 [Figure 9]). The ore body appears to be restricted to a zone of especially intense fracturing and lies within exceptionally heavy ground. None of the workings on it is now accessible, except some of the crosscuts on the No. 9 level. In these the granitic rock is considerably fractured, but not particularly altered.

The ore body was notably quartzose, but carried considerable arsenopyrite and perhaps minor amounts of other sulphides. It did not, however, contain silver-bearing minerals and the gold lay in the quartz or intimately associated with arsenopyrite. This ore body contained the only coarse grains of gold that were found in the mine. **Central**

The Central ore body is separated from the Old Chunk by about 600 feet of ground too low in precious metals for profitable extraction. However, some ore was mined from a stope about 100 feet long and 20 feet high on the No. 6 level about midway between the two shoots (fig. 3 [Figure 8]). This small ore body conformed with a minor variation on the strike of the major shear zone and its characters are much like those of the Old Chunk and Central.

The Central ore shoot is approximately bisected by the No. 6 level. Although it was necessary to raise as much as 40 feet above the No. 9 before the ore was compact and rich enough to be stoped, it is the only ore body which extended to the No. 9 level. On the No. 9, the ore was in bunches and too widely disseminated to be commercial.

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The ore body has a general trend of N. 65° to 70° E. and is, therefore, more oblique to the general direction of the lode than the Old Chunk (fig. 4 [Figure 9]). A cross section of the ore body (fig. 5, section 1 [Figure 10]) shows minor variations in dip.

The ore mined contained somewhat less than 0.5 ounce of gold per ton and only small amounts of silver. The mineralization was not much different from that of the Old Chunk, except that the gold was not as coarse, and there were few, if any, exceptionally rich pockets. The body produced 38,295 tons of ore.

**Hanging Wall (Pettit)**

The Hanging Wall ore body is separated from the Central by about 300 feet of practically barren, friable quartz, and occupies the hanging wall branch of the split Atlanta lode. It was the first of the ore shoots on the Pettit to be mined on the No. 6 level, largely because the prospecting had been directed along the hanging wall and because the larger body on the footwall was found later. The ore shoot has a general trend of about N. 70° E. (fig. 4 [Figure 9]), but as it approaches the property line the tenor of the ore decreases even though the shearing swings out at an increasingly larger angle. Its western border approximately coincides with the property line just beyond the 1,550 crosscut on the No. 6 level. Its eastern margin is near the 1,150 crosscut.

This body, like the Central, was longer than wide, but it did not extend to the No. 9 level. Its dip is less steep than that of the footwall body.

The ore on the hanging wall was notably siliceous and contained insignificant amounts of arsenopyrite, but considerable of the younger comb and drusy quartz. Little or no silver was found on or below the No. 6 level and little above except, perhaps, near the No. 2 Pettit. The ore was not as much broken nor the ground as heavy as along some of the other ore shoots. The mineable ore forms a small portion of the total amount of quartz present along the hanging wall.

**Southeast (Pettit)**

The Southeast orebody...occupies the oblique fracture zone which links the hanging wall body with the footwall in the vicinity of the 1,450 crosscut on the No. 6 level. This oblique fracture zone extends S. 70° E. from the hanging wall and was disclosed on the 1,450 crosscut and drifted on to the southeast to the footwall of the main shear zone. It contained mineable ore only for the first 180 feet. It was later opened on the 1,450 intermediate level 180 feet above, but contained ore only between the No. 6 and 1,450 and between the 775 intermediate and the No. 6 level, a vertical distance of 350 feet (fig. 5, cross section G-G [Figure 10]). In the vicinity of the 1,450 level the body pinched to a mere seam and was bounded by sharp walls. Although the body was no more than 3 feet thick, it produced 4,200 tons of ore, most of which was mined in 1933; the remainder in 1934.

The ore in the Southeast body differed from that in adjoining shoots by containing abundant silver minerals in the form of high-grade seams, particularly above the No. 6 level. It also contained a larger proportion of gold so that much of the ore was combined with that from other bodies to increase the value of the mill feed.

**Foot Wall (Pettit)**

The Foot Wall ore body, the largest on the Atlanta lode – not only in length and depth but also in the quantity of ore – is about equally divided between the Boise-Rochester and Monarch mines. The body, however, is nearly twice as deep on the Boise-Rochester as it is on the Monarch. Its stope length is about 800 feet, half of which is on the Monarch; its maximum depth on the Boise-Rochester is about 800 feet, in the Monarch about 450 feet. Altogether it has produced about 144,000 tons of ore since early 1933, somewhat more than half of which came from the Boise-Rochester. To this should be added an unknown but large tonnage from the Pettit No. 2 level to the surface 400 feet above, an amount probably as large as that mined from the section below the No. 2 Pettit. The lode above the No. 2 Pettit level is

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reported to have been 30 to 50 feet wide and to have contained zones of commercial ore of 5 to 15 feet wide and as much as 400 feet long. . . .

The general trend of the Foot Wall ore body is about N. 60° E., its direction very slightly oblique to that of the zone of shearing as a whole (fig. 4 [Figure 9]). The footwall of the ore body was bounded by a prominent bend of gouge which contained considerable pulverized ore. The ore body itself was more or less conspicuously shattered and broken throughout. The dip of the footwall body is steep and the thicker parts of the ore body accord with a local steepening and reversal of dip.

The ore on the footwall ore body was notably darker than that in the hanging wall and it contained much more arsenopyrite. Its tenor was also somewhat higher. Its values were mainly in gold, but there were appreciable amounts of silver, particularly on the higher levels, where bonanza streaks and pockets of ore rich in both silver minerals and gold were mined. Ruby silver was rarely observed in the ore on the No. 6 level nor was there any notable amount anywhere below the 1,450 intermediate. It was more abundant on the Monarch ground than on the Boise-Rochester and most abundant of all in the upper workings in the Monarch.

Early Operations

Little is known about the early history of the mine. Work at the mine appears to have started around 1869, and considerable ore was mined from the Pettit orebody in the 1870s through a 100-foot vertical shaft and, later, a tunnel from the lower slope facing Montezuma Gulch (Anderson, 1939). According to Campbell (1933, p. 34):

In the early days the General Pettit ore shoot was opened and operated through a 100-foot vertical shaft. The No. 2, or General Pettit, tunnel was then driven and connected with this shaft by a 300-foot vertical raise, in which were four intermediate levels; the mine was operated through this tunnel for many years.

The mine also has a 20-stamp mill near the bottom of Montezuma Gulch, but the mill recovery was apparently unsatisfactory (Anderson, 1939).

In 1872, Raymond (1873) listed the Old Chunk as one of several very promising properties that had been developed by “prospecting shafts and tunnels.” The eastern extension of the Atlanta lode was being worked by Turner and Steadman (Table 5) in 1875 (Raymond, 1877).

The 1881 DotMR (p. 174) stated:

The first claim located upon it [i.e., the easternmost claim on the Atlanta lode] was the Old Chunk, consisting of 1,800 linear feet. It is developed by three tunnels, aggregating over 1,000 feet in length. In the early days of the camp, considerable ore from this mine was worked which yielded $20 to $25 per ton.

Hastings (1895, p. 128) referred to the General Pettit group (Figure 9) as the Turner claims and described the property as follows:

A Boise City company has run several hundred feet on the Turner ground, and for 175 ft. has had 5 ft. of fair grade ore on the hanging wall. It will work six men all winter continuing this drift to the favorable outcrops, from which a good deal of ore has been milled in arrastres.
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<th>Company Name</th>
<th>Officer</th>
<th>Date Incorporated</th>
<th>Charter Forfeited</th>
<th>Year(s) at Mine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turner and Steadman</td>
<td></td>
<td>---</td>
<td>---</td>
<td>(1875)</td>
</tr>
<tr>
<td>Unnamed Boise company</td>
<td>General W.H. Pettit</td>
<td>1</td>
<td>1</td>
<td>(1895)</td>
</tr>
<tr>
<td>Unnamed New York company (East Atlanta and Old Chunk)</td>
<td></td>
<td>1</td>
<td>1</td>
<td>(1903)</td>
</tr>
<tr>
<td>Bagdad-Chase Gold Mining Company</td>
<td>J.N. Beckley, President</td>
<td>October 16, 1906</td>
<td>December 1, 1917</td>
<td>1906-1914</td>
</tr>
<tr>
<td>Boise Rochester Mining Company, Inc.</td>
<td>Leo J. Falk</td>
<td>August 9, 1915</td>
<td>December 1, 1920</td>
<td>1914-1917</td>
</tr>
<tr>
<td>Sawtooth Company</td>
<td>A.H. Burroughs, Jr., President</td>
<td>1</td>
<td>1</td>
<td>1936</td>
</tr>
<tr>
<td>Talache Mines, Inc.</td>
<td>A.H. Burroughs, Jr., President-Manager</td>
<td>April 21, 1917, as Amstead Mines; name changed June 8, 1922</td>
<td>November 30, 1966</td>
<td>1937-1966</td>
</tr>
<tr>
<td>A.H. Burroughs, Jr., and/or trustees for Burroughs's estate</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1966-</td>
</tr>
<tr>
<td>J.R. Simplot Company (exploration)</td>
<td>Robert A. Lothrop, Manager of Mining</td>
<td>February 2, 1946</td>
<td>active</td>
<td>1976</td>
</tr>
<tr>
<td>Simcor Co. (lessee)</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1977-1979(?)</td>
</tr>
<tr>
<td>Yanke Machine Co.</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1981-1986(?) or 1987(?)</td>
</tr>
<tr>
<td>Atlanta Gold Corporation (lessee)</td>
<td>Olaf Tolpinrud, President</td>
<td>March 6, 1985</td>
<td>1997</td>
<td>1985-1997</td>
</tr>
<tr>
<td>Company Name</td>
<td>Officer</td>
<td>Date Incorporated</td>
<td>Charter Forfeited</td>
<td>Year(s) at Mine</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>--------------------------</td>
<td>------------------------------------------</td>
<td>------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Newmont Exploration Limited (exploration)</td>
<td>1</td>
<td>wholly owned subsidiary of Newmont Mining Corporation</td>
<td>active</td>
<td>1990-1991</td>
</tr>
<tr>
<td>Ramrod Gold USA, Inc.</td>
<td>1</td>
<td>subsidiary of Consolidated Ramrod Gold Corporation</td>
<td>Consol. Ramrod Gold Name changed to Quest International Resources</td>
<td>1993-1996</td>
</tr>
<tr>
<td>Quest International Resources</td>
<td>Donald Gustafson, President</td>
<td>name changed from Consolidated Ramrod Gold</td>
<td>active</td>
<td>1996-present</td>
</tr>
<tr>
<td>Twin Gold Corporation</td>
<td>Hermann Derbush, Chairman, President and CEO</td>
<td>formed by share exchange between Atlanta Gold and Voisey Bay Resources, Inc.</td>
<td>active</td>
<td>1997-present</td>
</tr>
<tr>
<td>Monarch Greenback LLC (owner?)</td>
<td>1</td>
<td>1</td>
<td>active</td>
<td>(1997)-present</td>
</tr>
</tbody>
</table>

1Information not available in Idaho Geological Survey's files.

Eldridge (1895) noted that General W.H. Pettit was the manager of the company that controlled the eastern 1,500 feet “or more” of the Atlanta lode. By this time, only one small claim divided the property from the Monarch Mine to the west (Eldridge, 1895).

Two groups were active on the east end of the Atlanta lode in 1903. According to the 1903 IMIR (p. 58-59):

The Pettit mine has been developed during the past year on quite an extensive scale and the work done increased the amount of ore in sight several times with marked increase in values. This property is now in the hands of the original owners, and a small force is now at work in the mine blocking out ore preparatory to installing machinery in the spring for its reduction.

The East Atlanta and Old Chunk group of mines are also being developed by a New York company who have the property under bond and are meeting with good success.

The following year, the Idaho Mine Inspector estimated the reserves in the district (1904 IMIR, p. 62):

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It is safe to say that half a dozen of the principal properties of Atlanta contain proven pay ore resources amounting to over a million tons that will exceed $5.00 per ton in gold value. A large proportion of these great ore reserves will do better than $10 per ton; in fact, there are developed as much as 50,000 tons in the Monarch and Petit mines alone, of that value, and important pay streaks of a good deal higher grade.

In 1905, the Mine Inspector's observations were even more favorable (1905 IMIR, p. 60):

At the Petit Mine, adjoining the Monarch to the east, on the same ore body, a small force has been kept steadily employed during the past year in blocking out ore. This mine is developed by adit tunnels and underground connections and has ore to the gross value of something like a million dollars exposed.

It has an ore shoot 600 feet long, that is 12 to 15 feet wide and carries a pay streak between 3 and 4 feet wide that will average $14.00 to $16.00 per ton in gold. A number of laboratory tests were made for the treatment of this ore by the cyanide method and some very satisfactory results obtained. It is under option at the present time to some wealthy mining investors and is likely to be equipped with a large mill next season.

Bagdad-Chase Gold Mining Company

The mine was sold to the Bagdad-Chase Gold Mining Company in 1906 (Anderson, 1939). According to the 1906 IMIR (p. 57-58):

Adjoining the Monarch mine to the east, the Petit mine on the same lode and ore courses is developed quite extensively by three adit levels and numerous raises and underground connections which has completely blocked ready for extraction to the gross value of something like one million dollars, which averages about fourteen dollars per ton in gold and silver. In this direction on the lode the gold tenor of the ore increases and amounts to fully ninety per cent of the combined values, otherwise the ore and veins of the two mines are practically identical, and the lower adit face of the Petit is within one hundred feet of the long upper tunnel heading of the Monarch mine from the opposite side of the mountain and in a lode of such pronounced strength and permanency this fact practically insures a continuance of the values and ore resources of the Petit to a further depth of five hundred feet, which would match the lower level of the Monarch mine. This is a strong prospective feature of the Petit and greatly enhances its value.

The Petit mine was sold last fall to the Bagdad-Chase Gold Mining Company of Rochester, New York, of which Mr. Wayne Darlington is manager and Mr. C. E. Stevens is superintendent in charge.

This company has commenced the erection of a fifty ton mill which will use the same process as that designed for the Monarch mine. This mill will be strictly first class and up to date all through, and will be run by electric power supplied by the Monarch power plant. The impossibility of obtaining material and machinery and getting it hauled before winter closed in is seriously retarding this enterprise, but everything is being done towards its construction that can be, and next summer will see its completion. In the mean time development is being continued at the mine.

The company spent most of 1907 building its mill. The mill equipment included twenty stamps, vanners, and Callow screens. The crude ore averaged $10 to $12 per ton.
gold and silver, and after being roasted and treated with cyanide, the concentrates were expected to average $200 a ton. The 1907 IMIR (p. 93-94) described the year’s activities:

The Pettit mine adjoins the Monarch mine on the same great lode to the east, but its development is only half the depth of that of the Monarch as yet, and entirely through adit tunnels. The Monarch development, however, right up to the end line of the Pettit claim on the same ore shoot, and developed to a further 300 feet, practically proves the continuity of the values in the Pettit ground at that much further depth, and there is no reason why, in such a powerful lode, the values will not be maintained for a thousand feet in depth or more. The ore resources of the Pettit mine, completely blocked out by numerous raises, a short crosscut and two main levels are shown in the accompanying plan [Figure 22], and aggregate over a million dollars in gross value of a grade ranging from $12 to $15 per ton. At this end of the lode the gold values are stronger and amount to fully 90 per cent of the total values of the Pettit ore. This property also carries much higher grade ore, but the values given are what it is shown by thorough sampling can be depended on in good, big mineable widths. The treatment of the Pettit ore has been the subject of extensive practical tests, and its milling plant of 100 tons daily capacity [Figure 23], now receiving the finishing touches, is designed and expected to recover 90 per cent of the contained values. The mill is connected with the mine by an aerial tram 3,600 feet in length and has an independent power plant of its own on the Boise River, a short distance above Atlanta, and should be in the market with a good yield of bullion within 90 days.

The Pettit mine is being operated by the Bagdad-Chase Gold Mining Co. of Rochester, N. Y., of which Mr. J. N. Beckley is president, Mr. J. H. Steadman, secretary and treasurer, both of Rochester, and Mr. Wayne Darlington of Boise, Idaho, is general manager. The company has carried a force varying up to 50 men during the year, the bulk of which, however, were on construction work. Miners on this property are paid $3.50 per day, and timberman, engineers, electricians, carpenters an average of $4.00, all of 8-hour shifts. The company owns its own sawmill and makes lumber cheaply. Mining timbers cost 8 cents per foot. Electricity will furnish power and heat for the whole plant, which has involved a total cost of something over $100,000, and will have about 100 tons daily capacity.

During 1908 the Pettit mill produced both bullion (by amalgamation) and concentrate, which was treated by roasting and cyanide. The 1908 IMIR (p. 9) noted:

In Elmore County, the Atlanta District has been the scene of great activity during the year through the purchase and transfer of the Pettit mines from the original owners for $125,000 cash to the Bagdad-Chase Gold Mining Company, of Rochester, New York. This property has been equipped with a 20-stamp mill, which has been in successful and profitable operation throughout the year and is now being enlarged by an addition of 20 more stamps, which will increase its capacity to 150 tons a day. . . .

The Pettit mine is responding in a very handsome manner to development and is showing up an enormous tonnage of ore of good milling grade.

The equipment added to the mill included sixteen Frue vanners, eight slime tables, a Callow screen, dewaterers, Dimnick sizers, a 16-foot tube mill, and a Pierce amalgamator with 12-foot copper plates. A 150-tpd cyanide plant was also added.

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The length of the grinding cylinder of the mill.
Figure 22. Cross-section of the workings at the Pettit Mine. The bottom level is 300 feet deep. All workings are in ore (Bell, R.N., 1908, Ninth Annual Report of the Mining Industry of Idaho for the Year 1907, p. 95).
Figure 23. Pettit mill (Bell, R.N., 1908, Ninth Annual Report of the Mining Industry of Idaho for the Year 1907, opposite p. 97).
Development on the property totaled 1,500 feet of tunnels. Bell (1908, p. 176-177) described the milling process:

The latest success in this line of development [milling ores of the type at Atlanta] in Idaho is in the Atlanta district, where the Bagdad-Chase Gold Mining Company, of Rochester, N. Y., operates the Pettit mine, which has recently been equipped with a new milling plant, comprising a 20-stamp mill, 16 True vannurs, 8 Dimnick slime tables, 10 Callow dewaterers, a Callow screen, and Dimnick sizers, a 16-ft. tube mill and a Pierce amalgamator.

The ore is a massive white quartz, yielding about 1 per cent. of high-grade concentrates, consisting of iron sulphides, rich in gold and antimoniour silver minerals, and involves very fine grinding and close concentration. The ore is crushed at the mine, transported by aerial tramway 3000 ft. to the mill, stamped, and then run over 12 ft. of copper plates, which are broken every 2 ft. with a ½-in. drop. The pulp then passes over Callow dewaterers and vannurs, the slimes going directly to slime tables, and from the first vannurs to Callow screens, with the over-size to tube mill; the fines pass to Callow dewaterers and Dimnick sizers; the tube-mill product, after grinding, passes over a Pierce amalgamator, thence to the Dimnick sizers. All material is distributed from the Dimnick sizers to vanners and slime tables.

The high-grade concentrates will be roasted and cyanided, which gives a very high extraction. The ore of this district has always been looked upon as difficult to treat; but the present installation seems to have solved the problem both in the matter of cost and of extraction. This means an important addition to Idaho's gold yield, for the ore resources of this district are extensive. The crude ore now supplied to the mill averages $10 to $12 per ton, and the concentrates run about $200 per ton, the ratio of values being about 85 per cent. gold and 15 per cent. silver.

The mill began operation about the end of February, 1908, in extremely cold weather, and has run satisfactorily without any serious difficulty. The results thus far obtained show that a saving of about 85 per cent. of the total values in the ore is being made, about 40 per cent. of which is recovered on the plates.

The power used is transmitted as electric current from the company's waterpower plant, situated a mile from the mill, on the Middle Fork of the Boise river. The flume is covered and gave no trouble, even in extremely cold weather. The machinery of the power plant embraces a 200-h.p. Trump water-wheel, under 50 ft. head, with a 200-h.p. dynamo and exciter. The capacity of the mill is about 70 tons in 24 hours... The milling costs with the present equipment are $3.50 per ton. The mill building has been built with a view of adding further machinery, as the mine promises to warrant an output of several hundred tons per day. With increased capacity it is believed that the milling costs can be reduced to $3 per ton, and probably less.

Bell (1908, p. 177) also described the mine:

The Pettit mine is operated through adits to a depth of 500 ft., with extensive underground connections, developing the ore to the estimated values of $2,000,000. The vein is from 5 to 27 ft. wide and stands nearly vertical in walls of porphyritic granite. The ore course is clearly defined, but is accompanied by a mineralized condition of the wall rocks, which carry small quantities of gold and silver for a width of 25 to 50 ft. on each side of the main quartz vein. These combined constitute the great Atlanta lode.

The holdings of the company embrace 5600 ft. of the Atlanta lode, which is so situated that it can be readily developed to an additional depth of 1000 ft. by adits on the course of the vein. Recent development in the present lowest level has shown a marked
expansion in the width of the orebody, and it seems likely that the property may develop into one of the big mines of the West that will produce a very large tonnage of ore, and can be very cheaply worked, even in its somewhat remote location, 80 miles from railroad transportation.

Production increased significantly in 1909, and the mine was one of the two largest producers in the district. Over three-fifths of the gold and silver was recovered by amalgamation, while the remainder was in the concentrate. The 1909 IMIR (p. 54-55) described the year’s events:

The Bagdad-Chase Gold Mining Company, owning a large group of claims one and a half miles south of Atlanta upon Montezuma Creek, has operated throughout the year, employing an average of 60 men and running its 40-stamp, concentration and cyanide mill, treating 150 tons per day at a fair margin of profit. The concentrates represent from 1 to 2 per cent of the total weight of the ore, averaging from $100 to $200 per ton, are roasted prior to treatment by cyanide process. The property is operated by electric power furnished from a plant owned by the company and is elaborately equipped.

The Atlanta lode, on which this property is located, has been developed extensively in this and adjacent properties, is from 50 to 150 feet in width and can be plainly traced along the crest of the mountain. In connection with this vein system there are several important lateral fissures upon which several good mines have been developed. This property has immense ore reserves blocked out but experienced considerable difficulty in treating the ore economically. Mr. Edgar Van Eten is the general manager.

The mine was closed in March 1910, but the mill operated for most of the year on tailings. As a result, the company shipped a considerable amount of bullion. The mine had a large reserve of $10 to $20 ore on the General Pettit claim. However, the company was using shrinkage stopes to mine the ore, and this resulted in caving which diluted the ore to an unacceptable level (Reigart and Nicolson, 1933).

The mine was still closed the following year, although the Idaho Mine Inspector noted (1911 IMIR, p. 44):

The Bagdad Chase Company and the Atlanta Mines Company’s properties have made little progress during the year. These properties have extensive ore resources and elegant milling equipment of good capacity; their ore carries fair values of $6 to $12 per ton in good sized bodies, but the complicated nature of the fine mineral sulphides with which the gold and silver values are associated have been such as to resist all the efforts of successful treatment that have been so far made. However, these properties represent such large investments of capital that these experiments will doubtless be continued and a solution of the problem may be ultimately arrived at.

Boise-Rochester Mining Company

The property remained closed in 1912 and 1913, but the Boise-Rochester Mining Company (reorganized from the Bagdad-Chase Gold Mining Company) reopened the

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Atlanta Mines Company owned the adjacent Monarch Mine.

80
mine in 1914 (Anderson, 1939). The mill was run for a few days on the ore from a new vein. Amalgamation and concentration were used on this ore, but the cyanide plant was idle. Tables 6 and 7 show development at the mine.

In 1915, the mine was the biggest producer in the district, even though low water and the resulting lack of power restricted operations for part of the year. Only the amalgamation section of the mill was operated, and no concentrates were sold. The mill recovered only 60 to 70 percent of the values in the ore (Reigart and Nicolson, 1933). According to the 1915 IMIR (p. 99-100):

The most important lode mining operations of the year in this county were in the Atlanta district, on the middle fork of the Boise River, where the ore disclosures made in the Boise Rochester Mine, formerly known as the Pettit and Bagdad Chase, have proven of a most gratifying nature and manifestation for future profits.

The pronounced contact fissure vein on this property has been opened by a new tunnel at considerable depth below the old works and now discloses an ore shoot of $10.00 to $15.00 values that carries a stopping width of 3 to 6 feet for a length of 500 feet. Ten stamps of the company’s mill were successfully operated during part of the year, when power was available, that gave amalgamation recovery results of between 60 and 70 per cent of the total values, and quite a lot of rich concentrates were made that are now the subject of practical experiment for local treatment by cyaniding, and in spite of their rather complex mixture of rich silver minerals with the gold bearing pyrite, in the hands of a capable cyanide expert, are giving promise of a very satisfactory recovery.

This discovery was the Old Chunk ore shoot; the Central ore shoot was discovered as the tunnel was continued toward the Pettit orebody (Anderson, 1939). Campbell (1933, p. 34) noted: “Later operators [the Boise-Rochester Mining Company] drove No. 6 tunnel, a crosscut, which intersected the lode 2,200 feet east of the General Pettit shaft and 430 feet below No. 2 tunnel. Old Chunk ore shoot is located near the point where No. 6 tunnel intersected the lode. It and the Central ore shoot were both unknown until encountered by this tunnel about 1915.”

Activity continued at the mine in 1916, with the company working the Old Chunk orebody from stopes raised from the No. 6 level (Anderson, 1939). Experiments continued in the search to find an acceptable process for treating the ore and concentrates, and a 100-ton flotation plant was added to the mill. The 1916 IMIR (p. 34) summarized the year’s activities:

This old mining district, eighty miles east of Boise, came to the front during the year with one of the best strikes of rich gold ore of its history. After a long period of inactivity successful milling ore disclosures were made in 1915 on the property of the Bagdad-Chase Mining Company, which was reorganized through the activity of Mr. Leo J. Falk, of Boise, under the title of the Boise-Rochester Mining Company, embracing the Sy. Smith interests. The property was successfully operated on $8.00 to $10.00 ore values at a capacity of about 100 tons a day for a year until September, 1916, when a blind vein was opened on the extreme eastern end of the Atlanta lode that revealed a pay streak varying from a mere seam up to ten inches thick of the same high grade bonanza ore values for which this famous lode was noted during the most productive period of its operation over forty years ago.
## Table 6. Development work, number of men employed, and operating companies at the Boise-Rochester Mine, by year.

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Men Employed</th>
<th>Tunnels (feet)</th>
<th>Sinking (feet)</th>
<th>Cross-cutting (feet)</th>
<th>Drifting (feet)</th>
<th>Raising (feet)</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
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<td>1913</td>
<td>2</td>
<td>--</td>
<td>--</td>
<td>138</td>
<td>--</td>
<td>--</td>
<td>Bagdad-Chane Gold Mining Co.</td>
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<tr>
<td>1914</td>
<td>1</td>
<td>162&lt;sup&gt;2&lt;/sup&gt;</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>Bagdad-Chane Gold Mining Co.</td>
</tr>
<tr>
<td>1915</td>
<td>25</td>
<td>--</td>
<td>--</td>
<td>250</td>
<td>--</td>
<td>--</td>
<td>Bagdad-Chane Gold Mining Co.</td>
</tr>
<tr>
<td>1918</td>
<td>1</td>
<td>1,500&lt;sup&gt;2&lt;/sup&gt;</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>Boise Rochester Mining Co.</td>
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<td>9</td>
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<td>none</td>
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<td>St. Joseph Lead Co.</td>
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<tr>
<td>1933</td>
<td>126</td>
<td>--</td>
<td>500</td>
<td>1,750</td>
<td>--</td>
<td>--</td>
<td>St. Joseph Lead Co.</td>
</tr>
<tr>
<td>1934</td>
<td>140</td>
<td>--</td>
<td>1,000</td>
<td>2,000</td>
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<td>--</td>
<td>St. Joseph Lead Co.</td>
</tr>
<tr>
<td>1936</td>
<td>120</td>
<td>--</td>
<td>1,000</td>
<td>3,825</td>
<td>--</td>
<td>--</td>
<td>St. Joseph Lead Co.</td>
</tr>
<tr>
<td>1939</td>
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<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<tr>
<td>1940</td>
<td>1</td>
<td>1,000&lt;sup&gt;1&lt;/sup&gt;</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<tr>
<td>1941</td>
<td>225</td>
<td>4,500&lt;sup&gt;3&lt;/sup&gt;</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<td>Talache Mines, Inc.</td>
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<tr>
<td>1942</td>
<td>200</td>
<td>2,500&lt;sup&gt;3&lt;/sup&gt;</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>Talache Mines, Inc.</td>
</tr>
<tr>
<td>1943</td>
<td>148</td>
<td>863&lt;sup&gt;1&lt;/sup&gt;</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>Talache Mines, Inc.</td>
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<tr>
<td>1944</td>
<td>42</td>
<td>0&lt;sup&gt;4&lt;/sup&gt;</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<tr>
<td>1945</td>
<td>17</td>
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<td>none</td>
<td>none</td>
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<tr>
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<td>150</td>
<td>430</td>
<td>130</td>
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<td>1949</td>
<td>21</td>
<td>--</td>
<td>--</td>
<td>60</td>
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<td>--</td>
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<tr>
<td>1950</td>
<td>11.9</td>
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<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
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<td>200</td>
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<td>--</td>
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<td>415</td>
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<td>--</td>
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<td>1953</td>
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<td>--</td>
<td>50</td>
<td>160</td>
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<tr>
<td>1954</td>
<td>5</td>
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<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>Talache Mines, Inc.</td>
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<tr>
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<td>6</td>
<td>0&lt;sup&gt;4&lt;/sup&gt;</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>Talache Mines, Inc.</td>
</tr>
<tr>
<td>1956</td>
<td>7</td>
<td>0&lt;sup&gt;4&lt;/sup&gt;</td>
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<sup>1</sup>Information not reported to the Idaho Inspector of Mines.
<sup>2</sup>Total development for the year.
<sup>3</sup>Estimated total development for the year. Talache Mines did not report development work to the Idaho Mines Inspector. This number was obtained from the difference between total development for the current year less the total development for the previous year (Table 6).
<sup>4</sup>All work was performed by lessees.
Table 7. Cumulative development at the Boise-Rochester Mine, by year. Information is from company reports to Idaho Inspector of Mines; discrepancies in numbers reflect inconsistencies in the original data.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Development (ft)</th>
<th>Total No. of Tunnels</th>
<th>No. of Shafts</th>
<th>Total Length of Tunnels, Crosscuts, and Drifts (ft)</th>
<th>No. of Raisings</th>
<th>Total Length of Raisings (ft)</th>
<th>No. of Crosscuts</th>
<th>No. of Drifts</th>
<th>Length of Principal Tunnels (feet)</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
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<td></td>
<td></td>
<td></td>
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<td></td>
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Table 7 (continued). Cumulative development at the Boise-Rochester Mine, by year.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Development (ft)</th>
<th>No. of Tunnels</th>
<th>Total Length of Tunnels, Crosscuts, and Drifts (ft)</th>
<th>No. of Shafts</th>
<th>Total Length of Shafts (ft)</th>
<th>No. of Rises</th>
<th>Total Length of Rises (ft)</th>
<th>No. of Crosscuts</th>
<th>No. of Drifts</th>
<th>Length of Principal Tunnels (feet)</th>
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<td></td>
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<td>1</td>
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<tr>
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<td>2</td>
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<td>4,130</td>
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<td>1</td>
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</tr>
<tr>
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<td>22,845</td>
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<td>2</td>
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<td>2</td>
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<td>1</td>
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<td>1</td>
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<td></td>
<td>4,130</td>
<td>1</td>
<td>1</td>
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</tr>
</tbody>
</table>

1 Information not reported to Idaho Inspector of Mines.
2 The mine had four intermediate levels with lengths of 300, 400, 200, and 90 feet.
3 The mine had five intermediate levels with lengths of 300, 400, 200, 90, and 50 feet.
4 The length for this adit was not reported.
5 The principal vertical shaft was 420 feet deep. There were four intermediate levels (700, 750, 775, and 830), but lengths were not given for any of them.
6 The principal vertical shaft was 420 feet deep. There were six intermediate levels (the 300, 400, 700, 750, 800, and 830), but lengths were not given for any of them.
7 The principal vertical shaft was 420 feet deep. There were four intermediate levels (the 700, 750, 800, and 830), but lengths were not given for any of them.
8 There were five intermediate levels (the 700, 750, 775, 830, and 1450), but lengths were not given for any of them.
9 The principal vertical shaft was 400 feet long, and the principal inclined shaft was 125 feet long and gained a vertical depth of 100 feet. The mine had five intermediate levels (the 700, 750, 775, 830, and 1450), but lengths were not given for any of them.
This interesting pay streak has been followed for over 300 feet and carries values ranging from $500 to $1,000 per ton in gold. Since its discovery it has been quite extensively opened by an adit tunnel now 500 feet long, disclosing an ore course that will average from five to seven feet wide with average milling values ranging from ten to twenty dollars per ton in addition to the rich pay streak, from which over a thousand sacks of choice mineral has been selected, in the stoping progress. A shipment of bonanza values can safely be anticipated from this property when the roads open next spring.

Bell (1916, p. 784) provided more detail on the year’s activities:

The Boise-Rochester Mining Co.’s property extends from the east end line of the old Monarch group for 2,700 ft. to Montezuma Gulch, where the lode is believed to be abruptly terminated on a big fault, as the texture of the granite northeast of this gulch is entirely different and other topographical features indicate a fault at this point. This property represents a reorganization of the Bagdad-Chase company holdings. The latter company was a former extensive operator in San Bernardino County, Calif., and about ten years ago purchased the Pettit group of claims, which at that time had an extensive development of $10 ore aggregating about $1,000,000 in gross value at the extreme western end of the group adjoining the Monarch showings.

The property was equipped with a 40-stamp mill and an aerial tramway one mile long. The ore proved decidedly difficult to treat, as only half of its content was amenable to plate amalgamation and the methods then in vogue, of concentration and cyaniding the concentrates, gave decidedly unsatisfactory results. The enterprise failed to pay a profit and was shut down several years ago and left in the hands of a caretaker. A little over a year ago a privately owned half-interest in the extreme east end claim was combined with the Bagdad-Chase property and a reorganization accomplished under the present name.

As a result of the development by intelligent concentrated annual assessment work on these claims in the lowest adit tunnel at the east end of the group, an entirely new shoot of ore was discovered carrying excellent mineral that varied from $4 to $20 per ton and averaged around $12 per ton. The mill was overhauled, new motors installed, and put in operation to the extent of 20 stamps, and for the past year it has been treating about 100 tons of ore a day from this new shoot, which proved to be 500 ft. long and from 5 to 15 ft. wide. At a distance of 100 ft. above this lower adit, while stopping up on this orebody, a flat fault was encountered which displaced the ore course to the south at a horizon of about 10 ft. below another old crosscut adit higher up the mountain.

After recovering the vein above this fault displacement, it was found to contain some extremely high amounts of gold. It has now been drifted on for 300 ft. to a face depth of about 180 ft. and shows for that distance a practically continuous pay course of bonanza value that varies from a mere seam up to 10 in. thickness containing material of better than $1,000 a ton in gold with selected hand specimens disclosing bands of native metal as much as ¼ in. thick. The vein on this level varies up to 15 ft. in width of talcy granitic gangué with irregular black bands of gouge material, a subordinate quantity of crushed quartz and occasional segregations of calcite crystals and siderite crystals, the latter a definite evidence of good gold values, and fortifies the belief of the origin of the minerals in a basic end phase of the granite magma.

The richest specimens are definitely associated at this point in the lode with a soft greasy looking noncrystalline black mineral that was thought to be petzite, a telluride of gold and silver, but the company’s assayer found no reaction for tellurium and a more detailed study of this particular mineral by A. G. Van Eman, a Boise chemist, has determined it to be a complex lead mineral, sulph-antimonide and sulph-arsenide of lead, containing fully 50% lead. It shows no crystal form, and it is interesting to note that some of the richest specimen
ore occurs on a decided movement plane in the vein and is polished like a mirror as it comes out of the vein, the native gold occasionally showing through the polish in the black mineral. It is barely possible that this high-grade ore may be localized to a few feet above the horizontal fault in the vertical vein; however, it ranges along the vein from the portal of the new adit tunnel to a face depth of nearly 200 ft., and a narrow diagonal fissure a few inches thick containing $600 per ton is now being drifted on from the foot-wall side of the lode toward the course of this new ore channel at a point 400 ft. farther west on its strike and under the fault. These conditions combine to indicate considerable lineal extent and depth to this high-grade mineral, and from present appearances the discovery should result in the shipment of several carloads of bonanza ore besides affording a continuation to the surface of the large milling-ore shoot shown and of much better grade than previously handled.

The old Bagdad-Chase company had entirely lost faith in the enterprise, and the new developments and operations are to be credited to the faith of local operators and local capital and particularly to the present manager of the property, Leo J. Falk, a young business man of Boise, who was personally concerned in the original transfer of the property. The present company has carried on extensive experiments in an effort for better recovery of values by fine-grinding and cyaniding the concentrates raw at the milling operations, has made considerable progress along this line and is now experimenting with flotation under the direction of George J. Wyman, Jr.

In February Mining and Scientific Press described the mine’s difficulties in mining, milling, and transportation (1916, p. 248):

Mining and metallurgical operations in this part of Idaho (Elmore county) show considerably more activity than a year ago. There are some notable old producers in the district; a year ago they were practically all idle. As a result of the active policy started, principally by the Boise-Rochester Mining Co., a revival has set in, and new life has been infused into the little town of Atlanta, the centre of business. Mining conditions are favorable, excepting transportation facilities. For six months of the year heavy traffic with outside points is suspended on account of the roads over the mountains becoming impassable. During the other six months freight charges are excessively high. A year ago an effort was made to construct a road along the river valley communicating with Boise, the nearest supply base. This road would have been available for any kind of traffic the whole year, and sufficient money was raised from various sources for its construction. As a result of bad judgement in laying it out, portions were subsequently carried away by floods and the communities and mining companies most interested continue to suffer complete isolation for at least half of the year. Considering the known and prospective resources of this region that is a state of things which should be rectified in the near future.

The Boise-Rochester company, with headquarters at Boise, of which Leo J. Falk is president, is the principal operating company. It recently took over the property and 40-stamp mill formerly owned by the Bagdad-Chase Gold Mining Co. Work was started on the claims in the fall of 1915, and is being advanced on an increasing scale as the winter advances. A Bleichert aerial tram, capable of carrying 120 tons in eight hours, now connects the lower workings of the mine with the mill. Recent development in the mine has opened a considerable quantity of ore worth from $10 to $20 per ton. At the present time 20 stamps are dropping continuously on this grade of ore. Under the former owner’s management the method of extracting ore was by the saving system, but this proved unsuitable under the conditions prevailing, resulting in an excessive quantity of waste being mixed with the ore sent to the mill. The vein material is exceedingly soft and friable, and the country rock swells whenever it is left exposed. These conditions necessitate heavy timbering and continued working of the
ground, and it was probably to avoid expenditure under these heads that the former system was adopted.

Another obstacle to successful operations heretofore was the difficulty of treatment. Amalgamation was followed by fine grinding, and an elaborate system of classification and concentration extracted a fairly high percentage of the bullion, but trouble was experienced in handling the concentrate. Transport charges preclude the shipment of anything but very high-grade product, and local treatment by roasting followed by cyanidation was only partly successful. An auxiliary plant has now been installed, and is ready to commence operations. In it the concentrate will be ground fine in tube-mills, agitated with cyanide solution in a Pachuca tank, and the gold precipitated from solution by zinc-dust. It is confidently anticipated that this treatment will be a complete commercial success, in which case it is intended to re-model the main plant with a vein treatment of the whole ore by a similar process. R. H. Richardson is superintendent.

In 1917, the Boise Rochester was the largest producer in the district. The company worked the Old Chunk ore shoot by stopes from the No. 5 (Ellison) tunnel, which was about 100 feet above the No. 6 level (Anderson, 1939). The mill operated from January to the end of September, with a Callow flotation cell used after the Wilfley tables to process the concentrates. The 1917 IMIR (p. 91) noted:

In the Atlanta District of Elmore County, the Boise-Rochester Mine was successfully operated during part of the year and made a handsome production of gold bullion, exhausting its shallow developed resources at the East end opening, towards the middle of the year, when milling operations were suspended and the property optioned to a strong New York firm that has since undertaken its more thorough and permanent development.

St. Joseph Lead Company

The Boise-Rochester Mine was optioned to the St. Joseph Lead Co. on October 19, 1917. Anderson (1939, p. 49) noted:

It is probably coincidence that the bottom of the [Old Chunk] ore body should have ended at the No. 6 tunnel level. It was the showing along the No. 6 that largely prompted the St. Joseph Lead Company to acquire possession of the mine with the natural expectation that the ore would continue to a depth at least equal to that already mined. Deeper development along the No. 9 level proved fruitless and no commercial ore was revealed until raises had been carried 35 to 40 feet above the 750 intermediate level, or a distance little more than 100 feet below the No. 6 (fig. 3 [Figure 8]). Although it yielded about $350,000, the tonnage of ore mined above the No. 6 was not learned, but the total output below the No. 6 was only 3,641 tons.

By September 1917, the Old Chunk ore shoot above the No. 6 level was mined out (Anderson, 1939). St. Joseph Lead did exploration and drilling on the mine for the rest of the year. Soper (1917, p. 7-9) described the property:

The ore deposits of the Atlanta district consist of a great shear zone in granite, known as the Atlanta lode, with numerous parallel branch, or spur veins which join the main lode on both sides at acute angles.
The Atlanta lode, which contains the principal ore deposits of the district, is a wide mineralized zone in sheared and altered granite, varying in width from 40 to 150 feet, the average being about 50 feet in the Boise-Rochester Mine. Not all of the width carries values, although the greater part of lode, including the crushed and brecciated country rock, shows considerable mineralization with iron sulphides, and intense alteration.

The lode strikes N. 50 degrees to 60 degrees E. and the prevailing dip is nearly vertical, although the dip varies in different mines in the district from 70 degrees N. to 70 degrees S., passing through the vertical. In the Boise-Rochester mine the dip ranges from about 75 degrees N. to vertical, the average being 80 degrees N.

The property of the Boise-Rochester Mining Company extends eastward for about 3,000 feet, from the east line of the Monarch along the strike of the main Atlanta lode. The claims covering the lode are the General Pettit No. 1, Atlanta East Extension, Old Chuck, and Lucky Strike No. 1. The principal workings of the Boise-Rochester mine are the Old Chuck and General Pettit No. 1, and No. 2 claims. In addition the property includes several of the branch, or spur, veins previously mentioned, at least two of which, the south vein and the Jessie Benton, contain large quantities of high grade ore and have been developed to a considerable extent.

The vein matter consists chiefly of intensely brecciated and altered granite, or granite rock, with seams of quartz, and occasional small lenses of calcite. Quartz is the prevailing mineral. The crushed country rock is made up mostly of small angular fragments of white-blush-white, or grey quartz, with altered feldspar which has been mostly kaolinized. The mica constituent has been almost completely removed by hydrothermal metamorphism. There are many horses of harder and less intensely altered granite, usually lenticular in shape within the shear zone. Seams of quartz, from a few inches to several feet in width, often showing symmetrical banding, occur within the zone of crushed country rock. These are also somewhat lenticular [sic] in shape, tapering to mere stringers around the edges, while in other cases they are persistent and of regular width for considerable distance along the strike. Not infrequently several of these quartz seams occur parallel to one another, or overlap along the strike, or dip, of the lode. They occur more often along either the hanging or footwall of the lode but numerous quartz seams were observed well within the shear zone in the Boise-Rochester mine. These quartz seams, especially those showing banded structure, carry most of the values in gold and silver, and some of them carry values up to several hundreds of dollars per ton in gold. In the Boise-Rochester mine, a thin seam of this nature, several inches thick, was encountered just above a flat dissipating [dipping?] fault out on the Spaulding (No. 5) level, which carried free gold values ranging up to several thousand dollars per ton.

Both the hanging and the footwalls of the lode carry a heavy black clay gouge, which exhibits strong slickensides with striations varying in direction from vertical to almost horizontal. Within the two outermost gouge walls are numerous irregular and discontinuous slickensides surfaces, so called "false walls" which may have any direction. These are, when parallel to the main vein, often misleading, and occasionally in mining operations, the ore has been stoped out to one of these gouge seams and the work stopped, when another shoot of good ore was to be found a foot or two beyond the "false wall."

The width of the pay ore within the fifty foot lode varies from a narrow seam on each wall, or in the interior, up to 25 or 30 feet. The entire width of the lode is seldom, if ever, of commercial grade, while, on the other hand, it is rare that at least some portion of it does not carry pay ore. This tendency of the pay ore to occur in parallel or overlapping lenses at different places across the width of the vein has been often overlooked in past mining operations where only a five or six foot drift, or stope, was carried along some shoot or seam which represented only a fraction of the total width, and no attempt was made to crosscut the remaining portion of lode, which may contain other parallel shoots of pay ore.
Mineralogically the ore consists of quartz and altered granite carrying gold bearing pyrite (iron sulphide), and the arsenical and antimonial iron sulphides. There is some coarse native gold present, usually coated with a film of black antimony sulphide. From 1.0 to 50 per cent of the gold in the pyrite is free and can be recovered by amalgamation on the battery plates. The remainder of the gold and most of the silver in the ore is not recoverable by amalgamation.

The highest values occur in the dark colored bands of sulphide minerals in the quartz seams, but all of the pyrite which is abundantly disseminated throughout the crushed granite and gouge carries values. There are two types of sulphides in the crushed and brecciated granite of the lode; a dark grey to nearly black mineral carrying good values, and bright brassy yellow pyrite, which carries very little gold. Both varieties occur in the thin coatings and films along the fracture planes, and in the finely disseminated grains throughout the soft, crushed ledge matter. It is probable that some of the finely disseminated pyrite in the crushed country rock and ledge matter represents material which has been derived from the crushing of quartz-pyrite seams due to post mineral faulting along the vein. On the other hand, the numerous fresh films of small pyrite crystals which coat the tiny fracture planes in the shear zone bear evidence of having been deposited after the last movement occurred.

The proportion of gold to silver, by value, in the ore ranges from 2:1 in the low grade material ($2.00 to $4.00 per ton), to 25:1, or more, in the high grade ore. There is no regularity in the relative proportions of gold and silver and out of 100 different assays from the same stope no two assays will show exactly the same proportions of gold and silver. However, gold values are always at the least twice as great as the silver values, and more often 10 or 20 times as great.

The values in the ore are very irregularly distributed which makes the ore spotty. This fact should be emphasized. Three samples cut across the same face in the breast of the stope may show a variation in values from $2.00 to $50.00 per ton. This "spotty" nature of the ore is characteristic and it is almost impossible to get two assays in the same stope to agree. The only cases where the values approach uniformity occur in the hard narrow seams of banded quartz, which often carry more or less constant high values. However, the values in the ore are so thoroughly disseminated that, while individual samples taken from adjoining points on the vein show a high variation, the average value per ton of ore sent to the mill will often be uniform for considerable distance along the ore shoots.

St. Joseph Lead continued its drilling and development work until the latter part of 1919. The 1919 IMIR (p. 122-123) described some of this activity:

At the close of the year the Boise-Rochester Mine was reported to be working 40 men on a new deeper line of development consisting of a long cross-cut tunnel to tap a proven productive ore shoot that is 300 feet long and up to 10 feet wide of $10 ore that has been successfully stope through past operations above a shallow surface adit. This property produced some phenomenally [sic] rich specimen ore during its former activity, small shipments having been made that averaged $500 gold per ton. It is developed on the east end of what is known as the Atlanta lode, a big igneous intrusive dike in granite with marginal developments of silver-gold ore courses containing average values of $8 to $15 per ton.

Several hundred tons of ore was milled for testing purposes during the year. At the end of the 1919 work, St. Joseph Lead put the mine in reserve for the next decade (Anderson, 1939). The company acquired the Idaho Gold Mines' Atlanta Group on the opposite end of the Atlanta lode around 1920.
In 1921, the Atlanta Mines Co. (Monarch Mine) and the St. Joseph Lead Co. (Boise-Rochester Mine) entered into an agreement with the Idaho Power Company to install, at some future time, an 800-kva power line from Featherville to Atlanta. The estimated cost for this 19-mile-long transmission line was $82,900 ($4,365 per mile), which was to be split equally between the two mining companies (Naething, 1927, as quoted in Reigart and Nicolson, 1933). Apparently both companies found this cost excessive, and they continued to generate their own power.

Ballard (1928, p. 33-34) visited the property in 1925 and described it as follows:

This property, consisting of eight patented and several unpatented lode claims adjoins the Monarch property on the northeast and covers the continuation of the Atlanta Lode in that direction. At present, only the necessary maintenance work is being done, but access was to be had to the N. 6 tunnel and to the lower or No. 9 tunnel and to the drifts therefrom. The upper workings were inaccessible when visited but some information was supplied by the superintendent, Mr. James W. Stewart, and by local miners who were familiar with the old workings.

The property was located and first worked about 1869 with the main production from the “Pettit” ore shoot. The mine was subsequently purchased by the Bagdad-Chase Co., who did considerable mining, with production of about $320,000 in bullion. Later the Bagdad-Chase property together with adjoining property was operated by the Boise-Rochester Mining Co., with production of $400,000 in bullion from the “Old Chuck” ore shoot (Atlanta lode) distant some 1100 feet N. E. of the Pettit ore shoot.

From a point a few hundred yards south of and above the mill an adit cross-cut (No. 9 tunnel) has been run southeasterly to the “Atlanta lode” cutting the vein at a depth of approximately 1100 feet beneath the highest point of outcrop.

These cross-cuts reveal a shear zone about 50 to 70 feet wide in which the sheared granite, considerably sericitized, is exceedingly soft and crumbly. Throughout this are numerous irregular quartz seams carrying medium fine-grained pyrite. This mineralization is also evident in some of the more highly altered granite. This zone of altered granite and quartz seams is reported to be sufficiently mineralized to constitute ore. On the footwall occurs a quartz vein from 3 to 5 feet in width and somewhat shattered. It is considerably mineralized here and there with pyrite. This constitutes an ore that is reported to average much better than the sheared granite. No evidence of oxidation by descending surface waters was seen anywhere in the vein at this level. Specimens of ore were “mortared” and carefully panned but showed no “colors” in the pyrite concentrate. From what could be gathered on concerning tests made, the gold and silver are closely associated with the pyrite and are not amenable as a rule to amalgamation. At no place in the three cross-cuts mentioned, were any silver minerals noted. This is in marked contrast to their reported occurrence along the same vein at the Monarch mine, adorning on the southwest.

As nearly as can be seen, the best ore consists of quartz carrying pyrite. Those in charge report the result of their sampling on this level as indicating an average value close to $8 in gold and silver over widths from 5 to 20 feet. Several selected pieces of ore were taken from some of the quartz lenses exposed in the main vein. Assay of these results ranging from $4 to $15 per ton in gold and silver. Pyrite could be distinguished and a qualitative test of the concentrate obtained from the above specimens showed no lead, zinc, antimony, or arsenic, and but a trace of copper. A concentrate from these specimens assayed 42.36 ounces gold and 26.5 ounces silver. These figures do not purport to give the value of concentrate to be produced by milling, but do convey some information regarding the relative amounts of gold and silver.
in the ore at this level. A grab sample taken from an old ore pile on the dump at No. 5 tunnel, about 450 feet above No. 9 level, assayed 0.30 ounces in gold and 4.6 ounces in silver and showed no lead or zinc.

The gross production of this property so far as is known is about $1,000,000 derived mainly from bullion obtained by amalgamation. Some concentrate was shipped, a few years ago, and some was treated locally by cyanidation. The concentrate ranged in value from $40 to $140 per ton. Haulage and railroad freight charges were about $40 per ton, varying with the season and condition of roads.

Old workings at this property showed two main shoots, both in the main Atlanta lode. The maximum "vein" width in the old upper levels are reported to be from 30 to 50 feet, but with the more highly mineralized sections ranging from 5 to 15 feet. So far as could be seen on the surface and in No. 9 tunnel, this estimate is reasonably accurate.

Recovery at this property from amalgamation was from 50 to 64 per cent of the assay value of the ore. The additional returns from concentrates brought the total to about 70 per cent.

Numerous tests by present operators show a probable mill-head of $7 to $10 with a recovery of about 90 per cent. According to them, there is nothing complex in the treatment process. Briefly the essential features proposed fine-grinding and cyanidation as ordinarily practiced in modern plants. Flotation followed by chloridizing of the concentrates is a possible alternative. The ore is not refractory and presents no unusual metallurgical problems.

The Boise-Rochester Company owns a 120 horsepower hydro-electric plant about two miles up-stream from Atlanta on the South Fork. During the winter season, however, the water supply is insufficient and as a result the capacity of the plant is reduced to such an extent that power will have to be brought into the country to permit any extensive operations.

In 1926, rumors circulated that the St. Joseph Lead Co. planned to consolidate the Boise-Rochester and Monarch mines. However, the company did not obtain its lease and option on the Monarch until the latter part of 1929. At that time, the company started development work. Nearly 650 feet of tunnels and crosscuts were driven during 1929, much of it apparently on the Monarch.

Work on 1930 consisted mostly of advancing the No. 6 level toward the Monarch shaft. Operations were suspended in July 1930, but resumed in August 1931 (Anderson, 1939). The 1931 IMIR (p. 136-138) described the year’s activities:

From a "ghost" city of less than a score of people to a thriving community of more than 300, with a picture show, school, and airplane mail service, is the experience of Atlanta in 1931, as a result of the resumption of operations in August by the St. Joseph Lead Co., at its Boise-Rochester mine.

The airplane service, which was started in December, is the first Star Route airplane mail service, to an isolated mining camp, to be established by the United States Post Office Department. It was made possible, in part, by the company constructing and maintaining a landing field at Atlanta. As there is seldom sufficient snow in Boise to permit ski-equipped planes to land, the use of wheels in landing at Atlanta is made possible by keeping the snow firmly packed with a heavy roller.

From September to the close of the year approximately 200 men were employed. The old mill was torn down, and the serviceable lumber and equipment used in the construction of a new mill of 200 tons capacity [Figure 24], which was erected near the portal of the lower or No. 9 tunnel. A 360-horsepower Diesel engine, driving an electric generator, synchronized with an old 125-horsepower hydroelectric plant, was installed for power purposes. All
Figure 24. New mill of the St. Joseph Lead Company at the Boise-Rochester Mine (Campbell, Stewart, 1932, Thirty-third Annual Report of the Mining Industry of Idaho for the Year 1931, p. 140).
construction work was completed, and the mill was placed in operation the latter part of December. A new 1,000-cubic-foot electrically driven Ingersoll-Rand compressor, a Mancha storage-battery locomotive, and all necessary mining machinery and equipment were installed at No. 9 tunnel. This tunnel and No. 6 tunnel were rehabilitated, and the mine was in condition for production, part of this work being the driving of a 340-foot raise to connect these tunnels. The transportation of the machinery, equipment, and 100,000 gallons of fuel, which was handled by nine trucks, operating day and night; the razing of the old building; and the construction of the new mill and additional mine buildings represent the second largest expenditure made in the State during the year. The short time required to construct the mill and place the mine in operation established a record which has never been equaled in Idaho and for which much credit is due the manager, Mr. Frank H. Skeels.

The raise connecting the No. 9 level to the No. 6 level was driven upward from a point beneath the Old Chunk ore shoot (Anderson, 1939). In 1932 the St. Joseph Lead Co. maintained capacity production all year and was the largest producer of gold in the state. The mine was credited with about 42 percent of Idaho’s gold output for 1932, an amount that exceeded the previous year’s total gold production for the entire state. The new mill made its initial run early in the year. The company sent gold bullion to the assay office at Boise, and rich gold concentrates were hauled to Mountain Home and shipped to Utah for smelting. In addition, the company did a large amount of development work. The 1932 IMR ran a detailed report on the mine and mill (Campbell, 1933, p. 32:39):

[The information presented herein is confined as closely as possible to the activities of the company [St. Joseph Lead Co.] since its resumption of operations in September, 1931; as most of the equipment was installed, and the mill erected and placed in operation during the period from Sept. 1, 1931, to Feb. 1, 1932. The short time taken for this new construction in an isolated district has never been equaled in Idaho.

LOCATION

The Boise-Rochester mine [Figure 25] is located near the head of Montezuma Gulch, about two miles south of Atlanta, which is situated in the northeast corner of Elmore County, 80 miles by road, northeast of Mountain Home, the county seat, and about 58 miles almost due east by air line from Boise.

TRANSPORTATION

The first 13 miles of road north from Mountain Home to Toll Gate is a standard gravelled highway, from Toll Gate to Atlanta it is a fairly well graded road maintained in part by the county and in part by the U. S. Forest Service; 28 miles north of Mountain Home it descends along Camas Creek to the South Fork of the Boise River which it follows to Featherville. From Featherville to Rocky Bar it passes through narrow gulches and over a low divide. The difference in elevation between Mountain Home and Rocky Bar is approximately 2,000 feet. In going from Rocky Bar, elevation about 5,000 feet, it follows Blake Gulch and then winds around Baldy Mountain to the divide between the South Fork and the Middle Fork of Boise River, a distance of 6 miles and a gain in elevation of 3,000 feet. From the divide it follows down James Creek to its junction with the Middle Fork, a distance of 4 miles and a drop in elevation of 3,600 feet. The heavy snowfall and the snowslides, which occur regularly each winter between Rocky Bar and the Middle Fork of the Boise River, close the road from November until June of the following year; require the storing of all supplies necessary for the winter operations; and prevent the shipping of concentrates except during the summer.

Mail, passengers, and perishable supplies, such as meat, eggs, butter, fresh fruit and vegetables, are delivered during the winter months by twice-a-week airplane service from
Figure 25. St. Joseph Lead Company’s camp at the Boise-Rochester Mine (Campbell, 1933, p. 35).
Boise. This service, which was started in December, 1931, is the first Star Route airplane mail service established by the United States Post Office Department to an isolated mining camp. It was in part made possible by the company building, donating, and maintaining the landing field at Atlanta. The airplanes in use have a carrying capacity of 1,675 pounds, and have transported in emergencies machinery repair parts weighing more than 800 pounds.

ATLANTA LODGE

The Atlanta lode is a shear zone varying in width from 50 to 120 feet. It starts at Montezuma Gulch—a fault contact of two granites of entirely separate ages—and strikes S. 70° W. with a lineal extent of approximately 2½ miles to the Yuba River, where it ends on another fault contact of two different granites. The lode is wholly confined to the older rock and does not enter the younger at either end. Going west from the east end for 3,000 feet, it dips an angle of 73 degrees to the north. The dip then commences to change to the vertical, through which it continues to a final dip of 75 degrees to the south.

The matrix consists of unreplicated granite, quartz, calcite and possibly, barite. The valuable metal content of the ore is gold, most of which is associated with arsenopyrite, and argentite. Pyrite is present in abundance, and assays of the concentrate show the presence of lead, copper, bismuth, and antimony minerals in small quantities. The pyrite, which is barren, occurs mostly as cubical disseminations in the matrix. The gold occurs as particles, varying from coarse to fine, scattered through a dense black ground mass. The gold is seldom visible to the naked eye, although occasionally bunches of high-grade are encountered in which it can be seen in streaks more than 1/16 inch in thickness. Seventy per cent is recovered as bullion, and the remainder is recovered in the concentrate.

The ore occurs as lenses varying from 4 to 12 feet wide, generally near the center of the lode and dipping toward the footwall but never reaching it. There is no line of demarcation between the ore and waste, and all mining is done to produce a mill feed averaging ½ an ounce gold, as economic conditions do not permit mining it to a lower gold content. The General Pettit ore shoot has been continuous from the surface to No. 6 tunnel, a vertical distance of more than 800 feet. As yet No. 9 tunnel has not been advanced far enough to intersect it and mining has not progressed far enough to prove the extent of the other two ore shoots, all mentioned later.

The ground in the lode is exceedingly heavy and swells so rapidly that it is almost impossible to keep an entry open for any length of time. As a consequence all permanent tunnels and raises are driven in the hanging wall, and all stopes are kept filled to the working face.

MINING CLAIMS

Three groups of mining claims cover the extent of the lode. Starting at Montezuma Gulch going west is the Boise-Rochester, with a length of about 2,700 feet; next the Monarch, covering approximately 1,800 feet; and then the Atlanta. The first and last named groups are owned by the St. Joseph Lead Co., and all operations are confined to the former.

ORE BODIES

The ore bodies are confined to different parts of the lode. Three, from east to west, known as the Old Chunk, Central, and General Pettit ore shoots, occur in the Boise-Rochester group. The Old Chunk is about 1,000 feet long, the Central 400 feet long, and the General Pettit 500 feet long; the three are separated from each other by 250 and 350 feet of barren lode matrix.

MINE ENTRIES

The Monarch group is opened by a 600-foot vertical shaft. In the early days the General Pettit ore shoot was opened and operated through a 100-foot vertical shaft. No. 2, or General Pettit, tunnel was then driven and connected with this shaft by a 300-foot vertical raise, in which were four intermediate levels; the mine was operated through this tunnel for

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many years. Later operators drove No. 6 tunnel, a crosscut, which intersected the lode 2,200 feet east of the General Pettit shaft and 430 feet below No. 2 tunnel. Old Chunk ore shoot is located near the point where No. 6 tunnel intersected the lode. It and the Central ore shoot were both unknown until encountered by this tunnel about 1915.

After the St. Joseph Lead Co. acquired the mine, No. 6 tunnel was driven in the hanging wall of the lode to the west end line of the Boise-Rochester group, a distance of 2,500 feet, and then later extended a distance of 1,900 feet to a connection with the 400-foot level of the Monarch shaft. No. 9 tunnel [Figure 26] a 1,900-foot crosscut, situated 280 feet vertically below No. 6 tunnel, was then completed to a point beneath the Old Chunk ore shoot, and the two were later connected by a two-compartment 70 degrees inclined raise. These connections provide an excellent natural ventilation throughout the mine.

UNDERGROUND TRANSPORTATION

When the mine was placed in operation in February, 1932, stoping started in No. 6 tunnel, on General Pettit and Central ore shoots, and since then has progressed steadily upward. A 1½-ton Mancha storage battery locomotive and side-dump mine cars of 2,000 pounds capacity are used to gather the ore, which is then dumped into the raise and drawn out in No. 9 tunnel. This latter tunnel is level with the top of the crude ore bin in the mill, and the cars are dumped directly into it. The ore is transported from the raise to the mill by locomotive and cars similar to those in No. 6 tunnel, each train being composed of from 10 to 15 cars. An extra set of batteries is supplied for each locomotive, so that one set can be charging while the other is in use. The motor-generator set for charging the batteries is located in the engine room, and the direct current is taken to the charging stations, which are located near the portals of the two tunnels. All track underground consists of 12-pound rails laid to a gauge of 18 inches. STOPING

The horizontal cut-and-fill method of mining is used in both stopes. The stope raises are spaced 46 feet, center to center, and are carried up periodically as stoping progresses. All raises have two compartments, chute and manway, each being 2½ feet by 3 feet in the clear. The tight-crib type of timbering is used in all raises, and both compartments are lined with 2-inch plank. The manway side is provided with straight ladders and a timber slide. This style of timbering has proved to be quite advantageous, as it permits flexibility when a change in the dip or offsetting of the ore is encountered. A trap door provided with control chains and constructed of 3-inch plank is maintained over the manway sides at all times, and the chutes are kept partly covered with a loose plank to a hole so small that the danger of a man falling down them is almost negligible.

The stope is advanced upward horizontally as a single face, in 50 to 100 foot sections. Selective blasting is practiced, but this does not produce sufficient waste for filling, so it is necessary to mine waste for the back fill. This is done by carrying a cross-sectional cut about 5 feet wide across the width of the lode. These cuts are staggered from foot to hanging wall at intervals corresponding to the center of the raises (46 feet) and progress upward with the stope as the ore is mined. Sufficient surplus waste is broken in these cuts to keep them always back filled to a point slightly higher than the floor of the stope. In addition to furnishing waste for filling, they make a complete vertical cross-sectional cut of the lode for its entire width, thus prospecting it for any overlapping or unknown ore shoots which may be parallel to ore being mined.

The fill is carried to within 6 feet of the face, or breast. Before blasting the ore the fill is leveled and covered with a 3-inch plank 8 and 10 inches wide and 3 feet in length. After blasting, waste sorted from the ore is thrown to one side, and the ore is shoveled directly into the chutes.

POWERS

All machinery is driven by electricity obtained from two sources, a small hydroelectric plant and a Diesel engine, the former being located on the Middle Fork of the
Figure 26. St. Joseph Lead Company’s mill and No. 9 tunnel at the Boise-Rochester Mine (Campbell, 1933, p. 33).
Boise River about 2½ miles from the mine. It is a low head plant and during the high-water season generates about 125 horsepower; during the low-water period and in freezing weather, the output is reduced to about 25 horsepower. The other plant is housed in a building adjoining the mill and consists of a 360-horsepower M. A. N. 8-cylinder Diesel engine, direct connected to a 3-phase 480-volt 375 kva generator. Both plants are synchronized, and all switchboards and synchronizing apparatus are located in the engine room. The fuel oil is stored in two 50,000-gallon tanks located outside of the building, and the exhaust from the engine is utilized to heat the mill building. A 987 cubic foot, 2-stage 1-8 compressor, direct connected to a 175 horsepower motor, furnishes all the compressed air needed for the mine, drill sharpener, and for operating the hoist at the raise in No. 9 tunnel.

WATER SUPPLY
Water is furnished from Flint Creek, a tributary of the Yuba River, over a low divide, to the Montezuma Creek side, and thence around the mountain into a series of 18 by 22 foot tanks at a point 150 feet above the mill. These tanks are connected with two pipe lines, one for general utility purposes, the other for fire protection. The fire line, which extends throughout the mill buildings and to all camp buildings, is provided with outlets and hose at all strategic points. An extensive fire protection sprinkler system has been installed in the mine and hand fire extinguishers are placed in all the buildings.

TIMBER
The region immediately adjoining Atlanta is forested with red fir, yellow pine, and lodge pole pine. All timber used in the mine is sawed in a mill owned by the company. The lumber and sawed timber are delivered to the timber-framing shed at the portal of No. 9 tunnel, where it is framed and sawed into size for use underground. It is then delivered to the raise in this tunnel and hoisted to No. 6 tunnel.

MILL
CRUSHING
The ore is transported from the mine (No. 9 tunnel) by a ½-ton Mancha storage battery locomotive and delivered into an 850-ton crude ore bin, from which it is drawn by a Stephens-Adamson feeder equipped with a 30-inch electromagnet, into a 24 by 14 inch Blake crusher, which reduces it to pass a ½ inch ring. The flow sheet for this mill is shown in Figure 27. The crusher discharges directly into a set of gear-driven crushing rolls, 36 by 14 inches, which are gauged to grind to ¾ inch. The rolls discharge into a 32-foot bucket elevator, with 12 by 6 inch buckets, spaced 2 feet apart, which discharges onto a St. Joe vibrating screen equipped with ½-inch mesh screen. The oversize from this screen goes to a second and similar set of crushing rolls, which discharge into the elevator, and the undersize goes directly into a 600-ton fine ore bin. The crusher is driven by a 100-horsepower motor, belt connected with line shafts and pulleys.

GRINDING
The fine-ore bin is provided with three gates on the lower side, and a fourth or central gate in the center of the bottom. Each gate is equipped with an 18-inch belt feeder, which discharges onto a main belt feeder, which in turn discharges into a gear-driven Cleary sampler. After it passes the sampler, soda ash in a ratio of 2 to 3½ pounds per ton of ore and water to give a pulp density of about 20 per cent solids are added to the feed, and it then passes directly into a 4 by 10 foot Marathon rod mill, where it is ground to 30 mesh. Equal weights of 3 and 4 inch drop-forged steel balls are used and a total ball load of approximately 16,000 pounds is maintained.

14The gape, or mouth size, of the jaw crusher.
15The diameter of the cylinder and the width of the face of the cylinders in the roll crusher.
16The diameter and the length of the cylinder in the rod mill.
Figure 27. Flow sheet for the St. Joseph Lead Company’s mill at the Boise-Rochester Mine (Campbell, 1933, p. 37).
The screening is done by an 18 by 36 inch conical screen attached to the discharge end of the mill and integral with it. The undersize is distributed through launder to the amalgamation circuit, and, after passing over the plates, it joins the oversize in a launder which carries both products to a No. 66 Marcy ball mill, operating in closed circuit with a 30 by 6 foot Dorr duplex classifier, grinding to 80 per cent minus 200 mesh. Approximately equal weights of 2½ and 3 inch drop-forged steel balls are used and a total ball load of about 9,000 pounds is maintained.

The total ball consumption for both mills averages 3½ pounds per ton of ore ground. Both mills are driven by a single 240-horsepower motor with Tex-ripe drive, and the classifier is driven by an individual 10-horsepower motor.

**FLOTATION**

The overflow from the Dorr classifier, averaging 20 to 23 per cent solids, passes directly to the intake of a 3-inch Wilfley pump. This pump discharges into the intake of another similar pump, which discharges into the rougher cell. The reagents, which are added by means of Denver wet reagent feeders, are fed into the intake of the second pump. Each pump is driven by a direct-connected 10-horsepower motor.

The rougher cell is a 40-foot St. Joe flotation machine equipped with 38 drop pipes. The tailing from this machine goes to waste and the overflow into launders and thence to the cleaner cell, a 4-foot St. Joe machine with 5 drop pipes. The tails from this machine are returned to the rougher cell, and the overflow goes into the launders, where additional reagents may or may not be added; thence to the cleaner cell, a 2-foot St. Joe machine with three drop pipes. The tails from this machine are returned to the cleaner cell and the overflow is washed down a launder to a 6-foot American filter.

All three machines are set in tandem, and the air is delivered to them through a single 16-inch header pipe for which it is taken off by a 3-inch feeder or drop pipes drawn down to ¾-inch vent slots at the lower ends. A centrifugal blower, with a rated air pressure of ¾ pound, which furnishes the air for all three machines, is located at the head end of the rougher cell and driven by a 27-horsepower motor.

The cake from the filter drops directly onto a hot plate, the heat for which is derived from the exhaust of the Diesel engine. After drying it is shoveled into sacks for shipment to the smelter.

The reagent consumption in pounds per ton of ore milled is as follows: Cresylic acid 0.15 pounds; pine oil 0.15 pounds; xanthate 0.12 pounds; potassium cyanide 0.002 pounds.

**AMALGAMATION**

All amalgamation is done on outside stationary plates. The pulp passing the screen on the Marathon mill passes to launders which distribute it to three 9-foot by 42-inch and four 6-foot by 42-inch copper plates set at an inclination of 3½ inches per foot. An amalgam trap consisting of a wooden box of length equal to the width of the plates and of a depth of 8 inches is attached to each plate. The pulp flows from these traps into a gathering launder, where it joins the oversize from the screen and is carried into the classifier. This launder is equipped with an amalgam trap, consisting of a wood box 12 inches deep by 2 feet long. The total plate area is 178.5 square feet, which gives an approximate average of one square foot of plate per ton of ore milled per day. All plates are made of copper and weigh approximately 5 pounds per square foot.

The plates are cleaned and dressed each morning, the amalgam being removed with a hard rubber scraper. After scraping, the plates are scrubbed and washed with a whisk broom and a weak solution of Iye. This operation is then similarly followed with a weak solution of

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17 The inside diameter of the cylinder of this ball mill was 6 feet, and the cylinder had a working (inside) length of 6 feet.

18 Length and width of the classifier tank: A duplex classifier had two sets of rakes for working the material.

19 The diameter of the filter's disc.
sal ammoniac, after which they are flushed with clean water; mercury is then sprinkled on them and rubbed in with a whisk broom. Following the application of the mercury, small chunks of clean gold-amalgam are added and thoroughly rubbed in with a whisk broom. The plates are then ready for 24 hours' operation although occasionally it is necessary for each following eight-hour shift to dress some of the plates. The cleaning and conditioning of the plates requires about 1½ hours. The amalgam is ground and cleaned in a small laboratory ball mill and is then ready for periodical retorting and melting. After melting it is poured into bricks and shipped to the United States Assay Office at Boise.

CLASSIFIER CLEAN-UP
After the mill had been in operation a short period, it was discovered that a large percentage of coarse gold was accumulating under the rakes and in the trap of the Deer classifier. Experiments proved that this gold should be removed twice a week. So the mill is shut down for three-fourths of an hour and the classifier is thoroughly cleaned. This material is then put over a Wilfley table, which makes three products: a tailing, which is returned to the classifier; a middling, which is sacked for shipment to the smelter; and a concentrate which is roasted and then melted into bullion.

PRODUCTS

<table>
<thead>
<tr>
<th>Average Assays of Mill Feed and Products</th>
<th>Gold Oz.</th>
<th>Silver Oz.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mill Feed</td>
<td>0.38 to 0.67</td>
<td>1.70</td>
</tr>
<tr>
<td>Flotation Heads</td>
<td>0.20</td>
<td>1.02 to 1.50</td>
</tr>
<tr>
<td>Flotation Cons</td>
<td>20.00 to 25.00</td>
<td>100.00 to 125.00</td>
</tr>
<tr>
<td>Flotation tails</td>
<td>0.03 to 0.04</td>
<td>0.25 to 0.35</td>
</tr>
</tbody>
</table>

Tons Milled ................................................. 90 to 120:1
Ratio of concentration ..................................... Averages 180 per 24 hours
Total recovery ................................................. 92 to 93% gold
Per cent gold recovered by amalgamation ................. 82 to 84% silver
Per cent gold recovered by flotation ....................... 70
Per cent gold recovered by flotation ....................... 30
Fineness of bullion averages about 550 parts gold, 443 parts silver, and 7 parts base metals.

Assay of Average Flotation Concentrate

| Gold                                      | 22.50 Oz. |
| Silver                                   | 112.50 Oz. |
| Lead                                     | 0.30%     |
| Copper                                   | 0.30%     |
| Arsenic                                  | 6.0%      |
| Iron                                     | 38.0%     |
| Insoluble                                | 8.5%      |
| Bismuth                                  | Trace     |
| Antimony                                 | Trace     |
| Moisture                                 | Approx. 4.0% |

TAILING DISPOSAL
The tailing is conveyed in a launder for a distance of 500 feet from the mill and dumped into a ditch 1,000 feet in length, which leads to three impounding ponds built in tandem in Montezuma Gulch. The ditch and ponds are so arranged that but one pond at a time is in use. The overflow from these ponds goes to a 2,000-foot ditch, which empties into a
settling or clarifying pond with an area of approximately 300 square yards. On leaving this pond the water is almost clear; it is then run into Montezuma Creek and finally reaches the Middle Fork of the Boise River. The impounding dams are started by laying three or four rows of logs, tied together by cross logs, across the bottom of the gulch; when these are filled the sand is then shoveled against the top log and carried upward in alternate steps with a slope or better of 45 degrees on the down hill slope. Each dam is provided with a deoanting launder at the top.

LABOR

Mill

The mill and power plants are operated 24 hours per day. There are three men to a shift in the mill, one to a shift in the Diesel engine plant, and one continuously at the hydroelectric plant. The crusher is operated two shifts with one man to a shift. Additional men on day shift are: Mill superintendent, bullion clean-up man, roustabout, mechanic, and a man on the tailing ponds; 19 in all.

Mine

The mine is operated in two 8-hour shifts with 40 men to a shift; additional men on day shift are: One electrician, two timber framers, two blacksmiths, one warehouse man, and one truckdriver.

Other employees are: Manager, bookkeeper, engineer and assayer, two night watchmen, and boarding house help.

Dean (1935, p. 80) described the airplane service to Atlanta:

The Boise-Rochester free-gold and silver mine of the St. Joseph Lead Co. is at Atlanta, Idaho, in the southwestern part of the State. The mine is 127 miles from Boise via Mountain Home. There is an improved oil road 44 miles from Boise to Mountain Home, but 60 miles of the remaining 83 miles of road traverse mostly narrow gulches and two divides of over 9000 ft. elevation. Several of the inclines have long grades exceeding 15 per cent. From November to June practically all of the sixty miles is impassable, occasioned by heavy snowfall of from 10 to 30 ft. after Jan. 1. Even when the road is open, at least five hours are required to make the trip one way from Boise, with a good car. The air route is 58 miles, and the trip is made in any part of the year in less than thirty minutes.

During 1933 and the first half of 1934 the employees at the property averaged about 126. These are included in the camp personnel of about 800 individuals, 150 being children.

Twice-a-week plane service for mail and supplies was started in December, 1931. It is believed this was the first Star Route airplane mail service established by the U. S. Post Office Department to an isolated mining camp. The mining company donated and constructed the field and has maintained it since completion. The service is steady from November to June of each year for handling all freight, perishable supplies, mail, bullion, and passengers. Throughout the year it is used for the transportation of all sick or injured to hospitals.

According to Frank H. Skeels, manager, who has kindly given much of the above information, "The plane service is vitally important and has been, on many occasions, the means of saving lives. For instance, compare the carrying of a sick or injured person on skis for 22 miles over a 9500-ft. summit, and then still have 105 miles to reach a hospital, against flying thirty minutes in a heated cabin plane for $10 to make the same destination. At $10 a trip from Atlanta to Boise or vice versa, the expense is less than can be made by car in summer."

Operating the field in winter was no easy task (Blomgren, 1933, p. 28-30):
Mail trips are scheduled twice each week on the run between Boise and Atlanta, and additional trips are made on call or when loads demand it. Approximate air time required for the trip is between 35 and 45 minutes, depending upon the wind.

The schedule of rates for this route is as follows: passengers $15 one way, or $27.50 for the round trip, express and freight, 10 cents per pound, with a minimum charge of 25 cents. This rate applies to shipments of less than 50 pounds, for more than 50 pounds the rate is 7 cents per pound. Light, bulky shipments bear a heavier rate than do shipments of less bulk and more weight.

Two ships are maintained at Boise for this run. Each of these is in the 4,000 pounds gross weight class, has a total useful load of between 1,670 and 1,680 pounds, and is capable of carrying six passengers and their baggage.

It must be remembered that the Boise Airport is free of snow, while at the other end of this run there is usually from 3 to 5 feet of snow on the field. It is therefore necessary to use wheels on the plane instead of skis. A combination wheel-ski arrangement might be used, but this equipment is heavy and cuts down the useful load of the ship. Therefore it is evident that the Atlanta field must be maintained in a condition to receive winter traffic on wheels instead of skis. When the method of keeping the Atlanta field in condition was being considered, the suggested practice of clearing runways with snow plows was discarded as impractical. Pusher plows were not feasible, because of the immense amount of snow to be moved to clear the runway to the desired width, from 150 to 200 feet. Rotary plows were not available. Appreciation as to the additional hazard of these piles of snow to aircraft operations, as well as damage to the field during spring thaws, definitely ruled out this method. Compacting by rolling appeared to be the most feasible plan, as it was believed that such a compacted runway would not only be economical to maintain but would be swept clean by the wind and not drift full of snow. A roller with varying weights, which would work equally well when the snow was dry and heavy (like sand), light and fluffy, or wet was necessary. One with a light drum or cylinder was constructed, part of the weight being built into the framework, and bags filled with sand being added when more weight was desired. To secure compactness the field was rolled twice and again rolled after each snow fall of 3 or 4 inches. When the rolling did not produce exactly the desired results with the cylinder running free, it was blocked and dragged up and down the field. From the air, the rolled portion presented a dazzling whiteness in decided contrast to the unrolled portion of the field. (Note picture [Figure 28].) To permit a better judging of distance when approach to the field was made, red flags were placed along the edges of the rolled area.

This method of maintaining and marking the field proved to be entirely satisfactory. It has been in use for the past two years at Atlanta, Cascade, McCall, Warren, and Stibnite, and has been adopted for fields in winter use on the Transcontinental and other Federal airways.

The airfreight service had practical benefits to the company. In the winter of 1931-32, it prevented the closure of the mine (Blomgren, 1933, p. 31):

The hoist at the mine of the St. Joseph Lead Co. at Atlanta was irreparably damaged. A drum containing a new clutch was ordered by telephone from the factory. When it arrived in Boise in April, 1932, its assembled weight was 1,400 pounds, and it was too large to go through the door of the airplane. It could not be taken over the mountains except by airplane, as travel by horse and sleigh was not possible, and it was too heavy for dog team and sled. The drum was stripped of all detachable parts; this reduced the weight to slightly more than 800 pounds, but even then it would not go through the door of the airplane. A method was finally devised. The drum was slung under the ship and so transported to the mine without any difficulty. Complete closing until June, 1932, was thus avoided.
Figure 28. Winter view of the landing field at Atlanta (Blomgren, 1933, p. 26).
The Boise-Rochester was the largest producer of gold in Idaho in 1933. The mine and mill were operated continuously during the year, and bullion, rich gold concentrates, and gold calincs from previous operations were sold. Gold production decreased about 10 percent from the previous year, but silver output increased. A considerable amount of development work was done throughout the mine. Anderson (1939, p. 46) noted: "By the end of the year all development on the Boise-Rochester had been completed necessary to the removal of all known ore."

The company was again the largest producer of gold in Idaho in 1934. Nearly 70,000 tons of gold ore was treated by amalgamation and flotation, and gold production increased more than 65 percent over the previous year’s output. The amalgamation bullion was shipped east for refining, and the concentrates were shipped to Utah for smelting. Additional flotation equipment was added to the mill. The company leased the Monarch Mine in 1934 and transferred most of its development work to that property (Anderson, 1939). Development for the year totaled over 3,000 feet of work. Gardner (1935a, p. 1-5) described operations at the mine in great detail:

In April 1934 the St. Joseph Lead Co., at Atlanta, Elmore County, Idaho, was mining and milling about 225 tons of gold ore daily with a total force of 150 men. The mine, which comprises the old Boise-Rochester and Monarch properties, is at an elevation of about 6,000 feet. Snow lies on the ground about 5 months each year but does not interfere greatly with local operations. However, the road to Mountain Home, the shipping point 80 miles distant, passes over a high range and usually is closed by snow from about November 15 to June 15. Heavy supplies are brought in and concentrates are trucked out during the summer. In winter the district is served by a biweekly mail plane and a passenger and express plane making 4 to 6 trips weekly. Mine timber is cut locally. A plentiful supply of water is obtained from a stream brought to the property though 7,500 feet of flume... Atlanta is one of the early mining districts in Idaho. Mining operations have been carried on intermittently since ore was discovered in 1864. At one time Atlanta was one of the principal districts in the State; many millions of dollars in gold and silver have been produced in the district. The property now held by the St. Joseph Lead Co. was worked last in 1917 before this company entered the field.

The Boise-Rochester mine, which is now being operated, was opened by early operators with two drifts from the surface. The ore was taken to an amalgamation and gravity-concentration mill by an aerial tramway. The present company built a new amalgamation and flotation mill and ran a crosscut haulage tunnel to the lode at the level of the mill 300 feet below the old workings. The company began operations in the ground August 18, 1931; the air compressor was started November 16, 1931 and the mill, February 1, 1932.

The development of flotation for gold ores during recent years has made possible a much higher recovery of gold and silver than was possible in the old amalgamation and gravity-concentration mill. Ores can now be mined that could not be worked profitably under the old conditions.

The St. Joseph Lead Co. was the largest producer of gold in Idaho in 1933; about 28.5 percent of the total production of the State was from this mine.

GEOLGY

The ore occurs in the Atlanta lode; this is a shear zone 50 to 120 feet wide, at or near a contact of two granites of different ages. The lode is confined wholly to the older rock and
has well-defined walls. The material in the shear zone is fractured and partly decomposed granite with minor quantities of quartz and calcite.

The ore occurs as lenses ranging from 4 inches to 40 feet wide and up to 360 feet long on the strike, the principal ore shoot has been followed for 600 feet on the dip. The orebodies occur on the footwall, near the hanging wall, or within the lode. The dip of the orebody being worked in May 1934 was 72° to 85°.

The ore consists of dark-colored quartz containing disseminated fine crystals of arsenopyrite, pyrite, and argentite. Pyrite which is generally barren is abundant in places. The gold occurs free and with the sulphides. The ore as it went to the mill in the spring of 1934 ranged from 0.3 to 0.5 ounce of gold and 0.75 to 3.00 ounces of silver per ton; the quartz streaks, however, were much higher in grade. There is no line of demarcation between the ore and the other lode material; in most places close sampling and assaying are necessary to determine the ore limits.

The ground within the lode although dry is very heavy and swells upon exposure to the air. Permanent openings within the lode are held open with difficulty; haulage drifts are run in the hanging wall. Close filling is required in the stopes. When a cut of ore is taken in a stope there is a tendency for blocks of vein material parallel to the ore to push into the opening.

The vein is prospected by running crosscuts every 100 feet from the drifts in the hanging wall. Seams of dark-colored quartz are followed by drifting and raising. Occasionally these seams widen out into orebodies. All new faces are sampled.

**MINE EQUIPMENT**

A completely new surface plant including buildings was constructed by the present company.

As the quantity of ore developed did not indicate a long life for the mine, equipment (except the power plant) was moved in from other properties of the company that were temporarily idle because of the low prices of base metals.

The mine equipment consists of the following: One 970-cubic-foot, 20-drill, two-stage, 19- by 11- by 14-inch \(^2\) Ingersoll-Rand XRE air compressor, driven by a direct-connected, 75-hp. motor running at 257 r.p.m.; two 1 1/2-ton Mancha storage-battery locomotives; one 20-kva generator for charging batteries; 4 extra batteries; forty 17-cubic-foot, 0.9-ton mine cars; 1 no. 50 Ingersoll-Rand drill sharpener; 15 to 20 Ingersoll-Rand CC stopers; 4 drifters; 7 jackhammers; and hand and miscellaneous tools.

**Power Plant**

Power for the mine, mill, and camp site is supplied mainly by a 360-hp., 8-cylinder, German-submarine, Diesel engine, direct-connected to a three-phase, 480-volt, 375 kva generator. A hydroelectric plant that generates from 40 to 125 hp., depending upon the water supply, is situated about 2 1/2 miles from the mine. The power from the two sources is synchronized at the Diesel plant.

**DEVELOPMENT**

The mine is developed by a haulage adit on the 900 level and a working adit on the 600 level. The main production of ore is from about the 600 level. Drifts are run midway between the main levels for prospecting and stoping the ore. The ore is drawn from chutes on the 600 level and trammed to a transfer raise to the 900 level, whence it is taken to the mill.

The men enter the mine on the 600 level and are hoisted to the upper levels; the steel-sharpening and blacksmith shop, at which 200 pieces of steel are sharpened daily, is on this level. Supplies for the mine are taken by motor through the 600 level and hoisted through a vertical raise, extending 400 feet from the 600 to the 250 level.

\(^2\)The diameter of the low-pressure and high-pressure air cylinders in the compressor, and the length of the stroke of the compressor's piston.
**Rises**

Development raises are 3 feet 6 inches by 7 feet outside measurement; they are divided in the middle to make two compartments. Raise sets are placed on 5-foot centers. The raise timbers are framed in a shed equipped with planer, and cut-off, and band saws.

Raise rounds consists of an average of twelve 5-foot holes. The raises are run for a contract price of $4 per foot for labor and explosives. The company furnishes compressed air, timber, and other supplies and hauls the muck from the bottom of the raise. A raise crew usually consists of 3 men on each of 2 shifts; occasionally, however, 2 men on each of 2 shifts comprise a crew.

**Drifts**

Drifts are run 5 by 7 feet in section. Drift rounds in granite consists of an average of 12 holes that break about 5 feet. A downward toe-cut hole round is drilled.

Drilling and crosscutting in the spring of 1934 were done at a contract price of $5 per foot for labor and explosives. The contractors also laid track and put in the air lines as a part of the contract. The broken rock was trammed by hand to a switch not over 600 feet away. A drift crew consisted of 1 driller on one shift and 2 shovelers on another.

Drift sets in the crosscuts are placed on 5-foot centers by company timbermen.

**STOPING**

A horizontal cut-and-fill is the principal method of stoping; in wide sections of the vein the stopes are square-set. Square-set stopes are 15 to 40 feet wide. Cuts in the cut-and-fill stopes are 3 to 4 1/2 feet high. These stopes are carried up the width of the ore where it is 4 feet or more in thickness. Where the ore is less than 4 feet thick it is first broken and removed, then enough waste is shot down to provide filling. The thickness of the ore ranges from 3 to 40 feet.

The ore is shot down on 2-inch plank floors and shoveled into the chutes. Coarse waste is sorted out of the ore by the shovelers. The floors are taken up before filling.

Drilling is done with stopers. In wide stopes vertical holes are drilled 3 1/2 feet apart in two rows also 3 1/2 feet apart. A round consists of 12 to 20 holes. In breaking narrow streaks of ore in hard ground the holes are drilled 1 foot apart and staggered; they are shot with one stick of 30-percent-strength gelatin to the foot of the hole.

As the stoping progresses upward the regular manway and chute raises are carried up the fill on 46-foot centers. They are built up 5 feet at a time. One compartment is used for an ore chute and the other for a manway and timber slide. Timber and other supplies are hoisted and lowered to the stopes through these raises by means of Little Tugger hoists. A hoist is sometimes set at the bottom of a raise and the sheave attached to a tripod or stull over the timber slide, and at other times the hoist is on a track on the level above.

Side blocks of vein material that tend to fall in the stope are supported largely by waste filling that is run into the stope as soon as a cut is completed. In wide cut-and-fill stopes the back requires some auxiliary support until the space is filled. Casual stulls, both from the filling to loose blocks in the back and between walls of the stope, are placed as required. The backs of narrow stopes stand well.

In wide, filled stopes filling is obtained from inclined waste raises run across the lode in each section midway between the chute raises. These raises are in effect channels or inclined shrinkage stopes across the shear zone. Most of the orebodies occur in the footwall; hence in these sections the raises are run toward the hanging wall. Where the ore is over 7 feet wide an extra waste raise is run in each section. The waste is leveled in the stopes by hand. It is allowed to pile up in the raises and drawn as needed.

The waste raises have prospecting value. Any seams of dark-colored quartz are followed; occasionally orebodies are found in this manner. The waste workings do not appear to cause weight in the stopes. In narrow stopes enough waste is broken during stoping to
provide the necessary filling. The mine was originally laid out in such a manner that development waste could rarely be used for filling; this condition, however, has been overcome. Now, raises are usually extended between levels ahead of stope.

In long stopes some of the 46-foot sections between raises are of different heights; where this is the case dry walls are built with coarse waste at the end of the sections to retain the filling.

The ore from the different stopes is drawn in a predetermined proportion and mixed to keep the mill heads as uniform as practicable.

TRAMMING

Tramming on the 900 and 600 levels is done by two 1 1/2-ton, Mancha, storage-battery locomotives. An extra battery is used for each locomotive. The charging stations are at the portal of the adits. The motor-generator is set in the engine house.

An ore train consists of 9 side-dump cars which hold 0.9 ton each. The track gauge is 18 inches; 16-pound rails are used on the 900 level and 12-pound ones on the 600 level. Tramming is done by hand in the intermediate levels.

VENTILATION

The mine is naturally ventilated; rock temperatures are relatively low. The two main adits are outcast during the winter. The workings are connected with a shaft at the other end of the mine. The air appears good in stopes where the only connections are to a level 325 feet below. Definite currents travel up some of the manways and down others; they are controlled by doors at various places on the 600 level.

Gardner (1935b, p. 1-10) described the mill and its operation in detail:

The concentrator is at an elevation of 6,000 feet and located in a timbered, well-watered region of relatively heavy snowfall. The snow, however, does not seriously affect local operations. The truck road to Mountain Home, which passes over a mountain range, is closed each winter from about November 1 to June 15. During this period concentrates are stored and bullion is shipped by the road. Power is generated by a Diesel engine and by an auxiliary hydroelectric plant.

Gold is the principal metal produced; the ore also contains an appreciable quantity of silver.

The ore is mined by cut-and-fill and square-set methods and trammed from the haulage adit to the mill bins. It reached the bins before the sulphides oxidize appreciably. The concentrator has a capacity of about 225 tons per 24 hours. A crew of 20 men is employed in the mill; although the mill is operated 7 days per week, the men work only 6 days. An average saving is made of about 90 percent of the gold and 94 percent of the silver. About 75 percent of the metals is recovered as bullion from amalgamation plates; the other 25 percent is obtained in flotation concentrates.

The mill was built during 1931 and 1932 and began operation on February 1, 1932. Previous operators had treated the ore from the mine in an amalgamating and gravity-concentration plant. The improved recovery by flotation makes it possible to treat ores that could not have been handled profitably under the old conditions.

ORE TREATED

The ore consists of quartz containing disseminated fine crystals of arsenopyrite and pyrite. Crushed and altered granite is the principal gangue material. The gold occurs free and with the sulphides. An attempt is made to save all of the sulphides in the mill.

METHOD OF MILLING

Crushing

The flow sheet of the crushing section of the mill is shown in figure 1 [Figure 29]. The ore as brought from the mine is dumped through a grizzly, with a spacing of 8 inches.
Figure 29. Flow sheet of the crushing section of the St. Joseph Lead Company's mill at the Boise-Rochester Mine (Gardner, 1935b, Figure 1).
between bars, into a 1,066-ton crude-ore bin. Oversize on the grizzly is broken by hammers. The proportion of oversize is small, as the ore is passed through the same size grizzly in the mine. The ore bin is of conventional construction, except the front, which consists of locally cut logs lined with planking. The ore is drawn from the bin by a Stephens-Adamson pan feeder, 36 inches wide and 5 feet 6 inches from center to center, to a grizzly with bars set 1 1/4 inches apart. The grizzly undersize goes to a bucket elevator, 51 feet between centers and with 6 1/4- by 14-inch buckets spaced on 18-inch centers. This elevator discharges onto a 4- by 5-foot St. Joe vibrating screen. The screen opening is one half inch; it is vibrated 1,200 times per minute. The undersize from the screen drops directly into a flat-bottomed, 600-ton, fine-ore bin. The oversize from the screen passes down a chute to a set of 14- by 36-inch, Joplin, gear-driven spring rolls. These rolls operate in a closed circuit between the elevator and the St. Joe screen. The grizzly oversize drops into a 24- by 14-inch, Blake-type, Carterville jaw crusher. The discharge from the crusher goes to a second set of 14- by 36-inch Joplin rolls and thence to the elevator.

The crushing plant is protected from tramp iron by a 39-inch 20-kva Cutler-Hammer magnet. This magnet is energized by the same motor-generator set which charges to Exide batteries used in the underground haulage. The crushing plant is driven by a 100-hp. motor, belt-connected to a line shaft. Crushing is done on two 5-hour shifts.

Grinding

The crushed-ore bin is provided with four gates in the bottom. An 18-inch belt feeder from each gate discharges onto a main belt feeder, which is driven by a 10-hp. motor and travels 71 feet per minute; this in turn empties into a Denver Equipment Co. automatic sampler. (See fig. 2 [Figure 30].) The ore from the sampler is mixed with enough water to give a pulp density of 60 percent solids and then fed into a 4- by 12-foot Marathon ball mill running at 32 r.p.m. The mill which was originally designed for rods has been remodeled to use balls, the load is 12,000 pounds of drop-forged steel balls. Daily addition of steel balls are made to replace consumption. Equal weights of 4- and 3-inch balls are used in the mill.

The pulp is screened in a 25- by 31-inch, conical, 8-mesh trommel attached to the mill. The screen opening is 0.071 inch and the wire diameter 0.054 inch. The undersize, amounting to 75 percent of the feed, passes over four amalgamation plates and thence to an 8- by 30-foot Dorr classifier; the oversize goes directly to the classifier. Six and eight tenths percent of the oversize is plus 4-mesh material.

The classifier is driven by a 10-hp. motor and is in closed circuit with a 6- by 6-foot Marcy bell mill which revolves at 27 r.p.m.; 5,000 pounds of 3-inch and 5,000 pounds of 2 1/2-inch forged steel balls are used; the circulating load is approximately 250 percent. The discharge from the Marcy mill goes over a 4-mesh screen and is then elevated by a 3-inch Willey pump to a 25- by 31-inch trommel with an 8-inch screen, whence it passes over three amalgamation plates and back to the classifier. The overflow from the classifier, which was 80 percent minus 200-mesh, goes to a 3-inch Willey pump and thence to a flotation machine.

The Marathon and Marcy mills are driven by a 240-hp. synchronous motor with Modart V belt and a 12-inch, 5-ply belt drive.

Amalgamation Plates

The amalgamation unit consists of 7 plates, of which 3 are 4 feet 1 inches by 9 feet 6 inches and 4 are 4 by 7 feet in size. The slope is 2 7/16 inches to the foot.

The undersize of the screen on the discharge of the Marathon mill constitutes the feed to four of the plates. It is 100 percent minus 8-mesh, 3 percent plus 20-mesh, and 33 percent minus 35-mesh. The Marcy mill discharge is pumped back and put over the remaining three plates.

The cooling water from the Diesel engine is used in the winter to keep the temperature of the pulp going over the plates at a minimum of 45°F.
Figure 30. Flow sheet of the grinding and amalgamation section of the St. Joseph Lead Company's mill at the Boise-Rochester Mine (Gardner, 1935b, Figure 2).
The plates are dressed one at a time every 2 hours. After the feed is diverted, a plate is washed with clear water from a hose. Quicksilver is applied to spots where the amalgam is hard. The plate is then brushed lightly with a dilute solution of ammonium chloride and the feed turned back on.

Quicksilver used for dressing the plates is cleaned with sulphuric acid to remove oil. An average of about 40 ounces is used for each dressing of the plates.

The amalgam is removed from the plates once each 24 hours. After the feed is shut off a plate is washed clean with water from a hose. Soft amalgam is scraped to the top of the plate with a section of rubber belting and taken off with putty knives. Then the plate is washed with caustic soda solution and hosed off. Enough quicksilver is sprinkled on the plate to bring the amalgam remaining on it to the proper hardness.

About 200 ounces of amalgam from the previous day's clean-up is used in dressing the plates. Enough amalgam is applied to each plate to protect the plate surface from souring and to aid in amalgamation of the gold and silver. This amalgam is cleaned with concentrated sulphuric acid then washed with water until no acid remains. After the right amount of clean amalgam has been applied to the plate, enough quicksilver to bring the amalgam to the proper hardness is sprinkled on and the plate brushed with ammonium chloride; the movement of the brushes makes distinct transverse ripples across the plates. The finished plate has a silver-white appearance and is now ready for use.

Traps

Traps 8 inches deep and with lengths equal to the width of the plates are used at the ends of the plates; they are cleaned up once each day. When the amalgamation unit is running smoothly 1/2 to 1 pound of quicksilver is sought in each trap daily. On rare occasions when the plates do not take the dressing properly, nearly half of the amalgam may be found in the traps.

Ripples

A 3-foot section of transverse ripples is placed in the main launder below the plates to catch any coarse or rusty gold and amalgam passing over the plates and through the quicksilver traps. The 24 ripples are made of 20-gage metal strips 1 1/2 inches high on 1 1/2-inch centers; they are tilted downstream. The ripples pack with sulphides, but the velocity of the pulp is sufficient to maintain a transverse hollow back of each ripple. The gold and amalgam are retained in the hollow. The ripples are cleaned up every 6 days, and about 5 pounds of concentrate is obtained.

Gold and amalgam are penned from the concentrate. The concentrate is then run over a laboratory amalgamation plate, the gold removed, and the balance put into concentrates. The pyrite is usually cemented and rusty and the quicksilver foul.

Six tenths pound of copper sulphate, 2.0 pounds of soda ash, and 0.01 pound of potassium-xanthate per ton of ore are added to the Marcy-mill discharge. The presence of these reagents on the three plates amalgamating the Marcy discharge has increased the amalgamation recovery.

Treatment of Amalgam

The amalgam, cleaned daily from the plates, together with amalgam from traps and ripples, is ground 3 hours in a Searns-Rogers laboratory ball mill with hot water and enough quicksilver to make the amalgam soft. The ground amalgam is then washed with hot water and cleaned with a magnet until all the metallic iron and sulphides have been removed. The amalgam is then wiped dry with cloths. Two hundred ounces is set aside for plate dressing the following day; the remaining amalgam is squeezed in an amalgam press. This squeezed amalgam is very hard and contains from 58 to 65 percent of quicksilver.

The compressed-air press, which consists of a 3-inch pipe 13 inches long, is capped on both ends. One-eighth-inch holes spaced one fourth inch center to center have been drilled.
in the lower cap. The amalgam is placed on two thicknesses of muslin (see fig. 3 [omitted]) lying on a 60-mesh wire screen, which in turn is on the lower cap. Air at 100 pounds per square inch pressure is introduced through a 1/4-inch pipe tapped into the press near the top; the moisture and oil in the air pipe is blown out through a by-pass valve before the air is used in the press.

Retorting

The clean-up is retorted once a week in a no. 14 retort. The fire box in which the retort is heated is 12 by 14 inches; the bottom of the fire box is 10 inches from the bottom of the retort. Crude oil is used for fuel; a Denver fire-clay no. 250 centrifugal fan supplies the draft. A 3/4-inch pipe extends from the retort to a 2 1/2- by 36-inch condenser.

About 1,400 ounces of amalgam is treated and about 560 ounces of sponge bullion obtained. The sponge is melted in a no. 50 graphite crucible with 5 pounds of soda ash, 2 pounds of borax, and 1 pound of silica in an oil-fired furnace. The length of time required to make a fusion is 4 hours. The bullion is poured into a 4 1/2- by 11-inch cast-iron mold. The bricks weigh 830 to 880 ounces. The slag is broken and fed to the Mary mill.

Each bullion bar is sampled by drilling two 3/16-inch-diameter holes halfway through the brick on the center line and 1 inch from the ends on opposite sides of the bar. The sampling checks almost exactly with results from the United States assay office at Boise, to which the bullion was formerly consigned. The bars range from 500 to 560 parts of gold per 1,000, usually near the latter figure. The total fineness of gold and silver is about 980; the impurity is principally speiss and metallic arsenic. The bullion is shipped each week by first-class mail to the mint. Postage, insurance, and mint charges total 8 cents per ounce. The amalgam and gold are insured from the time they leave the mill building proper. A watchman goes through the mill hourly; no other precautions against theft were taken in the mill.

Flotation

The classifier feed goes to a 3-cell St. Joe flotation machine. The first cell, 42 feet long, is a rougher; the second, 5 feet long, a cleaner; and the third, 2 1/2 feet long, a reclaimer. The feed enters at one end of the first cell; the concentrate from the first 14 feet flows to the second cell, which in turn delivers its concentrate to the reclaimer. (See fig. 4 [Figure 31].) The rejects from the last two cells, together with the middling from the first cell, are returned to the head of the first cell by a 3-inch Willey pump run by a 10-hp. motor. The tailings from the rougher go to waste.

The flotation feed is 80 percent minus 200-mesh and contains 27 percent solids. Tests show that an improved recovery does not result from finer grinding.

The three cells are in line and are supplied with air from a 16-inch pipe under a pressure of seven eighths inch of mercury. The branch lines leading down into the cells are 4 inches in diameter and 9 inches apart. The orifices at the bottom of the branch pipes are five sixteenths inch in diameter. Pressure is supplied by a 27-hp., General-Electric-type, F.S. 355, centrifugal compressor that ran at 3,500 r.p.m.

Mill slop is collected in a 5- by 12-foot circular sump, whence it is returned to the classifier every 2 weeks by means of a sand pump. An overflow of water from the sump carried away most of the lubricating oil.

Reagents

As mentioned before, 2.0 pounds of soda ash, 0.6 pound of copper sulphate, and 0.01 pound of potassium xanthate are added to the Mary-mill discharge. Eighty-four thousandths (0.084) pound of creosol acid, 0.017 pound of pine oil, 0.13 pound of Barrett no. 4 creosote, 0.064 pound of potassium xanthate, and 0.067 pound of aerofloat no. 25 are added to the flotation circuit ahead of the 3-inch Willey pump. The soda ash (10-percent solution) is prepared by agitating the salt in hot water by means of compressed air until it dissolves. The reagents are added to the pulp by Denver Equipment Co. bucket feeders.

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Figure 31. Flow sheet for the flotation circuit of the St. Joseph Lead Company's mill at the Boise-Rochester Mine (Gardner, 1935b, Figure 4).
Filter

The flotation concentrate goes to a 6-foot, 3-disk, Oliver-United filter run by a 7-hp. motor. A 9- by 12-inch, Ingersoll-Rand, vacuum pump run by a 25-hp. motor at 200 r.p.m. maintains a vacuum of about 18 inches of water. Cake from the filter drops directly upon a drier, which consists of hot plates heated by the exhaust gases from the Diesel. The concentrate is sacked in 130-pound bags and placed in storage.

Flotation Concentrate

The concentrate is shipped during the summer to Garfield, Utah. The rate for smelting is a flat charge of $5 per ton of concentrates. There are no penalties or bonuses charged against this concentrate.

TAILINGS DISPOSAL

The tailing is conveyed through a 500-foot launder to a 1,000-foot ditch leading to three settling ponds built one below the other in a gulch. Only one pond is used at a time. The overflow from the ponds goes to a clarifying pond with an area of about 300 square yards. The water as it leaves this pond is slightly “milky.” The dams were started by laying 3 to 4 rows of round-timber cribbing across the bottom of the gulch and then filling in with sand from the tailing.

SAMPLING

Automatic samples are taken of the mill feed as it comes from the fine-ore storage bin, of the classifier overflow, and of the mill tailings. The pulp samples are obtained by means of Denver Equipment Co. motor-driven samplers that take cuts every 12 minutes. All samples, both from the mine and the mill, are prepared for assaying in the mill. The equipment consists of 1 Denver Clay 4- by 6-inch crusher, 2 Braun pulverizers, and 1 air-pressure filter. The sample room also contains a Ro-Tap screen for making screen analyses of the mill products.

A close assay control is maintained in both the mine and mill. An average of 45 samples is assayed daily for gold and silver. Six samples from the mill are tested for metallics, and three are run for insolubles each day.

POWER

Power is supplied by an 8-cylinder, 360-hp., Diesel engine (6,000 feet above sea level) and an auxiliary hydroelectric plant. The Diesel is of the type used in German submarines; it was purchased in Germany. No American manufacturer could make delivery of a Diesel plant during the summer the mill was being built in time to get it to the property before the roads closed for the winter. The engine is direct connected to a 375-kva, 3-phase, 60-cycle, 480-volt, Westinghouse generator that runs at 360 r.p.m.

A supply of extra valves and valve stems are kept in stock. Other repair parts are made in the mill shops by the chief Diesel operator who is a machinist.

The winter supply of fuel oil for the Diesel is brought in before the roads are closed and stored in a 108,000-gallon tank. The oil is filtered through a 3-ply filter pack before it goes to the engine. After the filter had been installed no trouble was experienced with nozzles choking as before.

The plant is run by a mechanic and two helpers on day shift and by one operator on each of the other two shifts. The two helpers spend about one half of their time in the shops and one half in the mill. The mine air compressor is in the Diesel building and is operated by the Diesel crew.

The hydroelectric plant, consisting of a very old model Ingersoll turbine wheel and a 125-hp. generator, is on the Middle Fork of the Boise River about 2 1/2 miles from the mill. During low water the capacity of the plant is reduced to 40 hp. The head on the wheel is 60 feet. The current is transmitted at 2,200 volts. Both plants are synchronized; switchboards and synchronizing apparatus are in the Diesel engine room.
The connected load of the mine and mill is 353 hp. The average horsepower used for the different departments of the mill . . . [totals 230 horsepower.]

The mill building was heated during the winter by the exhaust gases from the Diesel engine.

WATER SUPPLY

Water from a local stream is flumed along the mountainside into a series of 18- by 22-foot tanks to a point 150 feet above the mill. The mill is supplied through one pipe line; a second line provides fire protection to the mill and other camp buildings. Approximately 85 to 100 gallons of water is used per minute in the mill.

TRANSPORTATION

The concentrates are hauled 85 miles to the railroad during the summer months. Freight is hauled from the railroad to Atlanta on the return load. Heavy supplies, including fuel oil, are hauled to the mine during the summer and stored for winter use.

The minimum freight rate on ore from Mountain Home to Salt Lake Valley smelters is $2.75 per ton. The rate on high-grade concentrates is about $28 per ton . . .

LABOR

The company runs a boarding house for single men. Board and room cost $1.25 per day. Men with families live in the village of Atlanta about a mile from the mine.

PLANT RECOVERY AND COSTS

Metallurgical data are given in table 1, screen sizes in table 2 [omitted], operating data in table 3, and operating costs in table 4 [omitted].

TABLE 1. - Metallurgical data of the Atlanta mill, April 1934

Head assay:

<table>
<thead>
<tr>
<th>Metal</th>
<th>Ounces per ton</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>0.467</td>
<td></td>
</tr>
<tr>
<td>Silver</td>
<td>1.541</td>
<td></td>
</tr>
</tbody>
</table>

Total tons treated: 6,575

Hours operated per day: 24

Recoveries:

<table>
<thead>
<tr>
<th>Metal</th>
<th>Percent</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>89.55</td>
<td></td>
</tr>
<tr>
<td>Silver</td>
<td>94.58</td>
<td></td>
</tr>
</tbody>
</table>

Recoveries by amalgamation: 70

Recoveries by flotation: 30

Concentration ratio: 55

Tailing assay:

<table>
<thead>
<tr>
<th>Metal</th>
<th>Ounces per ton</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>Silver</td>
<td>0.085</td>
<td></td>
</tr>
</tbody>
</table>

Concentrate, weight: 119.75 tons

Concentrate assay:

<table>
<thead>
<tr>
<th>Metal</th>
<th>Ounces per ton</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>5.703</td>
<td></td>
</tr>
<tr>
<td>Silver</td>
<td>61.63</td>
<td></td>
</tr>
<tr>
<td>Insoluble</td>
<td>15.0</td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>Iron</td>
<td>38.0</td>
<td></td>
</tr>
<tr>
<td>Days operated</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>----</td>
<td></td>
</tr>
<tr>
<td>Men employed per 24 hours</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Tons treated per man-shift</td>
<td>10.94</td>
<td></td>
</tr>
<tr>
<td>Bell consumption, pounds of steel per ton of ore:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marathon mill</td>
<td>1.65</td>
<td></td>
</tr>
<tr>
<td>Marcy mill</td>
<td>1.828</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3.478</td>
<td></td>
</tr>
<tr>
<td>Reagent consumption, pounds per ton of ore:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aerofloat</td>
<td>0.067</td>
<td></td>
</tr>
<tr>
<td>Potassium xanthate</td>
<td>0.074</td>
<td></td>
</tr>
<tr>
<td>Cresylic acid</td>
<td>0.084</td>
<td></td>
</tr>
<tr>
<td>Pine oil</td>
<td>0.017</td>
<td></td>
</tr>
<tr>
<td>Barrett no. 4</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td>Soda ash</td>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td>Mercury</td>
<td>0.006</td>
<td></td>
</tr>
<tr>
<td>Copper sulphate</td>
<td>0.60</td>
<td></td>
</tr>
</tbody>
</table>

The St. Joseph Lead Co. was the largest producer of gold ore and old tailings in Idaho in 1935, treating 78,036 tons of ore and old tailings. Most of the known ore was removed from the Boise-Rochester Mine by the end of the year. Starting on September 19, 1935, the company began milling old tailings in combination with its ore, much of which came from the part of the Pettit orebody that extended onto the Monarch ground (Anderson, 1939).

More than 29,000 tons of gold ore was treated in 1936 before the mine was closed in June. When St. Joseph Lead closed the mine, all known orebodies in both the Boise-Rochester and the Monarch mines were exhausted (Skidmore, 1941). During the early part of the year, the No. 6 drift was driven 3,045 feet beyond the Monarch shaft to explore the Atlanta claim group on the southwest end of the lode. After discontinuing operations, the mine and mill were dismantled and the equipment removed during the early part of the summer. The mine was then sold (Anderson, 1939). According to the 1936 IMIR (p. 172):

The Boise-Rochester mine at Atlanta, until recently operated by the St. Joseph Lead Company, has been acquired by the Sawtooth Company, A. H. Burroughs, Jr., 715 Grove, Boise, president. The mine, a gold producer, was purchased by the St. Joseph company about 20 years ago, but was not equipped with the present 200-ton amalgamation-flotation mill until 1931. The deal included the mine, mill and hydroelectric plant. It is understood that the Sawtooth company will not operate the property on its own account, but that operations will be carried on by others. This mine led the State in gold production the past few years. Forty-eight hundred twenty-five feet of development work performed during 1936.

Anderson examined the property during 1936 and described the workings at the time of his visit (Anderson, 1939, p. 47):

The mine has been developed by 9 tunnels (fig. 3 [Figure 8]), but the only ones of importance are the No. 6 and No. 9, the former having been driven beneath or through all
known ore shoots in the Atlanta lode (figs. 3 and 4 [Figures 8 and 9]). The No. 9 served as the main haulage level, all ore on or above the No. 6 being dumped into a raise and drawn out in the No. 9 tunnel, level with the top of the ore bin at the mill. Formerly the ore had been trammed from the portal of the Pettit No. 2 to the Pettit and Bagdad Chase mill across the gulch. All the mine workings, except some of those made in the early days, are shown in plan (fig. 4 [Figure 9] and in longitudinal section (fig. 3 [Figure 8]). These also show some of the workings on the Monarch, Buffalo, and Atlanta claims. Because of the heaviness of the ground along the lode, the drifts and other openings could not be kept open for any length of time, and most of those of recent date were inaccessible by the summer of 1936. Because of this, all permanent levels and raises were driven in the hanging wall and all stopes were kept filled to the working face.

Talache Mines, Inc.

Early in 1937, the property was taken over by Talache Mines, Inc. Some high-grade gold ore was shipped from the property to a smelter during the year. The 1937 IMIR (p. 159) noted:

The Rochester property, formerly operated by the St. Joe Lead Company, was taken over by the Sawtooth Company in the year 1936 and later absorbed by the Talache Mines, Incorporated. During the past year two small compressors were installed to furnish air for drilling machines, pipe lines relaid, and hydroelectric power plant put in operation and the mine rehabilitated for further development and production. An average crew of 18 men on the company payroll and several lessees were employed during the fall and winter months of 1937.

The lessees were working on some of the small, rich gash veins. They exposed one oblique ore seam that was several hundred feet long (Anderson, 1939).

In 1938, Talache assumed active management of the property. After blocking out enough ore along the oblique vein to provide mill feed for several months, the company re-equipped the mill (Anderson, 1939). Some of the machinery and supplies came from the Gold Hill Mine near Quartzburg. About 8,000 tons of gold ore was treated by amalgamation and concentration, and several hundred tons of rich gold ore was shipped for smelting. The company employed about twenty-five men during the year and was planning to carry a workforce of seventy-five, including lessees, through the winter.

Talache operated the property throughout 1939 and treated 41,634 tons of gold ore and 6,000 tons of old tailings in a 150-ton amalgamation and flotation plant. On November 1, 1939, Talache purchased the Monarch, Buffalo, and Last Chance properties (Skidmore, 1941). The company's report to the Idaho Inspector of Mines noted (1939 IMIR, p. 203):

Constructed new timber shed at 900 level and several hundred feet of snow shed, build 1 new dwelling, remodeled and made improvements on several others; also remodeled interior and exterior of old St. Joe Mill building for present 125-ton plant, and installed 300 h. p. Fairbanks-Morse diesel engine. The mine has been under development since July 1937. Milling operations began September 27, 1938, on a 70-ton per [24] hr. basis and have been gradually increased to the present rate of 125 tons per day as of May 31, 1939.
In addition, the Mine Inspector said the following about Talache’s activities (1939 IMIR, p. 200-201):

    The old mining camp of Atlanta is staging a strong comeback, thanks to the courage and covenants of its possible future by A. H. Burroughs, Jr, president of Talache Mines, Inc. Housing facilities are at a premium. The big problem is in keeping the water grade road up the Middle Fork of the Boise River passable during the winter months. All agencies should cooperate in keeping the road free of snow so that the residents of this thriving mining camp could come and go to Boise any time of year. . . .

    Talache Mines, Inc., A. H. Burroughs, Jr., president-manager, Boise, is enlarging its holdings in the Atlanta district. During the past two years the company has driven more than 6000 ft. of exploration work. The Boise Rochester was obtained from the St. Joseph Lead Company and the Monarch mine has been lately acquired by this company. Consolidation of these two properties under one management brings together two of the famous old properties that made history in the early days of mining in Idaho. During the past year an average crew of 150 men was employed under the direct supervision of Joe H. Skidmore. William Settles is mine foreman, and Perry Grommer [Groome] has been in charge of milling operations. It is planned by the Talache Mines, Inc. to increase the capacity of the milling plant and to develop more power so both properties can be worked in conjunction.

    Equipment in the mill included: a 14-inch by 24-inch jaw crusher, a roll crusher, an 8-foot by 30-foot classifier, a 6-foot by 6-foot Marcy ball mill, a 36-inch Bendelari jig, a 2-inch Willley sand pump, four amalgamation plates, a 5-foot by 7-foot conditioner, 43-inch by 43-inch Denver flotation cells, a thickener, and a three-leaf 6-foot American filter.

    Talache operated the Boise-Rochester and Monarch groups throughout 1940. The company produced 79,119 tons of gold ore, which was treated by amalgamation and concentration, and 178 tons of rich gold ore, which was shipped direct to a smelter. This material yielded 18,160 fine ounces of gold, making Talache the largest producer of gold in Idaho. According to the 1940 IMIR (p. 138-139):

    Talache Mines, Inc. [Figure 32] . . . has enlarged its holdings in the Atlanta district until it is now the second largest employer of mine labor in Idaho south of the Salmon River. . . . During the past year an average crew of 200 men was employed under the direct supervision of Joe H. Skidmore. The company increased the milling capacity of the plant to 200 tons daily [Figure 33], purchased 10 new mine cars, several new rock drills, installed new 1545 Gardner-Denver compressor, added new addition to diesel room, revamped and improved method of handling and framing timber and did not forget to use this timber where it was most needed underground. This fact and the cooperation of the Talache company in mining safety is highly appreciated by the Idaho Mining Department.

    Production was increased to 200 tpd at the end of May. Mining World (1941a and 1941b) described the operation of the mine and mill in detail.

    The property was again the largest producer of gold in Idaho in 1941. The company treated 121,355 tons of gold ore by amalgamation and concentration, and this material yielded 23,027 fine ounces of gold. Mill capacity was increased to 350 tpd with the installation of six No. 24 Denver flotation machines. Skidmore (1941, p. 73-77) described Talache’s operation:
Figure 32. Talache Mines camp at the Boise Rochester Mine (Skidmore, 1941, p. 72).
Compare this photograph with Figure 25.
Figure 33. Talache mill at the Boise Rochester Mine in the winter of 1936-1940 (Skidmore, 1941, p. 74).
Talache Mines, Inc., purchased the Boise-Rochester mine in 1936, despite the view held by many that the town of Atlanta was destined to be a "ghost camp" due to the fact that there was no ore left in the hill. That was not a bright prospect, but there is now concrete evidence that ore does exist, in commercial quantities, in Atlanta hill.

The preliminary examination made of the Boise-Rochester property on July 3 and 4, 1937, was rather disheartening. The main haulage levels were in disrepair, the track that remained was of 12-lb. rails and badly worn, and many of the important drifts, crosscuts, and raises were either inaccessible or caved. An idea of the cost of repairing the mine and maintaining same in a workable condition is given in the following tabulated costs:

<table>
<thead>
<tr>
<th>Period</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development period, Sept., 1937-Sept., 1938</td>
<td>$8,485.00</td>
</tr>
<tr>
<td>Year 1939</td>
<td>37,402.00</td>
</tr>
<tr>
<td>Year 1940</td>
<td>80,000.00</td>
</tr>
<tr>
<td>Total cost for mine repairs to date</td>
<td>$125,887.00</td>
</tr>
</tbody>
</table>

The excessive underground repairs cost, which for the year 1940 has averaged $6,700 per month, is directly attributable to the heavy, swelling nature of the Atlanta lode. It is nothing uncommon to be required to relieve and repair a drift or stope sill, in the main shear zone, as often as every 60 to 90 days.

Many reports had been circulated concerning mill ore left in the stopes, and of the high-grade gobbed, but in all the places where old backs have been sampled or old gob prospected, no commercial ore has been found. One exception is the 1,450 cave area, directly above the 1,450 level. The previous operating company opened up a square-set stope, 125 ft. long and from one to six sets wide, a few feet above the 1,450 sill, but failed to hold the ground and lost the whole block. Later a raise was put through this cave and the ore worked above the caved area as two separate, narrow stopes. From this caved area and another high-grade narrow stope on the 900 level, plus some lessees' ore, Talache Mines shipped 367 tons of crude ore, netting approximately $40,000 during the development period, September, 1937, to September, 1938, in addition to mining and storing in stock piles, several thousand tons of millling ore, averaging approximately $12 per ton. This 1,450 caved area, which required two years for mining 95 percent of the available ore by the square-set receding method (without injuring a man), plus two stopes on the 900 level and one on the 750 level, supplied all the ore mined and milled from September, 1937, to November 1, 1939.

On that date Talache Mines, Inc., purchased the Monarch, Buffalo, and Last Chance properties. Since then production has been maintained from the Boise-Rochester, Monarch, and Buffalo properties. Old gob prospected and developed in the latter two properties has carried sufficient value in gold and silver to justify mining and milling. This gob, averaging from $5 to $20 per ton in gold and silver, is mined along with the marginal ore left on either side by the old timers. No difficulty has been experienced in removing this filling because, generally, it has been compressed to practically a solid mass due to the swelling nature of the Atlanta lode.

In order that one may appreciate the progressive steps taken from the fall of 1937, when all drilling and traming was done by hand, to December 31, 1940, and increase in scale of operations to over 300 tons per day, the following data are submitted:

<table>
<thead>
<tr>
<th>Period</th>
<th>Dry tons milled or shipped</th>
<th>Gross sales gold &amp; silver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development period:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sept., 1937-Sept., 1938</td>
<td>367</td>
<td>$38,573.00</td>
</tr>
<tr>
<td>Oct., Nov., Dec., 1938</td>
<td>7,939</td>
<td>63,848.00</td>
</tr>
<tr>
<td>Year 1939</td>
<td>41,625</td>
<td>357,200.00</td>
</tr>
<tr>
<td>Year 1940</td>
<td>79,119</td>
<td>669,708.00</td>
</tr>
<tr>
<td>Totals</td>
<td>129,050</td>
<td>$1,129,329.00</td>
</tr>
</tbody>
</table>

122
This property was the largest producer of gold in the state for 1940.

Description of Ore Bodies

The Atlanta lode, striking N. 45-65° E. and varying in width from 30 to 150 feet, has been traced on the surface for more than 2 miles, and lies in granitic rocks related to the Idaho batholith. The batholith has been so thoroughly and repeatedly shattered by crustal movement that blocks of unfractured granitic rock, more than a foot square, are difficult to find. The main zone of shearing is occupied by the Atlanta lode, and the related, but subordinate oblique zones of fractures, contain the lateral lodes on either side. The laterals, some of which are older (800 Split) and some younger (270 Split), strike from S. 65° W. to N. 70° W. Apparently some of the laterals or split veins have nothing to do with the ore in the main shear zone, and again evidence is conclusive that the laterals governed the enrichment of the ore found in the Atlanta lode. The former operating company overlooked much commercial ore by disregarding the importance of such splits. This is especially true concerning the downward extension of the “Old Chank” ore shoot below the 600 level, which was condemned as barren. Since April, 1939, this “Old Chank” zone under the 600 level has developed into the richest stope recently worked in the mine, having a strike length of 325 ft. on the 900 level and 550 ft. on the 750 level. At times this ore shoot has been required to produce in excess of 150 tons per day, while other areas were developed. Nevertheless, this stope is still producing and has many months supply of ore in sight. The 270 Split (Figure 34), first discovered on the 900 level in one of the old headings, is a split much younger than the main shear zone and the key to the “Old Chank” mineralization.

Although the ore shoots differ radically in gold and silver value, extent, etc., nevertheless they all conform more or less to the precious-metal epithermal type; that is, deposits formed near the surface by ascending thermal waters in genetic connection with igneous rocks. The deposits consist largely of fine to medium grained brecciated quartz, containing finely crystalline arsenopyrite and pyrite. Some of the gold is free but the larger part seems to be intimately associated with the sulphides, especially pyrite and chalcopyrite. Silver occurs chiefly as complex silver antimonial or arsenical sulphides, although native and horn silver are quite abundant near the surface. Native silver and gold, also electrum have been found to depths of 600 feet or more.

In the vicinity of the Monarch shaft, which is located near the center of the Atlanta lode mineralization, there is a very complex localization of ore shoots. The ore on the north wall, known as “B” stope, characteristically black in color, lying on the contact of the shear zone and granite north wall, is heavily brecciated and has been developed laterally on the 100 level for 800 ft. east of the shaft. “B” ore is uniformly good in gold value but carries very little silver. “C” stope ore, which lies 20 to 30 ft. south of “B” ore, makes in a brecciated quartz zone, striking almost parallel to “B” ore shoot. “C” ore contains almost equal value in gold and silver with the silver minerals composed chiefly of complex silver sulphosalts. The antimonial silver sulphides pyargyrite [sic], commonly known as dark ruby silver, and stephanite are the most common. The third ore zone lying farthest south in the main shear is known as “D,” or southwall ore. On the upper levels this ore it is like “C” in that the silver value is as important as the gold, and at times the silver value predominates. Dark ruby silver sometimes occurs as massive lenses of almost pure mineral from a fraction of an inch to 6 in. wide. These hot spots, however, seldom occur for more than a few sets in length, or far in vertical extent. “C” ore converges into “D” or southwall, east of the shaft, and then the combined “C” and “D” mineralization converges with “B” stope ore about 500 ft. east of the Monarch shaft.

Tungsten Found in the Buffalo in Commercial Quantities

The Buffalo ore is similar to the Monarch and usually lies either on the north or south wall or a combination of both. The main shear zone narrows down rapidly near the Buffalo shaft and shows indications of the two ore zones merging into one mineralized area. The chief
Figure 34. Ore face in the 270 stope in the Old Chunk orebody of the Boise-Rochester Mine (Skidmore, 1941, p. 72).
interest, other than gold and silver in the Buffalo ores, has been the discovery, in commercial amounts, of the tungsten mineral scheelite. One stope, although relatively small, proved to have more value in tungsten than the gold and silver being recovered. This block of ground has been partially developed and will not be worked until more prospecting is done to ascertain further the tungsten possibilities.

The Boise-Rochester ore shoots are chiefly confined to one mineralized zone lying on either wall or between the walls. However, the Petit ore shoot, which lies mutually on Boise-Rochester and Monarch ground, has, in part, a northwall and a southwall orebody that in places merges to make one ore zone.

The Atlanta lode's chief production has come from six ore shoots, named in order from east to west: Old Chunk, Central, Petit, Monarch, Buffalo, and Yuba. At the present time, ore is being produced from the Old Chunk, Petit, Monarch, and Buffalo shoots. The shoots have an ore width from 2 to 30 feet, averaging 6 ft., a length of 200 to 800 ft., and many have a vertical range of 100 to 800 ft.

Methods of Underground Exploration

Prospecting and exploration is carried on by the combination of drifting, crosscutting, and raising. The usual procedure is to carry the main haulage adits in the north or south wall to avoid the heavy ground of the main shear. When developing an ore shoot on a level, the common practice is to drift on the strongest ore zone and crosscut through the shear zone to the opposite wall at regular intervals to ascertain other ore possibilities. Because most of the rock penetrated in the Atlanta hill is heavy and swelling, all crosscuts and drifts are timbered with extra large, seasoned, native fir timber, cut locally. All sets are framed with 4-ft. caps in the clear and posts are 7½ ft. overall. Each post is batted a full 18 in. and rests on a solid matting of planking, at least 30 in. square. When the drift bottoms are too soft to support posts with the above footings, a segment sill is used, making an angle of 90° to 120° between the segments, or approximately a minus 30° to 45° angle to the horizontal, the angle between the segments being governed by the softness of the formation. Under the lowest point of each segment sill, a solid mat of planking is laid to provide the necessary bearing surface.

Details of Sampling and Stopping

All normal, daily samples are taken by the shifters. This method of sampling has made it possible for each face to be sampled each shift. Channel samples are cut with a prospecting pick and caught in canvas catch-alls of local design. The average sample taken weighs about 10 lbs. Car samples are taken for all chutes, ore pockets, and development headings.

The stoning method first used was chiefly standard cut and fill, using stalls to support heavy slabs. This method was completely eliminated in the spring of 1939 because it was considered too hazardous in the blocky, shered granite. By the summer of 1939, all the stopes had been converted to standard square sets for the wider ore bodies, and a leaning half set for the narrow, flat-dipping sections. Square sets are the regular Butte 2-in. step frame, which are very flexible since posts and caps are interchangeable. Although this frame is rather expensive to make by hand with Skillsaws, nevertheless the advantage of the extra strength, for side-pressure ground, is more than justified in these stopes. All chutes and manways are placed at 40-ft. centers. Stopes must be filled and filling is derived from waste raises and exploration waste.

Underground Transportation

All loading and upper level tramming is done by hand. Ore from the Monarch and Buffalo levels is transferred to the 600 haulage level through ore passes and thence into large ore pockets. A 2½-ton storage-battery locomotive, hauling ten 20 cu. ft. mine cars, transports this ore 2,000 feet to R-3 transfer raise, through which the same is dropped to the 900 level R-3 transfer ore pocket. A 3¼-ton storage-battery locomotive, pulling twenty 23 cu. ft. mine cars,
transports the ore from there 3,400 feet to the mill bins. Both locomotives gather ore from other stops and take care of all waste from exploration. Waste from Monarch and Buffalo levels is trammed directly to surface dumps or hoisted to the surface, when not used for stope filling.

Ventilation is by Natural Means

All ventilation is natural, entering through the four adit levels and passing up the various raises and main Monarch shaft to the upper workings. All dead-end drifts, raises, or stopes are ventilated by 8-in. and 10-in. compress-air-driven fans, using a flexible ventilating tubing. A combination of compressed-air blowing and water spraying is used to eliminate dust in all working places.

Mining Costs

The following mining costs are complete, including overhead, depreciation, surface expense, administration, mine repairs, and exploration:

<table>
<thead>
<tr>
<th>Period</th>
<th>Dry tons mined</th>
<th>Cost per dry ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>1939</td>
<td>41,625</td>
<td>$4.48</td>
</tr>
<tr>
<td>1940</td>
<td>79,119</td>
<td>4.70</td>
</tr>
</tbody>
</table>

The increase in cost per dry ton of ore produced in 1940 over 1939 was due chiefly to the excessive expense for mine repairs. During 1940 the Monarch and Buffalo properties were made workable, which required the repairing and retimbering of most of the old drifts and crosscuts. The Monarch shaft and respective stations were reconditioned from the Boise-Rochester 600 level to the surface. About half of the shaft timbers were replaced or repaired and the shaft collar concreted for a distance of 10 ft. vertically.

Mill Has Been Rehabilitated and Enlarged

The present mill building is the one built by the St. Joseph Lead Co. in 1931 and 1932. In June, 1938, the present company rehabilitated the structure by placing new foundations where required, general repair, adding additions, and covering most of the old roofing paper with Celotex insulation and corrugated galvanized iron roofing. The mill, a modern amalgamation-flotation plant, using one 6 by 6 Marcy grate mill for fine grinding, was placed in operation September 27, 1938. The month of October, 1938, 2,684 dry tons were treated for an average of 86 tons per 24 hours for the full month. By December, 1939, the production had been increased to 4,449 dry tons, or an average of 143 tons per 24 hours. The month of April, 1940, the single unit mill treated 4,745 dry tons for an average of 160 dry tons per 24 hours. An average tonnage of 160 tons per 24 hours was considered very good for a single 6 by 6 Marcy grate ball mill, handling minus ¼-in. quartz ore and grinding to 53 percent minus 200-mesh. The secret of the good results obtained is partially due to the method of sending the crude ore to the ball mill. All the minus ¼-in. crude ore, and at times minus ½-in. feed when the ore was talc-rich, went direct to the lower part of one side of a Dorr 8-ft. by 30-ft. classifier, where it was washed of all fines and slimes before joining the normal circulating load of the classifier. With one mill, only half of the classifier was used. This arrangement, whereby all the crude ore was washed and freed of all wood pulp and chips from the mine, was not according to the "Book of Hoyte," nevertheless it proved to be a life-saver for this particular job. At one time minus ½-in. coarse ore was fed to the classifier for more than 30 days and experienced no undue wear on the classifier bottoms, because the rakes were raised sufficiently high to make a deep bedding on the classifier floor.

During the winter of 1940 ground was blasted and excavated within the mill building to allow room to install an 8-ft. by 22-in. Harding [Hardinge] ball mill in parallel with the Marcy. Concrete walls were poured in sections to support the mill building and 500-ton fine-ore bin, necessary equipment forms and floors were completed, and equipment was installed ready to operate by the last of May, 1940. The production for June, 1940, was 7,811 dry tons, or 260 tons per day. October, 1940, production was 9,247 dry tons, or 300 dry tons per day. The accompanying flow sheet [Figure 35] is self-explanatory as to operating practice.

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Figure 35. Flowsheet for Talache Mines' 300 ton-per-day mill at the Boise-Rochester Mine (Skidmore, 1941, p. 76).
Testing Carried On to Better Mill Recovery

Mill results were very good from the day operations started in 1938 to March, 1940; tailings averaging less than 0.02 oz. Au per ton, and some months as low as 0.12 oz. As soon as Monarch and Buffalo ores were treated, the tailing losses began to climb until in November, 1940, they averaged 0.093 oz. Au per ton. So far this year, 1941, tailing losses have averaged 0.042 oz. Au per ton. From August, 1940, to the present time, hundreds of metallurgical tests have been conducted to effect better recoveries. The services of several well-known metallurgical firms have also been employed in an effort to obtain more economical results.

Numerous reagent combinations and special flowsheets have been actually conducted in the regular mill circuit to check laboratory test work. None of these changes have improved the metallurgical results economically, except the cyanidation of final mill tailings. The following flowsheet and reagent combinations have been tried out in the mill circuit for periods of 1 to 15 days:

1. Slime dispersion with starch and sodium silicate in an alkaline circuit, using soda ash or caustic soda to obtain alkalinity.
2. All acid circuit, using H₂SO₄, with and without reagent 239.
3. All alkaline circuit, using varying amounts of soda ash and caustic soda.
4. Two circuits, acid and basic; also basic and acid, independent of each other.
5. Barium sulphide with and without an acid circuit.
6. Sodium dichromate added to ball mill or conditioner.
7. Reagents 208, 239, 404, Minerae “A,” and fuel oil used with varying amounts of standard reagents.
8. Cleaning independently of regular circuit and tabling cleaner tails to eliminate from the circuit a middling build up.

Power Requirements and Power Plants

Power requirements for the total job, based on an average 24-hour period, vary from 450 to 500 hp. when milling in excess of 300 tons per day. Peak loads will at times exceed 700 hp. During the high-water months, March to July, the hydroelectric power plants [Figure 36] generate sufficient power for all milling and milling requirements. During the winter freeze-up period, the following hydro-electric and Diesel plants are required to maintain full production:

Hydro-electric Installations:

1. Kirby Power Plant comprising two Sampson horizontal, double-runner turbines activating two Westinghouse 180-kw., 3-phase, 60-cycle, 2,300-volt, 514-r.p.m. generators. [Figure 37 shows the Kirby dam.]
2. Atlantic Power Plant comprising one Pelton bucket water wheel activating one Westinghouse 125-kw., 3-phase, 60-cycle, 2,300-volt, 900-r.p.m. generator.

Diesel Installations:

1. Fairbanks-Morse 300-hp. Style Y, Type V, 257-r.p.m. engine direct connected to General Electric 250-kv.a., 3-phase, 60-cycle, 480-volt generator.
2. Caterpillar D17000, 8-cylinder, 160-hp. engine direct connected to General Electric 90-kw., 3-phase, 60-cycle, 480-volt, 900-r.p.m. generator.
3. Cletrac DD 50 tractor belt connected through power take-off to 50-hp., 3-phase, 60-cycle, 440-volt, 1,200-r.p.m. induction motor. This unit is excited by the excitation of the other Diesel engine exciters, and is overspeeded to around 2,200 r.p.m. to give slippage, hence acts as a generator. This is a rather novel set-up, but is good for 40 to 45 amps, at 440 volts, or approximately 50 hp. It is questionable whether there is such a generating plant in operation elsewhere in the state.

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Figure 36. One of the hydroelectric plants used by Talache Mines, Inc., to supply power to the Boise-Rochester Mine and mill (Skidmore, 1941, p. 74).
Figure 37. Kirby Dam on the Middle Fork of the Boise River (Skidmore, 1941, p. 74).
Personnel:
The operating personnel consists of the following:
A. H. Burroughs, Jr., president and general manager, Joe H. Skidmore, general superintendent; Arthur A. McLeod, mine superintendent; J. N. Groomer, mill superintendent; William Settle, mine foreman; Arnold I. Rumsey, accountant.

A U.S. Bureau of Mines mining engineer examined the tungsten discovery in October 1941 (Moon, 1941, p. 1-2):

The Buffalo orebody of the Talache Mines, Inc., was examined October 10 and 11. The mine is situated about 1-1/2 miles south of the town of Atlanta. The town can be reached by fair water-grade road from Boise via Arrowrock dam. From Boise to Atlanta by this route is 85 miles.

The workings of the mine are along a steep N 65 E shear zone in granite that has been mined at intervals over a strike length of a mile and one half to a maximum depth of about 900 feet. Gold and silver have been produced from the property by several companies during its history. The present operation turns out about 400 tons daily of material that carries from $7 to $11 in precious metals. Part of this tonnage is from newly broken ground and part from gob in old workings. Some of the highest grade ore has been taken from gob.

As stated in the letter to the Bureau of Mines from Mr. Burroughs, president of the company, of September 17, scheelite was first discovered last year on a table in the mill. Intensive examination of the workings with the aid of an ultra-violet lamp and subsequent sampling has shown that the scheelite is confined to the western part of the mine, most of it in the Buffalo section. My examination was mainly in this section.

The shear zone varies in width from 25 to 125 feet where it has been opened. Precious metal ore occurs along both walls of the zone; it has been mined from 5 to 15 feet wide. In the Buffalo section the zone is comparatively narrow, varying from 25 to 50 feet. The ore in this section is usually mined one set wide along each wall - that is, there is a total width of six feet broken in each stop.

The ground in the shear zone is heavy and must be kept timbered and tightly lagged, but streaks of scheelite-bearing material from 1/2 to 18 inches wide were seen in a number of places, associated with calcite stringers. On the 100-foot level scheelite occurs along a strike length of about 400 feet, apparently along both walls of the shear zone, but better opened along the south wall. Drifts are being driven under this section along both walls on the 200-foot level. The south wall drift is about under the east end of the scheelite zone as known above and has shown some traces, but is not yet in strong tungsten mineralization. The north wall drift is not so far advanced, but showed some scheelite in the face at the time of the examination. The 300-foot level is tightly caved. The 400-foot level also is caved, but is being reopened. It is not yet accessible beneath the tungsten-bearing section and has not shown any scheelite. The deepest level in this part of the mine is the 400 - actually about 350 feet below the surface.

After the discovery of the source of the tungsten, samples representing 2465 tons from a 50-foot section of drift, a 100-foot length of stope, and a 100-foot raise, all on or above the 100-foot level, were available. An average tungsten assay, weighted by the tonnage represented, shows: WO₃ - 0.4%, Au - 0.24 oz./ton, Ag - 4.67 oz./ton. Channel samples, taken at odd intervals across scheelite-bearing streaks, as permitted by the lagging, indicate an average width of 22 inches carrying 1.92% WO₃. If it is assumed that all the tungsten values are contained in the 22 inches sampled, the average grade over a stopping width of 6 feet would be 0.56%. In the light of the partial data available, it seems likely that the average grade may be on the order of 1.72% WO₃ over a width of 6 feet in the section under consideration.

If half the strike length along each wall of the shear zone in the 400-foot length under discussion should be tungsten-bearing, there would be about 20,000 tons over a 6-foot width
above the 100-foot level. The work now in progress on the 200 and 400-foot levels will explore 2-1/2 times as much ground as that above the 100.

There is a strike length of several hundred feet to the west of the Buffalo workings about which little is known. Old maps show that the 400-foot level continues under this section, but it is not now accessible because of the cave mentioned above. Investigation of this area might be speeded by diamond drilling from the surface, but it is doubtful that such work would give satisfactory results because of the abundance of gouge and broken material in the shear zone. Probably the only core recovery would be from the granite outside the mineralized shear.

Experimental work on milling the tungsten-bearing ore has been done and plans are being made to split the mill into two sections, one for the tungsten-gold-silver ore from the Buffalo section, and the other to continue as at present on the gold-silver ore from the rest of the mine.

The logical procedure of drifting under the ore known to exist on the 100-foot level is being carried on by the company. If results in this section are favorable, it is probable that the old 400-foot level will be reopened to the west to investigate the area mentioned about which little is known. It would seem that the only possible project that the Bureau of Mines might contemplate would be drilling of the unknown section. Two facts seem to rule out even this as a possibility: core drilling would be unsatisfactory because of the sheared broken nature of the mineralized zone; if results in the Buffalo section are encouraging, the company probably will investigate the unknown area, while if they are not, the other area would lose its interest as a possibility.

In 1942, the mine produced 87,747 tons of gold ore. In addition, some tungsten concentrate was produced and marketed. The capacity of the mill had been increased to 400 tpd, according to the U.S. Bureau of Mines; according to the company, the mill’s capacity was 450 tpd of gold ore and 200 tpd of tungsten ore. Prospecting for additional tungsten ore continued. According to Beatty (1942), the program included surface examinations with a black light of much of the Atlanta lode and parts of the surrounding country, as well as a trenching program to expose the “bedrock” of the Atlanta shear zone. Most of the trenches contained at least some scheelite, but much of it was not in place. Also, it was discovered that the overburden was much thicker than had been originally thought, making it impossible to expose the full width of the shear zone in the trenches. In spite of these drawbacks, Beatty (1942, p. 6-7) concluded:

The evidence and occurrence of scheelite mineralization as found in the course of this work is definitely encouraging. While no ore or anything like a vein system has been found, nevertheless several favorable factors remain to be considered.

The chief item of importance is the establishment of a zone of scheelite mineralization to the west of the active production area in the mine. Now, scheelite is known to occur over a range of nearly 4000’ along the shear zone, starting at the Upper 106 Stope on the eastern end and continuing to the showings in Trench VI at the western end. Little can be deduced from surface exploration as to the vertical range, but underground prospect work in the region where the producing stopes are located together with findings in the mining areas indicate that by far the greater part of tungsten mineralization may be expected to occur within 150 to 200’ of the surface in this ground.

The above vertical limit downward is assigned chiefly because of a sparseness of any tungsten showings on the 600 level (400 level in the Monarch workings proper) in the ground beneath the working area, and because it is felt that the calcite stage of mineralization (the fourth and last in the shear zone generally) in which gangue material the scheelite occurs as an.
invasive mineral, has been emplaced in the Atlanta Lode in spaces provided less by crustal movement and shear displacement, and more by weathering and normal near surface alteration. The remark about the 600 level is unqualified from a standpoint of directed underground prospect work, since none has been carried on below the 200 level for tungsten, only lamp work being done on the 600. This resulted in a single trace of scheelite, being found about 400' east of the Monarch Shaft.

The showings in Trenches IV and VI [the trenches that showed the largest amounts of scheelite] give some width to the scheelite mineralization, although the northern showings are weak in assay, being formed by the "cold water" quartz split. The central source of these showings at a lower depth might reasonably be expected to be stronger. Further the lateral extent of showings over the area are equally encouraging in a similar way.

In this same connection, the amount and tenor of the surface showings generally are good. While they appear to be scattered and sparse, nevertheless these showings are stronger than any surface indications that exist over the present producing stopes. With the exception of the Monarch open cut operation, surface indications on the entire Atlanta lode are generally poor, even over the most productive portions of the lode.

It is felt that this work has shown that the trend of tungsten mineralization is westward, and that with such a relative abundance of surface indications, further prospecting underground is justified. This work should advance from the areas of known production into the unexplored ground. Whether the 100 S.W.D.W. [see Figure 38] should continue west first, or whether better exploration work would be done by raising towards the surface in the region closer to the producing section requires some thought. In the past week showings in the two western-most prospect raises, 41 and 90, have improved materially and some of the ground mined has been trimmed for tungsten ore. Surface work in any event has now been carried 500' ahead of the prospect drift, and exploration work for some time will be more profitable when working ahead of mining areas underground.

On October 8, 1942, War Production Board Order L-208, Section 3093, ordered the closure of all gold mines which had produced more than 1,200 tons of ore in 1941. A company that operated one of these "nonessential" mines was allowed to do only "the minimum amount [of work] necessary to maintain its buildings, machinery, and equipment in repair, and its access and development workings safe and accessible" (1942 IMIR, p. 19).

Despite War Production Board Order L-208, Talache milled 53,424 tons of gold ore and shipped 54 tons of rich gold ore direct to the smelter in 1943. The USBM Yearbook for 1943 noted that the Talache ore contained arsenic and tungsten, which may account for why the mine was not closed as "nonessential." Some tungsten concentrate was produced and marketed. In February 1943, U.S. Bureau of Mines engineers examined the mine to evaluate its potential as a tungsten resource. Their report, in part, contained the following information (Shaffer and Luukkanen, 1943, p. 1-2, 4, 7-10):

21There are two versions of this report in Idaho Geological Survey's mineral property files. The first version (Shaffer and Luukkanen, 1943), dated March 1943, is attributed to mining engineers Lysle E. Shaffer and Oliver B. Luukkanen. The later version (U.S. Bureau of Mines, 1943), dated April 1943, contains minor stylistic changes and significant revisions in the numbers used for the economic projections, all in an unfavorable direction. The March 1943 version is quoted here; the numbers in brackets are from the April 1943 version.
The presence of tungsten in gold-silver ores of the Atlanta district was first noted in 1940 when the staff metallurgist of the Talache Mines, Inc. observed a band of scheelite on one of the Willey tables in the mill. Active prospecting indicated that all of the tungsten mineralization was localized near the western end of the lode in what was known as the Monarch-Buffalo section. A tungsten section was incorporated into the mill and in the spring of 1942 tungsten production was gotten underway.

Several stopes were started on local "hot" spots underground and production from April 1942 through January 1943 totaled 15,849 tons, from which 1432.4 units (20 lbs. [each]) of WO₃ were recovered in the mill.

By February 1943 the grade of ore being treated had declined 40% below the average of the preceding 9 months and it is expected that both grade and tonnage will further decline as the limited orebodies so far developed are exhausted.

The ore occurs in the form of scheelite which has invaded and, in part, replaced a late calcite. This calcite stage of mineralization is quite shallow and is believed to have been emplaced in the siliceous lode in spaces provided by weathering and near surface alteration, rather than by movement along the shear zone. Occasionally a trace of scheelite is detected in "cold quartz", but this rarely assays more than .05% to .07% WO₃ and is not considered important.

There is a reasonable expectancy of developing an additional 21,330 tons of ore containing approximately 1928 units of WO₃ in the area to the west of the Buffalo section. Under present conditions this ore must be considered sub-marginal. With tungsten values at $30.00 per unit²², the gross value of this ore is only $2.71 per ton (based on the value of recoverable tungsten as indicated by mill recoveries to date)²³. Mining and milling costs are approximately $5.00 per ton. Preliminary exploration and development necessary before mining operations could be undertaken would add approximately $0.50 [$0.99] per ton to this figure. To allow a "break-even" operation on this ore with these costs, the price of tungsten would have to be $46.50 [$51.78] per unit. This figure is based on a credit of $1.30 per ton for the gold content which averages .0412 ounces per ton for all samples in the surface trenches. Preliminary development of this section would cost a minimum of $10,850.00 [$21,700] for drilling and raising. The expenditure of this amount is probably justified as a war measure to increase the known reserves of this metal²⁴. However, unless the tungsten supply becomes so critical as to result in a price of at least $45.00 [$51.78] per unit, it is doubtful if this tungsten can be mined and made available to the war effort at this time without entailing a substantial loss . . .

The existence of tungsten in the gold-silver ores of the district was not suspected until 1940. At that time the staff metallurgist of Talache Mines observed a streak of white mineral on one of the Willey tables in the mill. This was identified as scheelite (CaWO₄) and steps were taken to discover its source. Investigation disclosed that the ore was coming from the western part of the mine in the region known as the "Buffalo-Monarch" workings. An active prospecting program was undertaken during the following year both underground and on the surface, particularly along the western extension of the Atlanta Lode beyond the

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²²The price of tungsten, like the prices of most other commodities, was set by the government for the duration of World War II.

²³U.S. Bureau of Mines (1943) estimated the gross value of the ore at $4.01 per ton, taking into consideration both the tungsten and the gold in the ore.

²⁴U.S. Bureau of Mines (1943) recommended that this exploration program be considered only if the need for tungsten became so critical that sub-marginal resources had to be developed to supply to country's needs.
Monarch workings. Preliminary prospecting results were encouraging and a more elaborate program for tungsten production was undertaken. Outside prospecting by means of trenches was expanded and extensive alterations were made in the company's 400 ton amalgamation flotation mill to permit the recovery of the tungsten from the gold ores being treated. The cost of these alterations and additions to the mill were in excess of $20,000 [conversation with J.H. Skidmore, general superintendent of the mine]. Production started in April 1942, and by the end of January 1943, 15,848.9 tons containing 41,938.8 pounds of WO₃ had been mined and treated to produce 125.2 tons of concentrates containing 28,648.7 pounds of WO₃.

In February 1943 only two stopes were producing tungsten ore. The mineralization in both stopes at that time was growing steadily weaker and the stopes appeared to be nearing exhaustion. Grade of ore treated during January 1943 was approximately 40% lower that the average of the preceding 9 months . . .

All of the tungsten ores carry some gold and silver and, in general, the values of these metals are sufficient to warrant the ore being treated for their recovery before passing to the tungsten section of the mill.

Mine Workings

Figure 1 [missing from IGS's copies of both versions of this report; see Figure 38 instead] shows the mine workings toward the western end of the lode. The tungsten producing stopes shown appear to be located near the fringes of the gold-silver ore-shoots or in the shearer zone on or near the foot wall or the hanging wall opposite old gold-silver producing areas.

Underground mine workings total over 23,000 feet. The ground in the shearer zone is very heavy and constant maintenance is needed to keep the workings open.

The Ore

The tungsten occurs as scheelite associated with calcite and quartz. No tungsten minerals other than scheelite have been identified in the ore. Preliminary investigation indicates that the scheelite has, in part, replaced calcite and is therefore later. Scheelite with "cold quartz" has not been found as yet in sufficient quantities to constitute ore. This "cold quartz" apparently is the same age as the calcite and was deposited at the same time.

At the time of the examination by the Bureau of Mines engineers very little ore was evident. Two occurrences of scheelite in place were noted underground. One of these appeared to be a small (¼" or less) disconnected stringer near the foot wall of the shearer zone in Stope 90 (see Fig. 2 [missing from IGS's copy of this report]). In places this stringer appeared to be composed largely of scheelite; in others considerable calcite was evident. The second occurrence, near the top of Stope 41, (see Fig. 2 [missing from IGS's copy of this report]) consisted of scattered spots, blebs, and veins of scheelite with calcite, associated with brecciated country rock and quartz. This mineralization was on the foot wall of the shearer zone and occurred over a width of some 2.5 feet. A channel sample taken across this width assayed only 0.5% WO₃. No assays were made of the gold and silver.

The gold-silver ores consist of breccias of country rock and earlier quartz. The valuable minerals, gold and an assemblage of complex silver sulphosalts accompanied by minor amounts of lead, zinc, and copper sulphides, are associated with comb and drussy quartz. No scheelite is evident in this major mineralization.

Possible Ore Reserves

No blocked out ore reserves exist in the mine and the area thought to contain the bulk of the tungsten has only been superficially prospected or developed. Several factors, however, permit a reasonably accurate estimate of possible reserves to be made. Surface indications, while not conclusive, show that some tungsten mineralization exists throughout the lode in the area west of the Buffalo Shaft to a point at least as far westerly as Trench VI [presumably the same Trench VI as discussed in Beatty, 1942]. By measuring the areas along the lode from which production has been made during the past year, it is possible to calculate what production can reasonably be expected from similar sections; assuming that such factors as the proportion of mineralized to barren areas, grade of ore, etc., will remain constant.
Figure 1 [missing from IGS’s copy of this report] shows these estimates. The producing block (Buffalo Block) has an area of 127,000 square feet sectionally along the lode. Of this area 20,700 square feet have been stope d. Production from the block totals 13,852 tons which yielded 1252 units of recoverable WO₃. Applying these ratios to the undeveloped area to the west we have, for the “West Block”, an indicated possible production of 21,330 tons which should yield 1928 units of WO₃. For the purpose of these calculations the Upper 106 S. W. Stope has been omitted and reductions made from the total production to date in proportion to the area of that stope. To have included this isolated stope with the intervening stope out ground would have possibly introduced a large error. This intervening area has been the scene of mining operations for the past 75 years.

**Analysis of Production Possibilities**

**Value of the Ore:** At the present price of tungsten ($30.00 per unit for this operation) the 1928 indicated recoverable units in the “West Block” has a value of $77,840.00. On the basis of 21,330 tons this amounts to $2.71 per ton.

The gold content of the ore in this block is not known exactly but the average of all surface samples was .0412 ounces per ton. At 90% recovery in the mill this indicates a net value of $1.30 per ton to be added to the value of the tungsten, giving the ore a total value of $4.01 per ton.

**Costs:** The minimum exploration work indicated in Fig. 1 amounts to 280 feet of raising from the 100 level to the surface and 670 feet of drifting westward along the lode. Assuming a cost of $12.00 [$24.00] per foot for drilling and $10.00 [9.00] per foot for raising the total cost of this work is $10,850.00 (approximately) [$21,700] or $0.51 [0.99] per ton of ore possible to develop.

With mining and milling costs of $5.00 per ton (assumed), the total cost per ton to be charged against the ore is as follows:

<table>
<thead>
<tr>
<th>Cost per ton</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining and milling</td>
<td>$5.00</td>
</tr>
<tr>
<td>Exploration</td>
<td>.51</td>
</tr>
<tr>
<td>Total</td>
<td>$5.51</td>
</tr>
</tbody>
</table>

Deducting the net value of the ore (from above):

<table>
<thead>
<tr>
<th>Costs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$5.51</td>
</tr>
<tr>
<td>Net value</td>
<td>4.01</td>
</tr>
<tr>
<td>Net loss per ton</td>
<td>$1.50</td>
</tr>
</tbody>
</table>

**Price Necessary to Warrant Mining:** The probable tungsten content of the ore will be .9904% (based on recoverable tungsten) or 1.81 pounds per ton. Thus 11 tons must be mined and treated to recover 1 unit of WO₃. With an indicated loss per ton of $1.50 [$19.8] the loss incurred in recovering 1 unit of WO₃ is 11 x $1.50 [$19.8], or $16.50 [$217.8]. Adding this figure to $30.00, the present price per unit, gives $46.50 [$517.8], the price per unit needed to break even.

**Treatment:** Capacity of the tungsten unit of the mill is given as 200 tons per day. Actual rate of production since operations started has varied from 1100 tons to 2170 tons per month with an average of 1585 tons per month, or approximately 61 tons per day. Assuming that production could be maintained at 150 tons per day, the life of the operation on the possible ore in the West Block would be approximately 5½ months. Rate of production on this basis indicates that approximately 350 units of WO₃ per month could be expected to result from the operation at a cost of at least $46.50 [$517.8] per unit.

**Company Operations**

Company operations (on tungsten ores) at the present time are limited to a small daily production from Stoops 90 and 41. (See Fig. 2 [missing from IGS’s copy of this report]) A number of gold-silver stope are still active and development is going ahead on these ores.

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Company officials have suggested the proposed exploration work indicated on Figure 1 [missing from IGS's copy of this report] as the minimum necessary to prove the existence of additional tungsten ore-bodies west of the present workings. This proposed exploration work, as noted above, would cost approximately $10,850 [$21,700], and at this time the company does not feel that it is in a position to make such an expenditure. At such time as the need for additional tungsten production warrants, the expenditure of this amount for exploration and development should be justified as a war measure to be financed by Federal funds.

Work to be Performed by the Bureau of Mines

Due to the fractured condition of the deposit and the extremely spotty occurrence of the tungsten mineralization a diamond drilling program is not suitable and the drifting and raising program outlined by the company is without doubt the quickest and cheapest method that could be adopted. Such a program is not believed to be justified or suitable as a Bureau of Mines project at this time.

Conclusions

The Bureau of Mines, after a field examination and a study of other data concerning the occurrence of tungsten at the Talache Mine, concludes:

1. That present indications are that unless additional exploration work is undertaken at once production may shortly be expected to decline.

2. That there is a reasonable expectancy of developing at least 1928 units of WO₃ at the mine by an expenditure of $10,850.00 [$21,700] for preliminary work.

3. That in all probability it will be economically impossible to mine and treat the ore containing this amount of tungsten unless the price is substantially increased. It is calculated that a price of $46.60 [$51.79] per unit will be necessary to meet these conditions.

Beatty (1943a and 1943b) examined the structure and geology of the orebodies in the mine, with particular emphasis on where to explore for additional ore. One of his conclusions concerned the structure of the orebodies (Beatty, 1943b, p. 9):

The conception of several separate ore bodies existing in the Boise-Rochester section of the Atlanta Lode has now been nullified. Instead of the "simple, shallow vein" of the Old Chunk body, there is now a vastly more extensive body, that both structurally and mineralogically presents a far more unified and understandable picture as a single set of connected zones of deposition than as a group of three independent ore bodies.

During the year, the company put an addition on the mill building to facilitate concentrate storage and shipment.

Talache operated from January 1 to November 1, 1944, mining and milling 43,541 tons of gold ore. Government restrictions and a shortage of labor forced the company to suspend operations on November 1. No arsenic or tungsten was sold in 1944. The company installed an Ingersoll-Rand 245B double-drum hoist for use in open-cut mining on the property, probably in the second half of the year. Open-pit operations on the Monarch (Figure 39) yielded 39,000 tons of ore (Nugent, 1975). Most of the work at the mine in 1945 was maintenance and repair done by a skeleton crew. The mill ran intermittently, treating 1,815 tons of gold ore. In addition, 37 tons of high-grade gold ore was shipped direct to a smelter.

In 1946, the mine operated all year. The mill treated 14,523 tons of gold ore, which yielded 5,071 ounces of gold and 24,068 ounces of silver. The company also
Figure 39. Open pit at the Monarch Mine (c. 1985), with the Monarch headframe in the foreground (photograph by Earl H. Bennett, Idaho Geological Survey).
shipped 68 tons of high grade gold ore direct to a smelter. Starting June 1, the company leased out portions of the mine, and for the rest of the year, the ore was mined by an average of 25 lessees.

The leasing arrangements continued the following year. The mine produced 27,539 tons of milling-grade gold ore, which yielded 6,692 ounces of gold and 42,471 ounces of silver. An additional 3 tons of high grade gold ore was shipped direct to a smelter. Most of the 1947 gold production for Elmore County came from the Talache property.

Output from the mine declined in 1948. The mill treated 10,370 tons of gold ore, which yielded 2,563 ounces of gold and 11,227 ounces of silver. Most of the ore was produced by lessees. Also during 1948, the company milled 3,398 tons of antimony ore produced by the Hermada Mining Company. (The 1949 IMIR credits this for that year, but Talache’s 1949 report to the Idaho Mine Inspector specifies that the ore was milled “During calendar year 1948.”)

In 1949, the company milled 12,104 tons of ore, which yielded 3,102 ounces of gold and 15,233 ounces of silver. The mine was the largest producer in the district. A memo in Idaho Geological Survey’s mineral property files from P.T. Peterson to A.H. Burroughs, dated December 30, 1949, indicates that most of the company’s efforts were directed toward locating reserves of good milling ore while keeping the mill heads from current operations from falling below the break-even point. Samples of the flotation concentrate were submitted to the U.S. Bureau of Mines to determine if the arsenic content of the concentrate (12.6 percent in the sample submitted) could be lowered to less than 2 percent, which was the amount of arsenic being accepted by the smelter. The tests showed that low-temperature roasting reduced the arsenic content of the resulting calcine to 0.1 percent, but would cause air pollution from arsenic and sulfur unless the fume and gases released during roasting were properly handled (Wells, 1949). Talache Mines does not seem to have pursued this processing approach further.

The mine was still the principal producer in the district in 1950. The mine produced 8,825 tons of gold ore, which yielded 5,325 ounces of gold and 34,292 ounces of silver. In addition, the company milled about 500 tons of antimony ore for Hermada Mines in late 1949 or early 1950.

Talache operated the mine throughout 1951. The company’s 400-tpd mill processed 8,973 tons of gold ore, which yielded 6,301 ounces of gold and 37,367 ounces of silver. In 1952, the property was one of the largest gold producers in Idaho.

Talache Mines discontinued production at the Boise-Rochester property on October 15, 1953, and put the operation on a standby basis. Parts of the mine were leased to five former employees, who resumed production from the mine on a reduced scale. When sufficient ore accumulated, it was milled. The bullion bars were shipped to the San Francisco Mint and the concentrates were sent to the Tacoma smelter. During 1953, the mill treated 8,072 tons of ore, which yielded 2,535 ounces of gold and 27,827 ounces of silver. Peterson (1953a, 1953b) and McLeod (c. 1955) reinterpreted the geology of the
Atlanta lode with respect to fracturing and movement along the lode, as well as in regard to movements on faults in nearby areas. Peterson (1953a) noted that regional stresses had produced movement on shear planes adjacent to the Atlanta lode and the associated oblique lateral shears (or split veins) were ideal exploration targets. Appropriate exploration targets are listed in Peterson (1953b).

Lessees continued to operate the Boise-Rochester in 1954. The mine produced 2,028 tons of crude ore, which was milled at the Talache mill. The ore yielded 31 tons of concentrate containing 539 ounces of gold and 18,716 ounces of silver. In addition, the mill processed 150 tons of gold ore for Little Queen Mines, Inc. In 1955, the Boise-Rochester was active all year and produced 3,900 tons of gold ore.

Operations in 1956 produced 3,813 tons of ore. The gold and silver recovered by amalgamation were sold to the San Francisco mint, and the gold-silver concentrate was shipped to the Tacoma smelter. The company noted to the Idaho Mine Inspector that all production was by lessees, who furnished labor, while the company supplied "everything else" (presumably use of the company's mining equipment and mill). In 1957, the Boise-Rochester was the second largest gold producer in the state (the Blackbird Mine in Lemhi County ranked first). Lickes (1957, p. 1) describe the operation:

On a visit to the Atlanta district Mr. Harold Lanning, in charge of Talache Mines' Atlanta operation, and I went to the mill for samples. He told me that the operation is being conducted as a split-lease deal. The company maintains the mine openings and mills the ore; proceeds from the sale are divided 50-50. At present 3 groups are leasing.

All ore is removed through the 900-level haulage adit, which connects the Buffalo, Monarch, and Boise-Rochester mines. Total length of the 900 level is approximately 3/4 mile. Separate storage for lessees' ore is provided in 2 coarse and 2 fine ore bins at the mill. Ore is milled separately and the circuit cleaned after each run. Coarse gold is removed from the circuit by a mineral jig set at the discharge end of the ball mill. This product is amalgamated, then melted into bars of 5 to 25-pound weight, depending on the size and grade of ore being treated. The impoverished remainder goes to a flotation circuit that produces a sulfide concentrate containing the remaining gold and silver. The sulfide concentrate is sacked and shipped to the Tacoma smelter. The company is reimbursed only for the gold and silver content of the concentrate.

Lessees continued to operate the mine until 1964. The USBM Yearbook noted production in 1960 and 1961. The mine produced 350 tons of gold ore in 1963. In 1965 and 1966, the IMIRs reported that lessees were working the property, but no ore was shipped. Talache Mines, Inc., forfeited its charter in 1966. There seems to have been very little activity at the property for the next decade. Figures 40, 41, and 42 show the portal of the 600 level, the mill, and the tailings pile in 1994.

Total recorded production from 1902 to 1963 was an estimated 856,876 tons of ore and 55,978 tons of reprocessed tailings. This material yielded 243,755 ounces of gold, 1,032,381 ounces of silver, 33,363 pounds of copper, and 1,315 pounds of lead. In addition, the mine produced 490,486 pounds of arsenic and 30,471 pounds (1,523.55 units) of tungsten in 1942 and 1943. Except for the last two commodities, these amounts
Figure 40. Portal of the 600 level adit at the Boise Rochester Mine in 1994 (Idaho Geological Survey photograph).
Figure 41. Talache mill in 1994 (Idaho Geological Survey photograph).
Figure 42. Tailings from the Talache mill, as the area appeared in 1994. This area is the Atlanta Golf Course (Idaho Geological Survey photograph).
must be considered minimums, because it is not known if the production from all lessees was credited to the mine. In addition, old tailings were not always reported separately from ore, so it is not known how much of the material credited as ore was actually reprocessed tailings. No reliable estimates are available for production from the property for the period before 1900.

HILL AND DAVIS CLAIM

The Hill and Davis claim (Figure 5) is one of the oldest in the Atlanta district. It is on the west end of Atlanta Hill and extends a short distance down the slope toward the Yuba River, adjacent to the Atlanta Nos. 1 and 2 claims. The Hill and Davis claim is only 600 feet long and 100 feet wide (Anderson, 1939). Anderson (1939, p. 61) described the geology of the claim:

The claim appears to cover either a branch or a spur of the Atlanta lode some 300 feet west of the point at which the lode appears to fork. The lode does not have the characteristics of the usual gash vein nor of the general west-northwest group. It is nearly as wide on the surface as the main Atlanta lode and strikes about N. 65° E., an angle only slightly greater than that of the main lode. Its dip is about 80° S.E. on the surface, but in the crosscut 600 feet below its direction is reversed to steeply northwest. Although the lode is apparently as much as 60 feet across on the surface, the zone of shearing itself, 600 feet below, is little more than half as broad.

Much quartz is exposed along the outcrop, in part stained by limonite, in part by greenish scorodite. The drusy third-stage quartz appears to be rather abundant and some of it at or near the surface is reported to be fairly rich in gold and silver. The quartz exposed on the crosscut 600 feet below, on the other hand, shows only sparse sulphides, mostly arsenopyrite and pyrite. The lode at depth is composed mostly of altered granite rock apparently far too low in gold to be regarded as ore.

Anderson (1939) noted that there were a number of shallow cuts and tunnels on the property, although the tunnels were all caved in 1936. In addition, a crosscut from the St. Joseph Lead Company’s No. 6 West drift explored the claim.

IDAHO GOLD MINE (ATLANTA, BUFFALO & ATLANTA) AND RELATED PROPERTIES

The Idaho Gold Mine (Figures 3 and 5), also known as the Atlanta Mine or the Buffalo and Atlanta property, is on the western end of the Atlanta lode, extending from the west end line of the Monarch to the Yuba River. Anderson (1939, p. 60-61) described the geology:

Although the lode maintains its general southwest trend across the property, it has been offset in several places by faults of northwest trend and its course has been otherwise
modified by minor variations in strike and dip. One of the faults was uncovered in the 600 West Drift. It displaced the lode to the northwest about 40 feet. The most marked variation in its trend is along the main ore shoot where, as along the ore shoots in other parts of the lode, the strike is more east-west than that for the lode as a whole. Near the surface the lode dips about 75° S.E., but on the 600 level it has changed to 85° N.W.

The lode appears to be as much as 70 feet wide on the surface and from 40 to 50 feet on the 600 level, nearly 600 feet below. It reaches its maximum width at the crest of the hill and diminishes somewhat southwestward, even though it is still 40 to 50 feet wide where intersected by the Yuba tunnel. The ore shoot in it is about 600 feet long and was commercial to a depth of about 400 feet below the highest point on the outcrop. The No. 4 level marks the bottom of the commercial ore. At that depth, the ore was low-grade and still lower in the St. Joe 600 West Drift, 187 feet below.

Quartz is very conspicuous on the outcrop and shows the common three stages of deposition, including large amounts of the comb and drusy variety. The ore in the upper workings is reported to have been high-grade, rich in silver, mostly in bonanza-like bunches. Although the shearing is still fairly prominent on the No. 6 level, the quartz is not so conspicuous nor the mineralization so intense. Assays on lode material beneath the old stopes at this depth generally contained much less than 0.15 ounce of gold in samples taken across an advancing 5-foot face, much of it less than 0.10 ounce.

It is reported that as the No. 6 drift advanced southwestward from the Monarch shaft the shearing and mineralization became less well defined and that ore of commercial grade was found nowhere west of the Buffalo ground. The mine map (fig. 4 [Figure 9]) shows that much of the drift is in the lode and that crosscuts through the lode were made at 300-foot intervals. Cuts and shallow tunnels spaced at 100-foot intervals also explore the lode southwestward from the Buffalo shaft. Each has exposed considerable quartz, but apparently little or no ore of commercial grade.

The Idaho Gold Mine was known and worked in the early days of the district. The first workings included cuts and shallow adits on the outcrop near and along the top of Atlanta Hill. Other workings were lower down on the hillside and near the river, including a 1,400-foot crosscut known as the Yuba tunnel (Anderson, 1939). Strahorn (1881) noted that the Yuba tunnel intersected the Atlanta lode beneath the North Star claim and that the Lucy Phillips was the next claim to be developed by the tunnel. Part of the western extension of the lode was also known as the William Tell (Raymond, 1875). The North Star, Lucy Phillips, and William Tell are some of the older claims in the district for which no record of an exact location has been found. (The above information places the North Star claim approximately at the upper end of the Atlanta No. 4 claim as shown on Figure 5.) From the fragmentary information available, it appears that the western end of the Atlanta lode was originally held by a number of individuals and companies. These claims were apparently restaked, some claims perhaps more than once, before they were finally consolidated by the Buffalo and Atlanta Company (Table 8) around 1880. This part of the Atlanta lode never produced much ore, and records of its history are limited.

The earliest mention of this area is in 1866 or 1867 (Browne, 1868, p. 521):

On the south or Yuba side [of Atlanta Hill] are the North Star and Hard Times, continuations of the Atlanta, and the Sophia Tracy. For working the last three named there is an excellent 20-stamp mill, with modern improvements, now being put up on the ground by J. H. O'Neal
Table 8. Companies and individuals operating at the west end of the Atlanta lode. Dates in parentheses indicate indefinite or uncertain information.

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Officer</th>
<th>Date Incorporated</th>
<th>Charter Forfeited</th>
<th>Year(s) at Mine</th>
</tr>
</thead>
<tbody>
<tr>
<td>J.H. O'Neal and associates</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1866-7</td>
</tr>
<tr>
<td>Lucy Phillips Gold and Silver</td>
<td>Matthew Graham</td>
<td>October 22, 1866</td>
<td>August 31, 1883</td>
<td>1866-1869</td>
</tr>
<tr>
<td>Mining Co., Ltd.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buffalo and Atlanta Co.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>(1880)- (~1890)</td>
</tr>
<tr>
<td>Atlanta Consolidated Gold and</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1891-1895</td>
</tr>
<tr>
<td>Silver Mining Company, Ltd.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idaho Gold Mines$^2$</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>c. 1895-?</td>
</tr>
<tr>
<td>Idaho Gold Mining and</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>(1909)-1917</td>
</tr>
<tr>
<td>Milling Co.$^2$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>St. Joseph Lead Co.</td>
<td>Clinton H. Crane,</td>
<td>filed in Idaho:</td>
<td>certificate of</td>
<td>1917-</td>
</tr>
<tr>
<td>President</td>
<td></td>
<td>April 3, 1929</td>
<td>withdrawal:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>November 23, 1956</td>
<td></td>
</tr>
</tbody>
</table>

Property combined with the Boise-Rochester and other holdings of St. Joseph Lead Co. (Table 5) after 1917.

$^1$Information not available in Idaho Geological Survey’s files.
$^2$These two names may actually be variant ways of reporting the name of a single company.

and associates$^{25}$ Here also are the Minerva, Olive Branch and Confidence lodes, all of which give promise of value. In some of them gold predominates, in others silver. There are other claims which may, when further developed, prove valuable; but as little work has yet been done upon them no reliable opinion of them can be given. Mr. Graham, in co-operation with an English company, has a 20-stamp mill on the way up from San Francisco, intended to operate in this district. The field for working in quartz, and for exploration and development is extensive.

The story of Matthew Graham’s 20-stamp mill, purchased for the Lucy Phillips property, was not one of the high points of the district’s early history. After extensive development work was conducted on the Lucy Phillips in 1866, the company (organized by Matthew Graham), decided to install a twenty-stamp mill the following year (Wells, 1983). Graham’s next move was to promote his mine abroad (Wells, 1983, p. 57-60):

$^{25}$This is believed to be the mill whose story was related by Wells (1983); see pages 25 and 26. If this is the case, the mill was never completed.
British investment, introduced to Atlanta by Matthew Graham, began to make an impact in 1868. Graham, who had started an arsena near Rocky Bar with a $300 grubstake during the South Boise gold rush, was a self-made man. Having advanced into the milling business at Rocky Bar, he next became interested in the Lucy Phillips at Atlanta. On the strength of his representation, the Lucy Phillips Gold and Silver Mining Company, Ltd., had organized in London on October 22, 1866, with £120,000 capital stock: 24,000 shares at £5 each. Within a year, three-fourths of the total capitalization had been subscribed. This subscription gave the company £90,000, a sum which was augmented by £72,000 on assessments collected that year (only £151 was listed as unpaid assessments, an indication that the stockholders were in earnest).

With something like $800,000 available by November 1, 1867, the Lucy Phillips was an enterprise of greater potential magnitude than the ordinary quartz mining venture in Idaho. Of the 301 stockholders, more than half (183) were British gentlemen, a class to which Matt Graham (the leading stockholder, with £4,000 to his credit for his interest in the mine) was graciously admitted. There were thirty-four clerks-in-ord, and the others were from widely scattered occupations: a few surgeons, artists, merchants, attorneys, brokers, spinsters, and married women. In addition there were prominent figures in British society—two baronets, three rear admirals, and a number of military officers—and even some common folks, such as a leather cutter, a butcher, and a brewer. Development work on the Lucy Phillips had barely started before Matthew Graham left Yuba for London at the beginning of July 1867. Yet he had no trouble in arranging to get a large stamp mill authorized for the operation. The stockholders, in fact, were disappointed that the mill could not be brought in that winter.

As cheerful reports of development of the Lucy Phillips came to England during the winter, Graham was able to inform the stockholders in a London meeting on February 3, 1868, that a crosscut on their lode have been driven sixty feet without getting through the vein. The depth of the lode had not been determined, but for the moment, that was of no consequence. Enough ore already was in sight to supply their present machinery for a hundred years (this exaggeration suggests mostly the inadequacy of their machinery). Graham had not tried to get their new mill into the district that winter so as to save $5,000 in transportation and costs, but by the next summer the mill would be installed. By June, in fact, some twenty-five men were employed in erecting the mill, which, at ninety feet square, he could boast was the largest in Idaho.

Expansion of the Lucy Phillips' holdings in Atlanta came on June 20, 1868, when Henry James, the company manager, purchased two hundred feet in another of Matthew Graham’s properties. This deal apparently resulted from the prospect of serious trouble that ruptured Graham’s previously excellent relations with the British company. Disquieting news came back to London that the title to the company’s original mine was dubious. The Lucy Phillips’ shareholders, in an extraordinary general meeting on August 13, 1868, voted to enlarge the capital stock of the company in an effort to get more funds by issuing new shares. Edward Bishop was appointed managing director for operations in Atlanta, and the company was authorized to purchase other mines or to operate a custom mill in the event no ore should be available from their own properties.

Efforts on the part of Dr. Elwood Bishop during the summer of 1869 to bring more English capital to Atlanta looked promising for a time, but did not lead to much in the end. Sent to straighten out the affairs of the Lucy Phillips, Bishop also represented the interests of the Gold Mining Company of Yuba, Ltd., that was incorporated July 30, 1869. An initial purchase arrangement in 1869 fell through, however, and little resulted from later investment efforts of this concern—other than to teach British capitalists to beware of mines in the United States.

A dismal conclusion likewise awaited the Lucy Phillips enterprise. Matthew Graham, who regarded himself as the agent to watch the British company’s property, kept

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track of the elegant but not yet completed mill and other machinery from January 6 through November 30, 1869, at a rate of $10 per day. Realizing that he might have a hard time getting paid for his efforts, he filed suit on December 2 for $3,280. From this action he learned from the company that a £150 payment to him on August 30, 1869, was intended to represent a final settlement of all his claims against the Lucy Phillips concern. Graham managed to get a favorable verdict in court. The Alturas County sheriff attached the Lucy Phillips mill and equipment for him on December 10, 1869, and the case, heard in the court of Chief Justice David Noggle, went in his favor. The luckless Lucy Phillips Company filed a report or two after that but showed little signs of activity otherwise. Eventually, everyone agreed that the company ought to be liquidated: a resolution of an extraordinary meeting of the stockholders "duly held at the London Tavern" resolved "that it has been proved to the satisfaction of the company that it cannot by reason of its liabilities continue its business, and that it is advisable to wind up the same." An insurmountable obstacle then presented itself. Funds to hold a final meeting necessary to complete arrangements to dissolve the company could not be raised. Eventually, in 1880, the British Parliament came up with a simple procedure for getting rid of corporations as unsuccessful as this ill-fated enterprise. At last on August 31, 1883, the Lucy Phillips Gold and Silver Mining Company, Ltd., was formally dissolved. The Gold Mining Company of Yuba, Ltd., met the same fate on January 15, 1884.

Raymond (1874, p. 247) noted: "On both sides of the gulch, as well as on the summit and the slope of the mountain toward Yuba Creek, there are numerous other lodes, most of which look very promising, but lack sufficient development to justify an opinion on their value." In 1874 the western section of the Atlanta lode was described as follows (Raymond, 1875, p. 310):

West of the Miller ground [the Buffalo Mine] the Atlanta is claimed for 920 feet more in different small claims; then the outcrop disappears for perhaps 800 or 1,000 feet, but re-appears on the south side of Atlanta Mountain, which slopes toward Yuba River. The lode is taken up here as the William Tell lode, and claimed for a distance of 2,600 feet. The immense outcrop, averaging from 50 to 60 feet in width and sticking clear out of the ground, sometimes 8 to 10 feet high, can be seen from the top of the mountain quite a distance downward, and though no work amounting to anything has been expended on this lode to show and establish its value, there is every probability that proper development will prove this part of the Atlanta as good as the rest.

The following year, Raymond (1877, p. 211-212) reported minimal activity in the area: "On the Lucy Phillips and William Tell, which are both west extensions of the Atlanta, only so much work has been done as was necessary to hold the claims under the act of 1872." Clayton's observations of the western end of the Atlanta the following year also emphasized the lack of development (Clayton, 1876, as quoted in Raymond, 1877, p. 215):

West of the Buffalo Mine there has been no exploration below the water-line, and but little work of any kind has been done except surface-outs and holes dug to trace the lode and do enough work to hold the claims good against jumpers and relocators. No rich ore is found in the surface outcroppings anywhere on the lode, except that now and then some free gold is found. The surface-dirt all contains gold the whole length of the vein, but no rich silver-ore is found on the surface, not even any distinct traces of chlorides of silver.
By 1880, the Buffalo and Atlanta Company had assumed control of most of the claims in the western part of the Atlanta lode and had driven a 1,400-foot crosscut (the Yuba tunnel) to intersect the lode at depth. Although the original plan appears to have been to continue the tunnel along the lode beneath the Monarch and Buffalo, this was never done (Anderson, 1939). About 250 feet from the end of the Yuba tunnel, 200-foot crosscuts were driven to the northeast and southwest, presumably along the Atlanta shear zone (Kiiigaaard and Bacon, in preparation).

The 1881 DotMR (p. 174) noted:

Next to the Buffalo and Idaho [the Buffalo Mine] are 1,800 feet belonging to various parties upon which no work has been done. West of these claims comes the property of the Buffalo and Atlanta Company, and consists of 3,900 feet. The lode has been cut at a depth of 900 feet by a tunnel 1,400 feet long. The ore is reported to be of good grade, and the company contemplate erecting reduction works, some of the machinery for which has been procured.

Strahorn (1881, p. 39) described the property in more detail:

The Yuba Tunnel enterprise, near Atlanta, is destined to be one of the most important in Idaho. The tunnel is intended to develop the great Atlanta lode—is now in 1,400 feet where a good vein, the North Star, has been penetrated. The Lucy Phillips, another good claim on the Atlanta ledge, will next be developed, while the depth, which will be attained on the Buffalo and Monarch, will be 1,000 feet below the deepest workings of those mines. About $100,000 has been expended on this scheme [sic] by Judge V. S. Anderson and associates. Where the tunnel strikes the Atlanta vein (on North Star territory) it is seventy-five feet wide, and possesses many of the characteristics of the Monarch.

Strahorn (1881, p. 38) also described the mine as “the Buffalo and Atlanta mine, developed by a tunnel 1,435 feet long and 350 feet of drifts on a three-foot vein, rich in sulphurates of silver.”

Two years later the 1883 DotMR (p. 446) stated:

The mines of the Buffalo and Atlanta Mining Company are developed by a tunnel 1,250 feet long, intersecting the Atlanta lode at a depth of about 1,000 feet, the lode being from 40 to 50 feet wide, with well-defined walls.

Work on the Yuba tunnel was apparently discontinued in the early 1880s (Anderson, 1939). According to Thomson (1886), the Atlanta lode was 70 feet wide where it was intersected by the Yuba tunnel 1,600 feet below the surface. Several years later, a 20-stamp mill was built near the portal of the Yuba tunnel to treat the ore from the shallow workings in and near the outcrop of the lode (Anderson, 1939). According to Eldridge (1895), the mine was owned by the Atlanta Consolidated Gold and Silver Mining Company in the early or mid-1890s.

About 1895, Idaho Gold Mines began extensive development on a rich ore shoot in the upper part of the gulch (Anderson, 1939). Hastings (1895, p. 128) noted:

26Thomson’s numbers seem to be somewhat inflated.
The ores occur in chutes, as streaks of varying width, perhaps 1 to 10 ft., on either wall, and as ramifying seams through the vein. Three other outcrops on the lode indicate further ore chutes, one on the east end in the Turner claims, another about the center on the Atlanta Nos. 2 and 3 claims, and the third at the Atlanta No. 4 claims near the west end of the lode. An English syndicate controls 7,500 ft. on the west end of the lode, and is drilling on the vein, to reach the Atlanta No. 2 ore chute. It is also cleaning out the Yuba tunnel, an adit 1,400 ft. long, tapping the vein 1,020 ft. deep, which was run 16 years ago. The Englishmen have a working bond on the property.

In the area near the top of the hill, four tunnels were driven on the ore. By 1899, all the ore had been stopped above the lowest tunnel, which was about 400 feet below the highest outcrop. Operations were again suspended (Anderson, 1939).

Some of the tunnels were retubed in 1909 (Anderson 1939). According to the 1909 IMIR (p. 56):

The Idaho Gold Mining and Milling Company, adjoining the Monarch on the west, has been working 10 to 12 men in cleaning up and retubing the old Yuba mine preparatory to an aggressive campaign of operations during the ensuing year. Mr. T. C. Cunningham is the manager.

The property was formerly equipped with a 20-stamp mill but has been idle for several years; however, prior to the suspension of operations, had produced considerable wealth from shallow workings. The ore developed in the lower workings is of low grade, but as no cross-cutting or raising has been carried on it is probable that the main vein developed in the upper workings has not been encountered.

G.C. Cunningham was in charge this work and noted the following about the property (Cunningham, 1937, p. 1-2):

YUBA PROPERTY. (Atlanta Nos. 1, 2, 3, 4, and 5 Patented Claims) now belonging to St. Joe Lead Co. I superintended operations on the No. 2 Claim of this group in 1909, and at that time personally sampled the croppings of the vein in the various claims, paying particular attention to the outcrops on the Atlanta No. 1. Claim which we were driving towards, also to the vein outcrops on the Hill & Davis Patented Claim (not belonging to us but on which we were trying to get an option.) I enclose herewith a list showing the assay results on this sampling [not included with IG's copy of this memorandum].

The ore developed in the No.2 Claim was stopped to the lower tunnel level and averaged about $7 dollars per ton in gold and silver. Plated on average $5 dollars per ton. The ore lay in shoots on the south wall of the vein and averaged about 5 feet in width. We did not cross-cut over to the Hill & Davis Claim but from the work carried out I am convinced that there is no wall between the Atlanta No.2 and the Hill & Davis on the east end of the claims.

The average value obtained per oz. of bullion from milling the No.2 ore was $13.19. The Atlanta Lode apparently splits at the so called blow-out on the No.2 Claim, one branch apparently running through the Atlanta Claims, and the other through the Hill & Davis and the Idaho Group of Claims belonging to Mrs. Browne.

You will note that the cropping samples from the Hill & Davis Claim gave some very encouraging results also the sample from the Atlanta No.1.

I may mention that the old Yuba Tunnel driven from the Yuba Mill-Site into the vein on the Atlanta No.4 Claim has been caved for many years (was caved and closed when I first
stuck the camp in 1900.) Vein where intersected gave poor results I, learned. Reported two or three veins cross cut in driving the tunnel. Good portion of this tunnel in fairly hard rock and therefore might be re-opened at reasonable cost, this might be kept in view for large scale operations on Idaho Group if developments on same justify expense.

In 1917, the property was acquired by the St. Joseph Lead Company. The mine was idle until late 1935, when St. Joseph Lead extended its No. 6 level into the Atlanta group in hopes of finding a continuation of the ore shoot mined in the upper workings of the property. No good ore was found, and the work was discontinued in early 1936 (Anderson, 1939).

Production from the property was small. Kiilsgaard and Bacon (in preparation) report an output of 379 tons of ore, which yielded 751 ounces of gold and 5,657 ounces of silver, between 1902 and 1922. Seventeen tons of ore, containing an unknown quantity of metals, was produced from the far west end of the No. 6 level in 1935 (Anderson, 1939).

IDAHO GROUP

The Idaho Group is on the northern branch of a split in the Atlanta lode that occurs on the Atlanta No. 2 claim (the so-called "blow out.") The exact locations of these claims is not certain, but they were probably close to the area covered by the Idaho claims now held by Atlanta Gold Corporation. Most of the information known about the claims is contained in two unpublished reports. Cunningham (1937, p. 2-3) noted the following information, which dates from around 1900 or 1910:

IDAHO GROUP OF CLAIMS. belonging to Mrs. Browne. When I was in Atlanta the development work on this property was open and several times I inspected the vein exposed in the cross-cut tunnel close to the Atlanta No.2, also the tunnel to the west, I believe in the Idaho No. 2 Claim, called the Argo Tunnel, where considerable drifting was done on the vein. I have regretted many times that I failed to sample the ore developed in these workings, but I know that a good strong vein was exposed in both tunnels showing the same characteristic blue quartz of the Atlanta Lode. In my opinion these claims cover the main branch of the Atlanta Lode extending from the Atlanta No. 1 claim westward through the Hill & Davis Claim.

Browne (n.d., p. 1-3, as quoted in Almond, 1916) described the claims in more detail:

SITUATION:-

These mines are situated on the NE and SW slopes of Atlanta Hill on the Yuba side of mountain, about 7,500 feet above sea level. The highest point on the surface is about 1600 feet above Yuba River.

27This sentence should read: "Vein where intersected gave poor results, I learned." In addition, the closing period is missing from the preceding sentence.

28A map of Atlanta Gold Corporation's claims, as of 1986, is shown in Figure 52.

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The property consists of 6000 feet in length, 2315 feet of which is on the Atlanta Lode known as the Mother Lode. These mines are situated about 3 miles south of Atlanta in Elmore County, State of Idaho. The town is reached by a good wagon road from Hill City, a distance of 50 miles. Hill City is a station on the Oregon Short Line R. R. Autos make the trip regularly from Boise during the summer months in 8 hours via Mt. Home, Pine and Rocky Bar.

GEOLOGICAL FEATURES.

The Geological horizon in which these mines are found is granite and traverses a large area in an Easterly and Westerly direction.

The 1st and 2nd extensions are true fissures evidenced by the clay seams between the Quartz and country rock (granite) frequent occurrences of slicken sides. The banded structure of the Quartz and the remarkable continuity of the Atlanta Lode in its downward course.

The vein between walls varies in width from 10 to 35 feet with an average width of about 20 feet. In places the writer has cross-cut the vein where it showed 90 feet between walls.

The vein matter in Atlanta Lode carries Gold and Silver with a large quantity or percentage of iron pyrites carrying gold as evidenced by the work now being done by the Boise Rochester Mining Co.

IDAHO LODE.

This is a full claim 1500 feet in length by 500 feet in width at the East and 600 feet in width on the West end. The vein in this claim was tapped by a cross-cut tunnel 400 feet long. At this point the vein is 85 feet wide showing stringers of Quartz running through the mass. On North wall a body of ore was found giving assays from $5.50 to $27.50 per ton in Gold and Silver. The tunnel was allowed to cave in as it was simply an item of expense to keep open.

FIRST WEST EXTENSION OF ATLANTA LODE.

Commencing immediately west of and adjoining the patented lode Lot No. 51 named Hill & Davis on map, is the first west extension claim 815 feet in length by 500 feet in width on west end and 426 feet on east end.

Numerous cuts and openings were run and made upon this ground some years ago, proving course and width of lode; samples taken from 9 feet of this vein gave an average assay of $33.75 silver and $2.00 gold.

SECOND WEST EXTENSION OF ATLANTA LODE.

This property is situated between the first extension and the claim known as the Elbe, formerly the Jericho. The developments of the two properties showed so much good ore that very little development work was done on this claim. Representing work was done on tunnels run on Jericho as follows:-

The upper tunnel on Jericho cuts the vein about 200 feet from the portal, width of vein 60 feet with a lot of stringers running through the mass similar to all places where the Atlanta Lode has been exploited. Five to eight feet of ore ranging in values from $3.50 per ton up to $22.00 is found on the North wall; this level has been driven on the vein eastward about 160 feet and westward about 75 feet. A lower tunnel taps the vein about 515 feet from the mouth and has been driven east on the vein about 260 feet and west about 120 feet showing ore bodies the entire distance averaging about 4 feet wide with value of from $5.00 to $42.00 per ton in Gold and Silver. In this tunnel, before it was caved in, there was 18,000 tons of ore of the value of $6.00 per ton or $108,000 in sight. When this tunnel is opened and the levels are further extended East and West a large amount of stopping ground will be opened which will largely enhance the value of the property.

THE ELBE LODE.

This claim is situated on the West end of the second extension of the Atlanta Lode and is full claim 1500 feet long by 600 feet wide.

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The vein on this claim is opened by two tunnels, the upper one being about 200 feet long and the lower one about 400 feet, the vein as exposed by these tunnels is about 50 feet wide on an average, and the small vein, about 6 feet wide on the north or foot wall shows values of about $40.00 per ton for the 6 feet, the whole of the vein will average about $6.00 per ton.

There is a blow-out or glory hole on the top of the mountain on this claim over the tunnels from which was taken, some years ago by one man about 50 tons of ore that netted him $60.00 per ton in a primitive arrasta [sic].

**JERICHO NO. 1 LODE.**

This claim runs west from the west end of the Elbe claim for 1500 feet by 600 feet wide and crosses the Yuba River, which affords a very good mill-site, with an ample supply of water for milling or power purposes together with plenty of timber for mining and fuel etc.

This claim has only had the necessary representing work done on it but its great value lies in its situation on the Yuba River with the power and other facilities for cheap mining and milling.

By driving a working tunnel from the River on the vein a good depth could be obtained in short distance, and before the end of these claims are reached there would be about 1500 feet of stopping [stopping] ground over head, drainage would necessarily follow and the ore would be delivered to the mill at the minimum cost, such expenses as hoisting works, pumps, engineer's shafts etc. would be eliminated.

**REDUCTION.**

The only base metal contained in the ores appears to be iron. This important fact bearing upon the advantages possessed by these ores in possibility of treatment by amalgamation and concentration.

Almond (1916, p. 6) summarized the Idaho Group's potential as follows:

Prospective: - It will appear from the foregoing description of the claims included in this report that there is more than a chance to make this group a paying mine.

The driving of the tunnel at the foot of the mountain, on the vein will surely place them on a paying basis in a very little time with the minimum expenditure of capital. The tunnel will develop the ore as it progresses and will open up large bodies of mineral for milling and concentrating. The situation of the mill on the Yuba River, with ample water power, the timber on the claims for the building of the mill and the timbering of the underground workings, together with the excellent facilities of running the ore directly from the tunnel breast or from the stopes to the mill without any expensive hauling and pumping, make it an ideal mining proposition.

There are excellent chances of encountering high grade ore chutes the same as shown in the other properties on the same vein.

By opening up the ore bodies and showing the character of the ore, a mill could be built that would treat the ore so disclosed that would save the mineral contained in it with the least expense and with the greatest efficiency for that particular kind of ore, it is not good policy, as is often done, to build the mill before you have the ore and then find you have to alter the mill so as to save the mineral.

The 1903 IMIR (p. 59) noted, "Mr. R. G. Spaulding has taken a bond on the Jerico and West Atlanta mines and has let contracts to do considerable work during the winter. The work is being done to prove the extent of some large ore bodies that have been cut in this mine." The IMIRs from 1922 to 1933 listed the Jericho Group as being
owned by Fritz Scholl of Atlanta, but there seems to have been little activity on these claims.

LAST CHANCE MINE

The Last Chance Mine is on the south side of the Monarch, and the majority of the workings are in and along the gulch above the Monarch (Figure 3). It is on a lateral vein that branches from the Atlanta lode about 130 feet southwest of the Monarch shaft (Anderson, 1939). Anderson (1939, p. 62) described the geology of the property:

The lode strikes about S. 85° E. and dips, as indicated by the spacing of the levels on the mine map, steeply south. Its junction with the Atlanta lode was exposed in the Lantas tunnel, but at that point it apparently contained little ore and the main mineralized section of the lode was some distance to the east-southeast. Although the lode is comparatively narrow, generally no more than 3 feet wide, scattered pockets of very rich ore were found, particularly in the upper workings. These have apparently been found over a length of 500 to 600 feet.

The ore was clearly of the bonanza type. Ore milled in the early days is reported to have yielded $100 per ton, half of which was in free gold, 20 to 30 per cent in sulphide concentrates, and the balance in silver. There were also some specimens which were exceedingly rich in crystalized gold. It is reported that a piece of quartz weighing 5 pounds yielded 15 ounces of gold worth $14 per ounce, and another 7-1/4 pound sample, 46 ounces of gold valued at $646 [Ballard, 1928, p. 10 (footnote in original)]. These rich pockets are reported to have been confined to the upper workings and to have become less abundant and smaller with depth. In the drift from the Monarch crosscut the lode apparently contained insufficient ore to justify further development. A 2-inch streak of quartz exposed in this lowest level is reported to have had an assay value of $133 per ton, a 10-inch layer of quartz, $14.00, and a 36-inch layer on the south side of the 10-inch, $8.50 [Kirby, Daniel, Report on the Atlanta mines, May 15, 1903 (footnote in original)].

When the Last Chance was discovered is not known, but it was being worked by 1874. In that year, Raymond (1875, p. 310) described the property as follows:

A short distance above the Monarch Company's claim is the Last Chance lode, owned and worked by E. Heath [Table 9]. He has run a level on the vein 175 feet long, the latter portion of which is, however, partly caved in for a distance of about 40 feet. The vein runs northeast and southwest, pitches south, and is about 4 feet wide. The pay-streak is about 6 inches wide, and will mill $50 per ton. A little stoping has been done, and there are a few tons of good milling-ore on the dumps. By many persons the Last Chance lode is considered a spur or branch of the Atlanta, but, in my opinion, this belief is without foundation, as the former dips south and is a gold-bearing vein, while the Atlanta dips north and carries principally silver-ore proper. There is a difference of about 20° in the strike of the two lodes.

Work continued on the property the following year. According to Raymond (1877, p. 212):

The Last Chance is worked by Heath, Newton Brothers & Hogan, and yields extraordinarily rich ore, some lots running as high as $220 per ton in the mill. Very frequently
Table 9. Companies and individual operating at the Last Chance Mine. Dates in parentheses indicate indefinite or uncertain information.

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Officer</th>
<th>Date Incorporated</th>
<th>Charter Forfeited</th>
<th>Year(s) at Mine</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. Heath</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>(1869)</td>
</tr>
<tr>
<td>Heath, Hogan Brothers, and Newton (operators)</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1875</td>
</tr>
<tr>
<td>Barnhart, Markey, and Mullaly (Pomeroy)</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1875</td>
</tr>
<tr>
<td>Atlanta Hill Mining Company of New York</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1881-?</td>
</tr>
<tr>
<td>Last Chance Company</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>(c.1890)-1901 or 1902</td>
</tr>
<tr>
<td>Atlanta Mines Company</td>
<td>F.H. Minard, President</td>
<td>Delaware registration trust company (not incorporated)</td>
<td>---</td>
<td>1901 or 1902-</td>
</tr>
</tbody>
</table>

Property combined with the Monarch Mine (Table 4) after 1901 or 1902.

Information not available in Idaho Geological Survey’s files.

Small pockets full of native gold are encountered. Recently a piece of quartz weighing 5 pounds was pounded up and panned out, yielding 15 ounces of gold, worth $14 per ounce. Still later 46 ounces of gold, worth $646, were obtained from 7½ pounds of rock.

The Pomeroy is the west extension of the Last Chance, and is worked by Barnhart, Markey & Mullaly. They employ four hands, have an ore-vein 16 inches wide, which mills $70 to $75 per ton, and justly consider themselves fortunate.

Strahorn (1881) reported that the Last Chance had recently been sold for $225,000. The new owners began making extensive improvements on the property. According to the 1881 DotMR (p. 176):

A short distance above the Monarch Company, and near the summit of the hill, is the Last Chance Mine. This claim consists of 1,200 feet along the course of the lode, and is the property of the Atlanta Hill Mining Company of New York. The vein is almost 3 feet wide, and a large amount of ore, yielding principally gold, has been extracted. The mine has been worked by a tunnel, opening about two-thirds of the claim to a depth of 150 feet. Some specimens of crystallized gold of exceeding richness have been found in this mine.

The owners are now constructing a large building over the shaft situated near the western end of the claim, in which a whim will be constructed to be worked by horses; with this whim 200 additional feet in depth can be attained; they have purchased all the mining...
timbers necessary to put the mine in perfect working order. The mine having been worked by
the former owners in a very imperfect way, it was found, upon examination, that most of the
old works had caved, rendering it necessary to go over it again; but when once done, the work
of extraction can be prosecuted cheaply and without delay.

The company have also purchased a 10-stamp steam mill at the mouth of Quartz
Gulch, on which a force of men are now at work putting it in repair for the reduction of ore,
and when operations begin, about 10 tons of ore can be worked daily. The company
contemplate, as soon as bricks and other materials can be had in the spring, to erect a
chloridizing furnace, for the purpose of working the rich auriferous sulphuret with which the
ore abounds.

Work at the property continued in 1882. The DotMR (1882, p. 199) noted:

The Last Chance mine is the property of the Atlanta Hill Gold Mining Company. The
ore is free milling, taken from a 3-foot vein, opened by a shaft of about 400 feet in depth, and
yields $75 to the ton. The sulphures are sorted from the free milling ore and concentrated,
after which they assay $300 to the ton. The company contemplate erecting a chloridizing
furnace for treating the concentrates. Operations were suspended at this mine early in
November, owing to the early and deep fall of snow, which not only prevented hauling ore to
the mill, but obstructed transportation before winter supplies of provisions, &c., had been
procured.

The 1883 DotMR (p. 446) described the current developments at the mine:

Almost parallel with the Atlantic [sic] lode, and intersecting the same near the line of
the Monarch and Buffalo mines, runs the Pinnery and Last Chancee vein. The property
is owned by a New York company and work thereon has been pushed during the last two years
very energetically. The mine is opened by tunnels and a shaft 400 feet in depth connecting
with the lowest tunnel. During the last season the mine supplied the company’s 10-stamp mill
near Atlanta with ore in excess of the mill’s capacity. The ore assayed an average of $100 per
ton, about 50 per cent. free gold, 20 to 30 per cent. sulphures, balance silver. The company
intend to erect a new mill, and have also made arrangements to sink a new three-compartment
shaft with hoisting-works at a more suitable place. This mine is said to be one of the richest in
the district.

The 1884 DotMR (p. 259) stated:

The Last Chance mine is owned by the Atlanta Hill Gold Mining and Milling
Company. It has a level opened about 580 feet, with the larger portion stopped above it. A shaft
is being sunk to reach the point below it to drift and open up ground in the floor of the drift.
The ore assays, in gold, $56, in silver, $32.

According to Anderson (1939), most of the ore above the main level had been mined by
the end of 1884. Some work had also been done from the shaft on two levels below the
main adit. Like the other mines in the district, the Last Chance closed in late 1884 or
1885. Hastings (1895) noted that the mine was being worked by lessees.

Parker (n.d., p. 1-5) described the property in detail.
LOCATION

The Last Chance Mine is located about one mile and a-half southeast of the town of Atlanta, in Elmore (formerly Alturas) County, Idaho. This town is reached by a good wagon road from Rocky Bar, a distance of fifteen miles, the terminus of the stage road about one day's ride from Mountain Home Station upon the Oregon Short Line R. R.

GEOLOGICAL FEATURES

The geological horizon in which this vein is found is granite and traverses a large area in an easterly and westerly direction. The vein partly of the nature of a true fissure and its characteristics are similar in every respect to the large silver bearing veins of that locality [sic]. That evidence of its true fissure nature, are the clay seams between the quartz and the country rock (granite); frequent occurrence of slicken-sides; the banded structure of the quartz in many places and its remarkable continuity in its downward course so far as developed. It differs from the neighboring veins in that it is essentially gold bearing; the main value of the others being found in their silver contents. The vein varies in width from one foot to six feet with an average estimated width of about three feet. The vein matter carries native gold and silver, the latter being in small quantities with red and black ruby (arsenical and antimonials) ore, silver glance (sulphide of silver) and a fair percentage of iron pyrites carrying considerable gold. The quartz contains free gold and necessarily constitutes the main value of the mine; after which may be placed iron sulphurates, then the silver bearing minerals in point of value. Free gold has been found disseminated through the quartz in every portion of the mine that I have worked, shaft, winzes, drifts and stopes. Sometimes it is invisible to the eye though readily seen upon crushing and panning; frequently there is found a net work of gold wires interlacing the quartz mass binding and so permeating it as to render the mass malleable rather than brittle. Near the front surface large quantities of free gold have been found and the specimens that I have seen from surface workings of this mine have been extraordinarily rich. Occasionally small bunches of extremely high grade silver bearing minerals are found associated with free gold and gold bearing pyrites.

LOCATION OF VEIN

The vein having a course almost east and west dips to the south at an angle of about 70 degrees. The claim being 200 feet in width by about 1200 feet long, and having the outcrop along the principal axis of the claim, insures the future of the property by virtue of this latter fact as the vein may be followed indefinitely on its downward dip.

DEVELOPMENT

The mine is developed by one principal vertical shaft 345 feet deep, a whim shaft 100 feet deep, three levels known as the upper level, number one level, Blacksmith tunnel, and [Brick] Pomeroy tunnel. The principal shaft is 6 by 9 in the clear, timbered throughout, with cage road and dump and ladder way. This shaft is the one to which all the developments of the mine now tend, and from which the ore will be hoisted in the future. Stations in this shaft are located at the number one level, Brick Pomeroy tunnel and at the bottom of the shaft. The vein is reached by short crosscuts in the two first named levels, which run to the north and are seen upon the map [missing from IGS's copy of this report]. The bottom of the shaft at a point 340 feet vertical from surface of shaft cuts the vein on its incline course downward. The whim shaft is located upon the west boundary line of the property and has been unavailable for operating the mine since my taking charge of it. The whim shaft starting from the surface connects with, and was used as an auxiliary of the Brick Pomeroy tunnel when it was the principal working level of the mine, now it is of no further value. The Upper Level has been driven eastward a distance of about 160 feet and stopping has been carried on almost its entire length from the abandoned workings west of the main shaft eastward. This stope has yielded a large amount of decomposed quartz which carried free gold in quantity.

The Number One Level has been stope up for a considerable distance to this upper level east of the main shaft, and upon its further extension east will yield a large amount of

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valuable stoping ground as may be seen by reference to the map [missing from IGS's copy of this report].

The Blacksmith Tunnel has virtually been worked out and owing to the caved condition of the stopes will not be apt to yield much.

The Brick Pomeroy Tunnel Level has been developed for a considerable distance and has its entrance from the surface at a point more than 1500 feet from its present face. This has in the past, been the main outlet of the mine, but owing to the long tram involved it was deemed advisable to sink the main vertical shaft which later developments have proven to have been a judicious move. There is in the stope of this tunnel from the main shaft west a considerable quantity of quartz which in places is as much as eight feet in width. Here and there small horses of country-rock have been found but these cut no material figure in the mine developments. Along the floor of the tunnel, I have sampled for a continuous distance of over 275 feet between the west end of the mine up to the winze and found the quartz to yield over $40 per ton in gold and silver. With this information it was deemed advisable to prospect the ground below this level and in order to do so I sunk a winze 100 feet in depth at the point shown on the map [missing from IGS's copy of this report]. On its downward course the same characteristic gold and silver bearing quartz was found and at the place in this winze that is colored brown upon the map a large stope of extraordinarily high grade ore was found and partly mined. The main shaft was then sunk which, when connected by a drift to the winze would give a good working grade and drain the winze. The vein at the point of intersection by the shaft was about three feet wide and carried gold and silver to the value of over $150 per ton. The drift was then driven westward and connection made with the winze in very rich quartz. The character of ore taken from this drift is largely found in the ore pockets on the surface, and that may be taken as a fair average of the entire value of the ground contained between this lower level and the Brick Pomeroy Tunnel.

MINE EQUIPMENT

The mine is well equipped with machinery consisting of a six foot double cylinder Lidgerwood hoist, a sixty horse power boiler with all necessary connections; tools, shops and buildings, together with new ore bins capable of holding about 150 tons conveniently located in reference to the main shaft and wagon roads. I left large quantities of mining supplies, timber, lumber, wood, etc. and in order to secure dumping room, I located a placer claim south of the Last Chance location.

The mill is located about a mile and a half north of the mine and is new. It consists of ten stamps with the necessary plates, four Frue Vanning machines, a boiler and engine, and assay laboratory with complete outfit of furnaces, assay material and balances, etc. The capacity of the mill as proven by its operation is 22 tons of quartz through a forty mesh screen in 24 hours. The average value of the ore as determined by my working in the mill was about $21 per ton in free gold and silver with tailings consisting of iron sulphurates principally silver bearing minerals which averaged about $14.50 per ton. By running the tailings over the vanning machines, I obtained concentrates varying from $160. to $180 per ton which were sacked [sacked] and shipped to the smelting works at Ketchum, Idaho.

A test run of these concentrates was sent to the Buffalo and Idaho Silver Mining Co.'s mill and was treated there under a roasting the[n] chlorozizing process but with results that were not entirely satisfactory as that method failed to save all gold contents. The fact that this process is not applicable to all iron sulphurates has been well established in late years and I would recommend that in case the treatment of these sulphurates was determined upon at the ground, that a plant similar to the one now in use at the Plymouth Consolidated Gold Mining Company of Grass Valley, California, be used which consists of the reverberatory furnace, retorts for the manufacturing of chloride gas, (by means of common salt manganese and sulphuric acid) and the necessary vats, etc., by which means the tailings are worked to 95 per
cent of this assay value. This process is to be recommended when raw materials are cheap, freight low and no smelting plant within reasonable distance. The gold and silver by this process is transformed into a chloride which is soluble and which may be precipitated by the addition of ferrous sulfate. The difficulty of the roasting process when salt is added to the charge in the furnace consists in the fact that the moment the chloride of gold is formed it is apt to be volatilized and lost. The smelting works at Ketchum were particularly anxious to obtain sulphures from this mine on account of the iron which materially assisted them in their lead smelting, and of the gold contents which improved the grade of their base bullion. The charges were $3. per ton for smelting and they paid 95 per cent of New York quotations for the silver and $18 an ounce for the gold contained. The iron sulphures will yield about one ton of concentrates to 20 tons of ore treated and constitute no mean proportion of the daily profit of the mine. By accumulating the concentrates and making three or four shipments a year, the ore can be delivered to the smelter for a reasonable figure, certainly not over $25. per ton.

While in charge of this mine my work consisted mainly in developing it, and at no time was regular mine work (of which I mean stoping and drifting) done.

The portion opened before my time was virtually exhausted above the Brick Pomeroy Tunnel, and but little stoping ground was available when I began. The method of handling the ore was crude and expensive owing to long trams and the re-handling of the material at the tunnel entrance. The entire 345 feet of principal shaft was sunk during my administration and at an average cost of about $45 per foot. Now that it has entered the foot wall, the timbering which was so essential to the permanence of the shaft upon the hanging side of the vein may be discontinued and thus enable this cost to be reduced not less than $12 to $15 per foot. I estimated that the mine would easily produce 22 tons per day, only enough to keep the mill in constant operation.

The output of this mine should be considerable over 22 tons per day when the stopes and drifts are all operating, and mining is usually prosecuted every day in the year. What cannot be treated at the company's mill may be hauled to the Big Lode Mining Co.'s 20 stamp mill within less than a mile of the mine, and operated there on tonnage royalty or a lease from that company. I believe this mill can be bought cheap; it is first-class in every respect and can treat any surplusage of ore that may be mined at a lower cost than at the smaller mill owned by the Last Chance Company, on account of the shorter haul and greater crushing capacity of the mill.

I would advise that in future as few man-ways be carried up the stopes as may be found practicable to operate with. I made a survey for an automatic tram-way to serve the Big Lode Co.'s mill with ore from Last Chance Mine, and found the gradient sufficient to insure its successful operation, but owing to the decision of my Company at that time to operate their own mill, no steps were taken to erect it. It would cost in the vicinity of $8,000.00.

In conclusion I would state that too much care and attention cannot be given to the subject of close concentration of the product of this mine, as from the developments upon the Lower Level I hazard the prediction that they will increase in value over the estimate made by me herein.

The mine was left in the best possible condition at the time of my departure in 1886, and with the shaft down to its present depth, with the bottom level driven and so much ground all ready for stoping, it seems to me that the mine must present an enticing aspect to any one contemplating mining operations.

It has always been a source of regret that I was not able to mill the ore after developing it, for I am confident of the permanence and great value of the mine.

The Last Chance was purchased by T.N. Barnsdall in 1901 (1903 IMIR) or 1902 (Reigart and Nicolson, 1933) and combined with the Monarch and Buffalo. Barnsdall's
Atlanta Mines Company drove a crosscut from the Monarch shaft toward the Last Chance shaft. This crosscut intersected the Last Chance lode about 185 feet from the Last Chance shaft and about 140 feet below its lowest level. After about 60 feet of drifting on the Last Chance lode, operations were suspended. All the Last Chance workings were inaccessible in 1936 (Anderson, 1939).

The only recorded production from the Last Chance was in 1935, when 1,500 tons of ore yielding 60 ounces of gold and 777 ounces of silver was produced from the Buffalo and Last Chance properties. There are no surviving records of the pre-1900 production from the mine.

MINERVA MINE

The Minerva is a short distance south of the Atlanta lode on the upper part of the southern slope of Atlanta Hill. In 1936, the property included ten patented and three unpatented claims, and covered most of the southern slope of Atlanta Hill (Anderson, 1939). Of the mines located on gash veins, the Minerva was the largest producer in the district (Kiiilsgaard and Bacon, in preparation). Anderson (1939, p. 63-64) described the geology of the mine:

The Minerva lode is one of four west-northwest lodes which cross the property and the only one extensively developed. A short distance to the south another, the Alaska, has been partly developed and explored. The others have been prospected by surface cuts and shallow tunnels. These lodes are parallel and may be traced by croppings and the alignment of cuts for distances of 2,000 to 4,000 feet. They approach the Atlanta lode at a fairly acute angle. The Minerva and Alaska appear to strike the Atlanta lode about 1,500 feet northwest of the Minerva mine, in or near the workings of the Idaho Gold mine. These lodes are controlled by major fractures and are not the ordinary gash variety locally dependent on the shearing along the Atlanta lode. The known ore bodies in them lie some distance away from the Atlanta shear zone.

The Minerva appears to strike about N. 65° W. and to dip about 45° N.E. Its thickness ranges from 2 to 30 feet, the average about 8 or 10 feet. In two places, it is reported to have been displaced from 100 to 150 feet by faults of northeasterly trend [Ballard, 1928, p. 35 (citation from footnote in original)]. The lode is by no means uniformly mineralized, but the commercial ore is reported to have been confined to a shoot about 600 feet long and in places 4 to 5 sets wide. The lode matrix is extensively shattered and the ground is as heavy and difficult to maintain as that along the Atlanta lode, because of repeated adjustments along the fracture zone during and after mineralization.

The ore is very similar to that of the Atlanta lode. It shows as many periods of brecciation and mineral deposition, but, in part, it may have greater porosity and contain more drusy quartz. That in the outcrop is stained by greenish scroodie and brownish limonitic oxides, and in places is made up largely of the third-stage drusy quartz that encrusts extensively brecciated fragments of the earlier lode matrix. The primary ore is reported to contain pyrite and free gold as well as considerable ruby silver in more or less well-defined, bonanza-like pockets. It is also reported that there are large bodies of fairly uniform grade, much of which assayed about $14 to the ton in gold and silver. The gold was exceptionally
free. As much as 60 per cent of the gold was recovered by amalgamation and 25 per cent on
the tables in a concentrate worth from $100 to $200 per ton. The ore is reported to persist and
to maintain a good grade to the bottom of the winze [May, Frank: Oral communication
(footnote in original)].

The Minerva is one of the oldest mines in the district. It was one of the properties
listed by Browne (1868) as having "promise of value." After exploration through the end
of 1866 had discovered rich ore on the Minerva, William Clemens (who was a cousin of
Mark Twain, as well as a miner in various parts of Idaho for over thirty years) made plans
to bring in a mill in the following spring. During the summer of 1867, Clemens (Table 10)
pounded up a quarter of a ton of ore in a hand mortar and recovered $250 while sampling
the property. Cyrus Jacobs reported good assays and new discoveries during the summer
of 1868, and he was preparing to put the mine into production (Wells, 1983). By 1872,
the Minerva was still only developed by prospecting tunnels (Raymond, 1873).

There is no further mention of the property until 1903, when the "Alaska" was
listed as one of the district's important claims that was still idle. In 1904, the IMIR listed it
as one of several properties that had good ore in sight and that were undergoing further
development. In 1905, the Minerva Mining Company shipped some gold and silver bullion
produced from ore taken out in development. An 800-foot tunnel struck the ledge 200 feet
below the old workings. The ore assayed $19 to $20 in gold and contained some silver.
The 1905 IMIR (p. 59) noted:

Just over the summit from the Monarch, in the same formation, is situated the
Minerva Mine. This property was quite extensively developed during the past year and is
carrying a good force of men at the present time.

It is equipped with a fine 10-stamp mill and a substantial tramway 2,100 feet in
length. It carries two distinct ore courses that contain big milling values. These ore bodies
were rather shattered and disturbed at the surface, but in a new tunnel recently completed both
of the veins have been cross-cut at a depth of about 300 feet vertically below the outcrop.

The main vein is twenty-eight feet wide and shows a wide pay streak of the
characteristic blue-gray quartz of this district mixed with some brown oxide quartz that carries
high values in gold, some average samples several feet in width showing as much as $38.00 to
$40.00 per ton.

The mill was operated on some test runs from this new development for a short time
during the fall and demonstrated that the tailings would need additional treatment by cyanide
or some other method for the high recovery of the total values.

The mill is well equipped and the development now in progress promises a very
extensive reserve of profitable ore. It is being handled in an intelligent, practical manner and
seems destined to become an important dividend payer.

Activity continued at the Minerva in 1906. The mine had two tunnels, the longest
of which was 850 feet. According to the 1906 IMIR (p. 58-60):

South of the Monarch mine, over the crest of the Atlanta ridge, the Minerva mine is
developed by a total of twenty-six hundred feet of cross-cut tunnels, drifts and raises, of which
six hundred fifty feet was driven during 1906.

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Table 10. Companies operating at the Minerva Mine.

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Officer</th>
<th>Date Incorporated</th>
<th>Charter Forfeited</th>
<th>Year(s) at Mine</th>
</tr>
</thead>
<tbody>
<tr>
<td>William Clemens</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1866-1867?</td>
</tr>
<tr>
<td>Cyrus Jacobs</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1868-?</td>
</tr>
<tr>
<td>Minerva Mining Company[^]</td>
<td>W.C. McElheney,</td>
<td>2</td>
<td>2</td>
<td>1905-?</td>
</tr>
<tr>
<td></td>
<td>President</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minerva Milling and Milling</td>
<td>James R. Sterrett,</td>
<td>August 1, 1908;</td>
<td>December 2,</td>
<td>1908-1930</td>
</tr>
<tr>
<td>Company[^]</td>
<td>President</td>
<td>reinstated:</td>
<td>1918;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>December 31, 1920</td>
<td>1937</td>
<td></td>
</tr>
<tr>
<td>Frank May</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1931-1953</td>
</tr>
<tr>
<td>Frank May, Bad Brown, and</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1938-?</td>
</tr>
<tr>
<td>associates</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Little Queens Mines, Inc.</td>
<td>H.D. Hollenback,</td>
<td>April 22, 1949</td>
<td>2</td>
<td>c.1951-1959</td>
</tr>
<tr>
<td>(lessee)</td>
<td>President</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frank May Estate</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1954-?</td>
</tr>
<tr>
<td>Atlanta Gold Corporation</td>
<td>Olaf Tolpinrud,</td>
<td>March 6, 1985</td>
<td>1997</td>
<td>1988-?</td>
</tr>
<tr>
<td></td>
<td>President</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Minerva Mine has been part of the Atlanta Gold property (Table 5) since 1988.

[^]The relationship, if any, between these two companies is not known. The full name for the Minerva Mining and Milling Company rarely appears in published reports discussing the mine.

[^]Information not available in Idaho Geological Survey’s files.

This property carries two large fissures containing big shoots of fine milling ore, five to fifteen feet wide, consisting of a shattered quartz and talcy gangue that averages about fourteen dollars per ton in gold and silver, of which a high percentage is gold.

The ore is mined in overhead stopes with square set timbering. It is conveyed through a long cross-cut tunnel from the mouth of which it is transferred by a Leschen two bucket aerial tram to a mill lower down the mountain side on the Yuba River slope.

The mill is of ten one thousand pound stamps, equipped with copper plates and one Willey concentrating table. There is also a cyaniding plant in course of construction to treat the tailings, which contain about half of the gross value of the ore, the balance being saved as free gold on the plate.

This mill was not run to its full capacity, but nevertheless made a large production of precious bullion during the year and affords a handsome demonstration of the importance of deep development on the fissures of this district. Before the long tunnel was run that tapped the ore bodies of this mine at a depth of several hundred feet, the proposition was looked upon
in a skeptical manner, for the cropping of the vein and its shallow developments were very badly shattered, disturbed and low grade.

This company is running its mill with steam power and using cord wood fuel at a cost of five dollars per cord. Its new cyanide plant is of the Gavis type and of forty tons a day capacity, and it is proposed to install water power with which to operate the entire plant during the summer of 1907.

The cost of timber at this mine is six and one-half cents per lineal foot, and lumber is twenty-three dollars per thousand. The cost of transporting supplies from the railway ranges from one and a half to three cents per pound, according to the season, which will give an idea of the conditions under which this camp has operated.

The Minerva mine and mill employs an average of about thirty men, and the wages for miners is $3.50 per day of eight hours; laborers, $3.00 per day; timbermen, engineers and blacksmiths, $4.00 per day of eight hours. Mr. W. C. McElhenny of Pittsburgh, Pa., is president of the company. Mr. W. J. Keough of Atlanta, Idaho, is superintendent in charge of the work.

Work continued at the Minerva in 1907. The mill operated part of the year, and both concentrate and bullion were shipped. The main adit was 950 feet long, and several crosscuts added up to approximately 700 feet of workings. The 1907 IMIR (p. 94-96) reported:

The Minerva mine, adjoining the Atlanta lode to the south, is opened on a large lateral vein, carrying fine values in gold and silver, of which 50 to 60 per cent are saveable by simple plate amalgamation. This property is equipped with a 10-stamp mill, which, however, still needs additional equipment for a more complete saving of the values, and to provide for the dividend end of the operation. This company will probably be able to profit by the experience of its neighbors on secondary methods of saving, as the ores are very similar in character.

In 1908, the Minerva operated its mill in October, November, and December. Large shipments of bullion were made to Boise as a result of this mill run.

The Minerva and the Pettit were the largest producers in the district in 1909. The mine made a small shipment of bullion that was produced during mill tests the previous year, and rich concentrate was shipped to Salt Lake smelters. Most of the gold was recovered by amalgamation. The 1909 IMIR (p. 55-56) stated:

South of the Monarch mine, over the crest of the Atlanta ridge, the Minerva Mining Company has been operating for the past year and a half under the management of Mr. Thomas Keough.

The property carries two large fissures, containing big shoots of milling ore from 5 to 15 feet in width filled with a shattered quartz gangue carrying values of about $14 per ton in gold and silver.

The property is equipped with a 10-stamp mill and cyanide plant, operated by water power. The mill has operated profitably throughout the year, and I am informed that it is the contemplation of the management to increase the size of the mill in the near future.

The Minerva was the largest producer of bullion in Elmore County in 1910. The 20-stamp mill and six Johnson concentrators were operated constantly. According to the 1910 IMIR (p. 11):

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The Minerva Mining Company's property, which lies south of the Monarch, has operated during the year very successfully, the milling plant having been doubled in capacity, to twenty stamps. The ore is quite different from the ores developed in the Bagdad-Chase and Monarch Mines, as it is extremely free, sixty percent of the values being saved in the battery and five percent in the sands upon the tables, the concentrates varying from $100.00 to $200.00 a ton. The ore occurs in a quartz filled fissure in granite and varies from two to ten feet in width. The mine is opened by tunnels, and additional depth can be economically obtained by driving a tunnel from the mill level.

The Minerva operated from January to October 1911 and produced bullion from its 20-stamp mill. Most of the gold was recovered from the oxidized ore by amalgamation, but the concentrates were cyanided. The 1911 IMIR (p. 44) noted:

At Atlanta the Minerva Mine was successfully operated during a large part of the year with a 20-stamp mill. This is one of the best veins in the district and contains the easiest milling values of any of the Atlanta deposits. It has been quite continuously worked, however, with little development ahead, and was shut down in the fall for that and other reasons. Its further activities will probably have to await the completion of a long cross-cut tunnel, for which there is an excellent site, and the vein is going down strong in the bottom of the present working. This has been one of the most successful mines in the Atlanta District and has a bright future, if sufficient capital is expended in its further development.

In 1912, the Minerva was idle, but the mill treated a small amount of ore that was on hand. The property remained closed until 1918.

Cunningham (1937, p. 3) contained the following information on the property:

I am glad that I am able to give you considerable data on the Minerva Property, as I personally made a copy of the assays derived from sampling the ore-shoot in the Lower Tunnel level, the bottom workings in the mine at that time 1917. After that date a winze was sunk in the vein from this Lower Tunnel but I have no records of this work. I am enclosing herewith the original copy of these assays [missing from IGs's copy of this memorandum]. I personally was through the mine several times when the work was in full blast and the mine on profitable production.

I have before me a letter written by W.J. Keough who was Supt. of the property during it's producing days, written April 18th. 1912 to C.N. Miller of San Francisco for whom I superintended properties for several years. This letter was written in connection with negotiations for a deal.

Extracts from the letter state:

The approximate production of the mine to date is a little over $345,977 dollars U. S. Mint returns.

"As to changing of ore with depth and more sulphides, I do not believe it will change greatly. At our present deepest workings while the ore contains more sulphides than higher up, it is also richer in free gold. This has shown all through the stopes."

"We worked out practically all the profitable ore above the tunnel level. It is sure under foot but the mine will have to [be] opened before milling can be resumed."

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"In conclusion will say that while I firmly believe the property to be of
great merit I do not advise you or any mining man to come on expecting to
see ore opened up and to be able to start up the mill at once.
Mr Keough did not give any particulars regarding the value of the ore in his letter.
Some random noted [notes] that may be of value to you:—

**Minerva:**
- 68 per cent free coarse gold in ore.
- 1 ton [ton] of concentrate to 100 tons of ore
- Bullion worth about $12 dollars per oz.

Minerva records show that Mining and Milling costs for 1910 and 1911
including every item of expense is less than $4.50 per ton of ore.

Work resumed at the property in 1918. According to the 1918 IMIR (p. 86):

The Minerva Mine carried a small crew throughout the year, which was increased in
December, and a systematic plan of development work is being carried out under a competent
manager with a view to sinking on the main ore shoot, which was formerly a handsome
producer of good gold values. In the event this preliminary test proves satisfactory, it is the
intention of the Company to run a long tunnel and tap the deposit at the mill level, which will
give several hundred feet of new backs. Considerable talk has been in the air of a big
consolidation of the older properties of this district, embracing the Monarch, Buffalo and other
mines, which have extensive proven ore resources, but it is believed that the venture has been
temporarily set aside to await more favorable conditions.

A small crew continued developing the property the following year, and about 600
feet of crosscutting was done. The 1919 IMIR (p. 123) noted:

The Minerva, a closely parallel vein [to the Atlanta lode], was formerly operated
through a cross-cut tunnel to a moderate [sic] depth on the vein and produced several
hundred thousand dollars worth of $10 ore, principally gold. New development on this
property is being intelligently administered by sinking a winze on the main ore shoot from this
old development tunnel with a view to driving a long cross-cut tunnel to tap the ore course
several hundred feet deeper. This work has given very satisfactory results so far and is
showing a handsome shoot of the characteristic values formerly mined.

Despite this optimistic report, the work was discontinued when the winze was only
50 feet deep (Anderson, 1939). Ballard visited the district in 1925 and obtained the
following information on the Minerva (Ballard, 1928, p. 34-36):

The Minerva Mine is located about two miles due south of Atlanta with the main
camp in the Yuba River about four miles above its junction with the South Fork of the Boise.
The camp is easily reached by auto over a good road during the open season.
Ten patented and three unpatented quartz claims comprise the group, covering the
steep southern slope of Atlanta Hill from its summit down to Grouse Creek, a fork of the Yuba
River. The property has been idle for several years and the underground workings were
inaccessible in 1925. Maps were available, however, and much data was supplied by those in
charge of the property.

Due to their opposite dips, the Monarch vein or Atlanta lode, and the Minerva vein
should join at a comparatively shallow depth. The similarity of the ores and the presence of
antimonial silver sulphides may indicate a common origin, such as a junction of the two veins.
would afford. The silver minerals here are a rather prominent constituent of the ore even more so than at the Monarch to the north.

The old mill, now wrecked, is near the southern limits of the property on Grouse creek from which water was obtained for the camp and mill. An aerial tram connected the mill to the mine 2000 feet north of and 1350 feet above the mill ore-bin.

The portal of the main adit crosscut at the head of the tram was caved and the following data were obtained from maps. The crosscut extends northerly about 900 feet to the "north" vein which, at the place of intersection, strikes east and dips 45°N. In all, about 2200 feet of drifting was on the vein at this level, mainly to the east of the main adit crosscut. The vein was stopped overhead for a distance of about 500 feet each way from the crosscut to the next level, 150 feet above. Here, a short crosscut south, intersected what is called the "south" vein, from which some ore was stopped. Ore was stopped out on the main or north vein, above this upper level, but nothing definite could be learned about the size of the stopes. The ore was reported to be free-milling.

About 600 feet above the main lower level, as measured on the dip of the vein, are several hundred feet of shallow workings, now caved, from which rich gold ore was taken in early days. The map shows no connection between these and the later workings below. Two prominent faults striking northeasterly, cut through both the older and later workings, and evidently, displaced the vein from 100 feet to 150 feet to the right. From the amount of cross-cutting done at the first fault encountered, the operators had considerable difficulty in locating the continuation of the vein.

Several specimens of ore from the Minerva were supplied to the writer by those in charge of the property. It is essentially auriferous pyrite in quartz gangue. Small bunches of what appeared to be ruby silver were scattered throughout the quartz. Specimens of this showed both the dark and light varieties.

This vein, one of the east-west systems of "branch" veins from the Atlanta lode, would unite with the latter about half a mile to the east of this property on its calculated strike, and at less than 800 feet beneath the Monarch workings on its calculated northerly dip. The fact that the Monarch and Minerva veins both carry ruby silver with no known deposits elsewhere nearby, in connection with the probability of a junction at depth, indicate very strongly that the two deposits are of common origin, although not necessarily connected.

Such field evidence as could be obtained indicated that the Atlanta lode, rather than such veins as the Minerva vein, was the source of the mineralization. As nearly as could be ascertained, the older "branch" veins elsewhere along the Atlanta lode were more strongly mineralized near their junction with this main lead than at considerable distance therefrom, which would further confirm the belief regarding the source of mineralization. This has some bearing on any future prospecting of other veins at this place.

The Minerva was apparently sold under attachment around 1930. The mine was idle until 1936, when mining resumed on a small scale (Kiilsgaard and Bacon, in preparation). The 1938 IMIR (p. 153) noted: "Frank May, Bud Brown and associates acquired the Minerva property and constructed a 50-ton concentration, amalgamation and flotation mill and power plant with plans for an extensive development and production program outlined for the coming year." The mill was built at the old mill site on Decker (formerly Grouse) Creek. A new tunnel, the Lower Adit, was driven north-northeast for 850 feet, where it intersected a major shear zone about 200 feet below the Main adit. The Lower Adit was continued northwest along the shear zone for about 100 feet before exploration was terminated because of World War II (Kiilsgaard and Bacon, in
preparation). Minor amounts of ore were produced in almost half of the years between 1936 and 1942, and 2,681 tons of old tailings from the Minerva dump was milled and shipped in 1940.

Around 1951, Little Queens Mines, Inc., leased the property and resumed development. The Lower Adit was rehabilitated and extended northwest along the shear zone for about 1,000 feet. Much of the drifting was actually done parallel to the shear zone, because the heavy ground made it extremely difficult to keep the adit open in the shear zone. Near the end of the drift, a 120-foot, near-vertical raise was driven along the shear zone to connect with the 50-foot winze that had been sunk from the Main level. However, only scattered showings of mineralized material were found in the drift and the raise. Little Queens Mines discontinued exploration in 1956 before a connection was made between the two levels (Kiilsgaard and Bacon, in preparation). In 1958 and 1959, the company reported it was installing a 50-tpd mill on the Minerva property. No further mention is made of this mill, but may have been the building shown in Figure 43.

No underground work has been done at the Minerva since 1956. However, the property was mapped and drilled by Atlanta Gold Corporation as part of its exploration program. Atlanta Gold acquired the property in early 1988. Figures 43 and 44 show the mine in 1994.

Total recorded production from the Minerva from 1905 to 1942 is 65,234 tons of ore and 2,681 tons of old tailings. This material yielded 17,357 ounces of gold and 43,912 ounces of silver. Although there appears to have been at least minor production soon after the mine was discovered, there are no records of tonnage produced or metals recovered for any ore mined before 1900. If any ore was produced as a result of Little Queens Mines' exploration program, this material was not differentiated from the ore produced from the company's other operations.

SILVER TIDE MINE

The Silver Tide is just north of the Monarch. It is on a lateral vein that branches from the Atlanta lode about 400 feet northeast of the Monarch shaft. The property was discovered and worked in the early days, but little underground work was done on it (Anderson, 1939). Anderson (1939, p. 62) described the geology:

The vein is comparatively narrow, except in the vicinity of the Atlanta [lode] where the combined cropping of both is about 130 feet across. Although rich streaks and pockets have been found, its ore is reported to be low-grade. This lode was not positively identified on the St. Joe No. 6 level, but, like so many of the oblique laterals, it has probably diminished in size and tenor with depth.

By 1874, the property had been sold by its original owner (Table 11). The new company attempted to develop the mine, but ran into difficulties. According to Raymond (1875, p. 310):
Figure 43. Mill building and tailings at the Minerva mine in 1994 (photograph by Virginia S. Gillerman, Idaho Geological Survey).
Figure 44. Portal of the open adit near the mill building at the Minerva mine in 1994 (photograph by Virginia S. Gillerman, Idaho Geological Survey).
Table 11. Companies and individuals operating at the smaller properties.

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Officer</th>
<th>Date Incorporate d</th>
<th>Charter Forfeited</th>
<th>Year(s) at Mine</th>
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</thead>
<tbody>
<tr>
<td>Silver Tide Mine</td>
<td>John L. Tillman</td>
<td>---</td>
<td>---</td>
<td>7-1875</td>
</tr>
<tr>
<td>Buffalo and Idaho Gold and Silver Mining Co.</td>
<td>A. Allegewehr, Managing Director and Superintendent</td>
<td>1</td>
<td>1</td>
<td>1875-</td>
</tr>
<tr>
<td>Property combined with the Buffalo Mine (Table 3) after 1875.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Greenback Mine</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>W.R. DeFrees</td>
<td>---</td>
</tr>
<tr>
<td>Greenback Mining Company</td>
<td>1</td>
</tr>
<tr>
<td>The Monarch Gold and Silver Mining Company</td>
<td>1</td>
</tr>
<tr>
<td>Property combined with the Monarch Mine (Table 4) after 1869.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Washington, Gold Nugget, and Wonder</th>
<th></th>
</tr>
</thead>
</table>

Information not available in Idaho Geological Survey’s files.

About 50 feet north of the Atlanta is the Silver Tide lode, formerly owned by John L. Tillman, but now by the Buffalo and Idaho Gold and Silver Mining Company. In the summer a shaft was sunk on the lode 22 feet deep. This, however, went outside of the south wall. Owing to this fact, and the large amount of water in it, it was abandoned, and a cross-cut tunnel was run 110 feet long, which the company intends to extend this winter 100 feet farther, in order to strike the vein. The lode shows a large and bold outcrop, and, in an open cut some distance above the mouth of the shaft, a streak of very good-looking ore. The best ore assays about $200 per ton.

After being purchased by the Buffalo and Idaho Gold and Silver Mining Company, there is no further mention of the Silver Tide. No production records exist for this property.

GREENBACK MINE

The Greenback Mine is in the upper part of Quartz Gulch. It is to the north of and slightly below the Silver Tide, Buffalo, and Monarch mines (Figure 3). Anderson (1939, p. 69) described the geology of the mine:
The fracture zone is as much as 16 feet across and has the usual strike and dip of the west-northwest fracture system. It may be traced in an east-southeast direction for nearly 2,000 feet by the alignment of old cuts and damps to within a few hundred feet of the Atlanta lode.

The lode comprises thin veins and small bunches of quartz scattered throughout the fractured granitic rock. Most of the quartz is the dark gray and drusy varieties, partly iron-stained. It is reported that small pockets of rich ore have been mined along different parts of the lode.

The Greenback was discovered by W.R. DeFrees (Table 11) in November 1865. Almost immediately, he made plans to acquire a stamp mill and a sawmill for the property. The sawmill was running and the stamp mill was nearly completed by October of the following year. Exploration during 1866 determined the lode in the Greenback was 22 feet wide and extended to a depth of 90 feet (Wells, 1983). The initial operation of the mill, beginning in July 1867, had mixed results (Wells, 1983, p. 56):

W.R. DeFrees' mill, the one which started in July, did not show to great advantage at first. Indeed, it broke down, and although it was expected to resume on July 6, more than a month went by while the operators worked to get it going again. Then a preliminary fifty-six-pound lot was managed by mid-August, with a promising return of thirty-two ounces. At last, an initial twenty-ton run commenced on August 19 so successfully that the mill had to stop every two hours to clear the amalgamator until the entire supply of mercury (eight flasks) was exhausted. (The amalgamating practice at that time apparently did not include retorting to recover mercury at the mill, although Silver City mills retorted their amalgam. Because the better ore was not yet being milled, this beginning looked promising indeed. After the first 5% tons—the part actually worked before the mercury supply ran out—produced about $6,000, W.R. DeFrees left Boise at the end of August on a trip east to raise capital to develop what he now could represent as a proven mine and mill. His milling process, however, was probably losing three-fourths of the value, including all of the silver. But even at that, it would pay.

A second run of sixteen tons, begun after more mercury had been obtained from Idaho City, was completed on September 17. Although this run was thought to have been much better than the first, work in earnest waited for another year while capital was being raised. The district was not shut down entirely, however; the mill continued to test batches of ore for two other companies.

Browne (1868, p. 521) noted: "The Greenback Mining Company's mill, located at Atlanta, is run by water power, and is now working rock from this lode, although imperfectly, from want of proper appliances and skill. The result, however, is very satisfactory."

The following year, DeFrees sold his interest in the Greenback. The new owners originally planned to reopen the mill when the road became passable, but ended up developing the mine instead (Wells, 1983). Raymond (1870, p. 249) described the mill, which was idle in 1869:

[The Greenback (water-power,) owned in Northern Indiana, having ten stamps, four pans, and two settlers, and connected with the mill a sort of Dutch oven for burning ore, for what particular purpose did not appear.

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The Greenback was sold to the Monarch Company in 1869 (Wells, 1983).

Anderson (1939, p. 69) reported: “In 1936, some work was under way on the lower of two short, closely-spaced tunnels. The upper, about 50 feet long, follows the lode just under the outcrop. The other, about 70 feet long, is no more than 40 or 50 feet lower and is in part beside the lode and in part around an old cave.”

There are no reliable records of production from the property, although Wells’s (1983) account of the mill runs suggests that at least a small amount of amalgam was shipped from the Greenback.

PAYMASTER MINE

The Paymaster is on one of the gash veins on the north side of the Atlanta lode. The only information available on this property is from Anderson (1939, p. 68-69):

The Paymaster claims lie along a tributary of Quartz Creek, less than half a mile west of the Monarch, on one of the lodes of the west-northwest system. Some work was done on the lode in the early days, but the most extensive development, principally a tunnel with about 260 feet of workings including a short crosscut and longer drift (fig. 7 [Figure 45]), was made in recent years. This tunnel is in the bottom of the gulch and a short distance below an old 50-foot adit and a series of five cuts which extend west-northwest up the slope to the top of the ridge. An old tunnel below and on the opposite side of the gulch is caved.

The lode strikes about N. 80° - 85° W. and dips vertically or steeply south. It was traced in a west-northwest direction to the crest of the ridge about 500 feet from the bottom of the gulch, and may join the lode on the other side of the next gulch. This probable extension of the lode crosses the Yuba divide and indicates an overall length of not less than 2,500 feet, so that it is one of the longest laterals in the district. The zone of fractured granite rock is as much as 15 feet wide on the surface and in places is largely quartz, much of it of the drusy variety.

In the 50-foot adit the lode structure appears to be fairly simple, but in the main lower tunnel the structural relations appear to have been complicated by much post-mineral movement, considerable of it along fracture zones which cross the lode (fig. 7 [Figure 45]). The ground is exceedingly heavy and the walls and roof concealed by heavy, closely spaced timbers and lagging. The zone of shearing appears to be considerably wider than that above and is not entirely exposed by the crosscuts and drifts. Since slips of northeast trend are conspicuous and have brought unaltered granite rock against the altered and have displaced segments of the lode laterally to the northwest (fig. 7 [Figure 45]). The apparent size of the zone of shearing may be due in part to the post-mineral faulting.

Bunches and small discontinuous lenses of shattered quartz as much as 10 inches thick are scattered through parts of the crushed and altered rock. Seams of black, containing crushed ore are also conspicuous. In addition to the drusy quartz, the ore contains some of the older fine-grained quartz containing arsenopyrite.

In 1941, the Paymaster was reported to have produced 2 tons of ore, which yielded 5 ounces of gold and 3 ounces of silver. This is the only known production from this property.
Figure 45. Geologic sketch map of the underground workings at the Paymaster Mine (Anderson, 1939, Figure 7).
JESSIE BENTON MINE

The Jessie Benton, another of the original mines in the district, is on the east side of Quartz Creek some distance up the slope from the creek (Figures 3 and 5). By 1936, the Jessie Benton had been combined with several other nearby prospects (including the Atlanta Eagle and the Moultrie) to form the Bixby Group. At that time, there were several large dumps on the property, and all at the associated adits were caved (Anderson, 1939). Anderson (1939, p. 67) described the geology of the property:

The Jessie Benton lode is one of the longest in the district and has been exposed on both sides of Quartz Gulch. It crosses the creek below the Big Lode and extends east-southeasterly up the slope to the top of Atlanta Hill and apparently passes over into Montezuma Gulch not far from the Atlanta lode. Mining, however, has been confined to the section between the creek and the top of the hill, especially the part about half way up the slope. Several adjacent parallel lodes do not appear to be as long nor as well mineralized as the Jessie Benton. Although the lodes are continuous for considerable distances, they pinch and swell, and in part are barren. In places, the lodes are as much as 10 feet thick, in other places no more than a few inches.

The ore which remains on the dumps of the Jessie Benton contains considerable finely crystalline arsenopyrite and pyrite. The outcrops are partly stained by greenish scorodite and brownish limonitic oxides. Some of the ore mined in the early days was high-grade for 100 tons of ore treated by the Buffalo mill in 1883 was worth $123.53 per ton.

When the Jessie Benton was located is not known, but Browne (1868) included the property in his list of nearby lodes that were believed to be equal to the Atlanta lode in extent and richness. In 1872, Raymond (1873) included the Jessie Benton in a similar list of promising properties which had only minor amounts of development. The 1881 DotMR and Strahorn (1881) also mentioned the Jessie Benton, but gave no information on the property.

The 1883 DotMR (p. 446-447) stated:

The Jessie Benton mine, owned by Messrs. Hale & Tinis [Table 12], is situated about a half mile north of Atlanta lode. It is said to be a very fine property, opened by tunnels, drifts, &c., showing ore, bodies of high grade. It is claimed that 100 tons of this ore worked at the Buffalo mill last season were worth $123.53 per ton.

The 1903 IMIR (p. 59) stated: “The Burton, a San Francisco corporation, has taken over the Jessie Burton and Moultrie mines and is working six men on them this winter.”

According to the 1904 IMIR (p. 63):

29It is believed that this description is of the Jessie Benton. “Burton” is almost certainly an error on the part of the Mine Inspector.

30The Moultrie is downhill and to the west of the Jessie Benton, and is on the same vein.
Table 12. Companies and individuals operating at the Jessie Benton and associated properties. Dates in parentheses indicate indefinite or uncertain information.

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Officer</th>
<th>Date Incorporated</th>
<th>Charter Forfeited</th>
<th>Year(s) at Mine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jessie Benton Mine</td>
<td></td>
<td></td>
<td></td>
<td>(1883)-?</td>
</tr>
<tr>
<td>Hale and Tinnis</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1903-1909?</td>
</tr>
<tr>
<td>Burton (Benton?)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1909-1931</td>
</tr>
<tr>
<td>Corporation</td>
<td></td>
<td></td>
<td></td>
<td>1932-1</td>
</tr>
<tr>
<td>G.L. Bisby</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>G.L. Bisby Estate</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
</tbody>
</table>

| Atlanta Eagle Mine    |         |                   |                   | (1905)-1909     |
| Atlanta Eagle Company | 1       | 1                 | 1                 | 1909-1931       |
| G.L. Bisby            | ---     | ---               | ---               |                 |
| G.L. Bisby Estate     | ---     | ---               | ---               |                 |

1Information not available in Idaho Geological Survey’s files.

The Grey Eagle\(^1\) has a vein of quartz 40 feet wide that crops out boldly at the surface for several hundred feet in length. The Jessie Benton, next to the Monarch, is being most actively developed. This winter a shaft is being sunk on a strong shoot of ore, carrying fifteen to twenty-five dollars per ton. A stamp mill of 20 tons daily capacity was erected to treat the ore of this mine last summer, which was gotten into commission during the fall, and made a very satisfactory run, making a high percentage of saving—so much so that the company are planning its enlargement next summer.

The Jessie Benton mill was closed during 1905 while additional machinery was installed. The 1905 IMIR (p. 59-60) described activities at the Atlanta Eagle property:

Below the Monarch mine, to the north, the Atlanta Eagle Mining & Milling Company own a group of eight claims\(^2\) and developed considerable good ore during the past year and now have a shoot exposed that is nearly 200 feet long with an evidence of extending an additional 100 feet further on the strike of the vein.

\(^1\)The exact location of the Grey Eagle is not known. However, from the context, it is believed to be either on a vein adjacent to the Jessie Benton or on an extension of the Jessie Benton vein.

\(^2\)The exact location of these claims is unknown. However, this description suggests they were close to the Jessie Benton, which was also below and to the north of the Monarch. This interpretation is supported by the 1909 unification of the two properties.
This ore shoot will average about 3 1-2 feet wide and $18.00 per ton in gold and silver, of which fully four-fifths are gold. This company also have a new mill of fifteen tons daily capacity, and several test runs of the ore were made showing an extraction of 55 per cent of the values by amalgamation, 22 per cent of the remaining values by concentration and 80 per cent of the balance by cyanide treatment.

The Jessie Benton and Atlanta Eagle mines were operated in a limited way in 1906. Concerning the Atlanta Eagle, the 1906 IMIR (p. 60) noted:

The Atlanta Eagle Company’s plans were interrupted by the San Francisco disaster, where the owners of this property reside. This property has two good veins, in which important ore shoots are known to exist, and I am informed that the affairs of the company have been adjusted, and that extensive development of the property will shortly be undertaken.

By 1909, the Jessie Benton and Atlanta Eagle properties had been combined into a single group under a new owner. According to the 1909 IMIR (p. 56-57):

This property, formerly known as the Jesse Benton and Atlanta Eagle mines, lying north and west of the Bagdad-Chase and Monarch mines, has recently come into the control of Mr. G. L. Bixby and preparations are being made to equip and develop the property in a systematic manner during the coming year. This property, which is one of the earliest discoveries in the camp, is reported to have produced upwards of $80,000 from shallow surface workings, and under good management is likely to again figure in the production of this district.

In 1917, Soper (1917) noted that the Jessie Benton was one of the lateral veins that was being explored by the St. Joseph Lead Company in conjunction with that company’s development work at the Boise-Rochester Mine. However, the IMIR for 1922 listed the “Benton Group” as being owned by Gill Bixby. By the following year, the owner had been changed to Gill Bixby. The IMIRs from 1924 until 1931 listed the owner of the Benton Group as G.L. Bixby. From 1932 until 1937, the owner was the G.L. Bixby estate; ownership of claims was not reported in the IMIRs after 1937.

The Jessie Benton and Grey Eagle properties were being rehabilitated and developed in 1938, 1939, and 1940. No further mention is made of these properties.

The only recorded production from the Jessie Benton is in 1905. In that year, the mine produced 50 tons of ore, which yielded 77 ounces of gold and 59 ounces of silver.

There are no accurate records for ore produced before 1900.

BIG LODE (LEONORA) MINE

The Big Lode (or Leonora) Mine is in Quartz Gulch about halfway between the Tahoma and the Monarch (Figures 3 and 5). The main tunnel was near the creek, and its portal led directly to the associated mill (Anderson, 1939). Anderson (1939, p. 67) described the geology:

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The alignment of old cuts and dumps suggests that several lodes cross the property, but apparently only one, the Leonora, has been mined. It, as well as the others, appears to strike about N. 65° W., and to dip steeply northeast. Whether or not the northeast dip is maintained with depth could not be learned. The lodes possess considerable length; the Leonora alone has been traced for more than 1,000 feet. It is reported to have an average thickness of 15 feet, but, to judge from surface exposures, the others can be not more than 8 feet thick and most of them must be considerably less.

The mineralization resembles that in other lodes on Atlanta Hill. The ore exposed in the outcrops shows the three main varieties of quartz in breccias. Drusy quartz is abundant in some places as are limonitic oxides and scorodite. Sulphides were sufficiently abundant at depth to be a serious obstacle in the recovery of silver and gold by stamp amalgamation. The ore first mined was reported to be rich, but at a depth of 60 feet the lode is reported to have increased in size. The gold and silver were thus more widely dispersed and the tenor of the ore correspondingly diminished. Early-day assays showed the ore to run about $15 a ton in silver and about $8 in gold.

The Leonora was discovered in 1866 and was the most promising discovery made that year (Wells, 1983). According to Wells (1983, p. 55):

It did not resemble the Atlanta lode at all. It was in gold rather than silver, and although it ranged from very thin up to two inches in width, in its thinner parts it was almost a solid sheet of gold; indeed, the owners thought that they took out almost $10,000 worth of ore in a few hours one day.

In 1868, the Leonora attracted the attention of one of the district's indefatigable promoters (Wells, 1983, p. 57-59):

[W.R.] DeFrees (Table 13] now had acquired another property—1,800 feet in the Leonora and 4,000 additional feet adjacent—along with the Northern Mining Company's ten-stamp mill, which he planned to put into use on his new mine. In the meantime, he set out for the East again to promote another big mill project to serve his new property. ... Some milling was managed during the winter of 1868 and 1869 on DeFrees' Leonora. A ten-stamp mill processed 130 tons for a $9,000 recovery before the end of December, and because the mill was inferior (lacking pans, concentrators, and separators), the result was considered fine. Another $6,060 in gold came out of Leonora ore in January, with only half of the gold and none of the silver recovered. ...

William R. DeFrees, after all his efforts to get the Leonora going, went broke early that spring (1869). When he was unable to pay off a $3,000 note due April 9, his creditors attached the Leonora mine and mill.

By the early 1870s, the Leonora was again producing ore. Raymond (1873, p. 204-205) described the activities for 1872:

The Leonora lode runs nearly due east and west, dips south, is from 3 to 5 feet wide, and carries, on an average, about 2 feet of ore. It was worked last summer by S. Mattingly. The yield of the ore was not ascertained, it is, however, known that several samples of tailings assayed at the rate of $90 per ton. There are three shafts on the lode, two of them are 100 feet apart, and measure respectively 85 and 60 feet in depth; the third is only 40 feet deep. Levels
Table 13. Companies and individuals operating at the Big Lode (Leonora) Mine. Dates in parentheses indicate indefinite or uncertain information.

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Officer</th>
<th>Date Incorporated</th>
<th>Charter Forfeited</th>
<th>Year(s) at Mine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big Lode (Leonora) Mine</td>
<td></td>
<td></td>
<td></td>
<td>1866-1868</td>
</tr>
<tr>
<td>unnamed owners</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1866-1868</td>
</tr>
<tr>
<td>W.R. DeFrees</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1868-1869</td>
</tr>
<tr>
<td>S. Mattingly</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>(1872)</td>
</tr>
<tr>
<td>Baxter &amp; Orr (lessees)</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1876-1881</td>
</tr>
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<td>Frank T. Wyman, Agent</td>
<td>not incorporated</td>
<td></td>
<td>1882-?</td>
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<tr>
<td>Washburn Milling Company</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>(1905)</td>
</tr>
<tr>
<td>Frank T. Wyman</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1921-1933</td>
</tr>
<tr>
<td>E.B. Smith</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1934-?</td>
</tr>
<tr>
<td>C. Mohrmann, Joe Briggs, and Earl Smith</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1938-1940</td>
</tr>
</tbody>
</table>

1Information not available in Idaho Geological Survey's files.

have been run from the bottom of the shafts, both ways, and the ground above is stope out. The predominating metal in this and the lode is gold.

The Leonora was idle in 1873, but Raymond (1874, p. 247) described the property:

On the other side of the gulch, about half way between the Atlanta and the town, is the Leonora lode. A cross-cut tunnel has struck the lode, and shows a crevice 6 to 8 feet wide, with a pay-streak of 3 feet. During this season the mine has not been worked.

Only minor development work was done the following year. According to Raymond (1875, p. 310):

On the Leonora lode, the cross-cut tunnel has struck the vein, and a level has been run for 50 feet along the vein, developing a pay-streak of 2 to 3 feet of average milling-ore. Besides this no work has been done on the lode the whole year.

There was more activity at the mine in 1875. Raymond (1877, p. 212) noted:

The Leonora and Stanley lodes have been leased to Baxter & Orr for five years, together with the 10-stamp mill owned by the Gold-Mining Company of Yuba. Work is
progressing steadily on the Leonora, and Mr. Baxter says that he has now ore enough in sight to keep his mill running steadily from April to November without any further development. A run of this ore made in November yielded at the rate of $80 per ton.

By 1881, more work had been done on the property, and the 1881 DotMR (p. 176) summarized the recent developments:

The Leonora consists of 1,000 feet. The ore in this mine was at first rich, but at a depth of about 60 feet the vein suddenly increased in size and the yield in gold diminished. The vein averages 15 feet wide, and assays about $15 silver and $8 gold per ton. It would be a suitable character of ore for concentrating works.

The Leonora was sold to the Big Lode Mining Company late in 1882. The 1883 DotMR described the new owner’s activities:

Between the Atlanta and Tahona lodes is situated the Big Lode mine (formerly called Leonora), owned by the Big Lode Mining Company of Boston. The company erected a 20-stamp mill in the fall of 1883, with all modern improvements, for the treatment of free gold milling ore, with concentrator attached to collect the sulphuric.

Eldridge (1895) mentioned the Big Lode as one of several important mines that occurred on lateral veins, but provided no details on the deposit.

The 1903 IMIR listed the Big Lode as one of the important claims in the district that was still idle. By the following year, the 1904 IMIR noted that the property was being developed. The Washburn Milling Company operated a 20-stamp mill on ore from the Big Lode in 1905.

The mine was reopened in 1919 (Anderson, 1939). According to the 1919 IMIR (p. 123):

The Big Lode is another old property that has been idle for a number of years and is being reopened and tested out by a new company at the present time. It also carries the characteristic silver-gold ores of the district and some milling tests are reported to have been in progress on its resources recently.

A little gold and silver bullion from milling tests at the Big Lode Mine was shipped in 1920.

From 1921 to 1933, the IMIRs listed the Big Lode as the property of Frank T. Wyman of Atlanta. E.B. Smith of Boise was listed as the owner from 1934 to 1937; ownership of claims was not listed in the IMIRs after 1937.

Some rehabilitation and development work was done on the property in 1938. According to the 1938 IMIR (p. 153): “The Big Lode property was rehabilitated by M. C. Mohrman, Joe Briggs, both of Atlanta, and Earl Smith of Boise. The 10-stamp mill was also put in shape for operation.” Development continued for at least the following two years; there is no mention of the property after 1940. Figures 46 and 47 show the property in 1994.
Figure 46. Collapsed mill at the Big Lode (Leonora) Mine in 1994 (photograph by Virginia S. Gillerman, Idaho Geological Survey).
Figure 47. Collapsed adit at the Big Lode (Leonora) Mine, with riparian vegetation near the portal (1994; Idaho Geological Survey photograph by Virginia S. Gillerman).
Sporadic production from the Big Lode Mine between 1905 and 1949 yielded 1,078 tons of ore containing 138 ounces of gold and 221 ounces of silver. Equally sporadic production between 1921 and 1958 from nearby claims believed to be associated with the Big Lode yielded 173 tons of ore containing 47 ounces of gold and 104 ounces of silver. There are no accurate records of the production from before 1900.

TAHOMA MINE

The Tahoma Mine is in lower Quartz Gulch about a mile below the Monarch (Figures 3 and 5). There are workings on both sides of the creek, but the major development and production came from the west side of the gulch (Anderson, 1939). All workings were caved and inaccessible in 1994 (Killsgaard and Bacon, in preparation). The Tahoma Mine proper consists of four patented claims (the Tahoma, West Tahoma, North Tahoma, and Nettie), but Anderson’s (1939) discussion of the mine also includes the Baltimore claim to the south and may include additional claims along the length of the lode. Anderson (1939, p. 65-66) described the geology of the property in detail:

Several lodes extend across the property, but only the Tahoma has been extensively developed. Another, on the Baltimore claim from 100 to 200 feet to the south, has been exposed in several caved tunnels on the west side of the creek and by the main tunnel on the east side. One or two others north of the Tahoma were prospected by cuts in the early days.

The lodes appear to be parallel and, therefore, should strike about N. 50° W. and dip steeply northeast, in accordance with the general strike of the Tahoma. The strike and dip of the Tahoma are not uniform, however. Although its average trend is about N. 50° W., it varies somewhat from place to place. Its dip is difficult to determine, but on the lower tunnel on the west side of the creek is approximately 80° N.E.

The Tahoma lode is one of the largest of the west-northwest set, and has been prospected for a distance of not less than 4,000 feet. All that could be learned of its magnitude in the upper workings was that it has an average thickness of 35 feet. In the lower workings, its thickness appears to range from 10 to 40 feet, but the volume of quartz and sulphides in the lode may be somewhat less with depth. Where the lode is shown, about 270 feet from the portal of the crosscut on the west side of the creek, it is only about 10 feet across (fig. 6 [Figure 48]), but it widens toward the northwest. The drift is in the footwall for the next 140 feet and the full size of the lode can not be determined until the drift passes diagonally through into the hanging wall (fig. 6 [Figure 48]). From this point, the drift is mostly in the hanging wall, in places in the lode itself. The thickness is only partly revealed in crosscuts. In some places, however, the fracture zone appears to be as much as 40 feet across and locally may be even more.

Near the face of the tunnel on the east side of the creek the lode is composed of not less than 35 feet of massive quartz and has additional thin quartz seams in the fractured rock along the hanging wall (fig. 6 [Figure 48]). The lode appears equally as large on the surface, 200 feet or more directly above. Numerous cuts and caved tunnels further to the southeast afford evidence of the great length of the lode, but give no clue to its size.

The Tahoma lode has been more severely disturbed by structural adjustments than most others, both during and after ore deposition. Consequently, the ground is exceptionally
Figure 48. Geologic sketch map of the accessible underground workings at the Tahoma Mine in 1936 (Anderson, 1939, Figure 6). The workings are not in their normal relationship to each other.
heavy. It is reported that upper tunnels and stopes could not be readily kept open, but were rapidly filled with the crushed, more or less plastic, lode matrix, much of which would flow in from above and from the sides. It may be that this lode was affected much more by the mid-Tertiary faulting than the others. Eldridge [1895] reports a dike of white, decomposed porphyry in the upper workings, 25 to 30 feet thick, which cuts the lode at an acute angle, its strike being N. 26° W., its dip 45° S.W. to the vertical. On some of the levels, the lode is reported to have been offset by the dike, but a second fault, 50 or 60 feet beyond and approximately parallel to the dike, had again brought the lode into alignment. This dike was not observed in the recent lower workings, but there is ample evidence of post-mineral movement which might well be related to Miocene disturbance. The lode zone is tremendously shattered and in places contains an abundance of gouge, especially along the footwall. Lateral offsets may be hidden by the heavy lagging under the roof and along the sides of the tunnel.

In the upper workings, the ore is reported to have formed lenticular bodies 2 to 12 feet thick. In the lower tunnel, the lode appears to contain scattered bunches of quartz and quartz veins, as much as 4 feet wide in one place where the drift is in the lode itself. In other places, as shown in Figure 6 (Figure 48), the bunches of quartz and quartz veins are smaller, generally less than 2 to 3 feet wide. The ore on this level appears to be sporadic and confined largely to small shoots and pockets. The large mass in and near the face of the east tunnel appears to be an exception, but whether or not it contains ore of commercial grade was not learned. This quartz has not been as greatly shattered by post-mineral movement as has that elsewhere along the lode, and it contains less sulphides.

The ore shows the usual three stages of quartz, and, locally, considerable fourth stage, somewhat ferriferous calcite. The second-stage quartz is the fine-grained variety, high in arsenopyrite. The third-stage is the comb and druzy variety. Some of that on the dump at the mouth of the lower tunnel west of the creek contains small amounts of mica and pyrrhotite. It is reported that ruby silver was abundant in the upper workings. Although some of the ore treated in the Buffalo mill yielded from $100 to $150 per ton in gold and silver, the average toner is reported to have been $50 to $100 per ton.

The parallel lode on the Baltimore claim is apparently much smaller and less extensively mineralized. Small amounts of ore remain at the portals of the caved tunnels on the west side of the creek. The drift along the lode on the east side of the creek is so tightly timbered that nothing could be learned, except that the zone of crushed, gougy rock is broad, the ground heavy, and the lode there has little or no quartz.

The Tahoma is one of the oldest mines in the district. By 1866 or 1867, Browne (1868, p. 521) included the Tahoma in a list of lodes “thought by some to be quite equal, both in extent and richness” to the Atlanta lode. In 1872, Raymond (1873, p. 205) reported:

The Empire State[3] runs nearly east and west, and dips slightly south. There is a tunnel on the vein 150 feet long, gaining 60 to 70 feet in depth. A lot of 14 tons of ore, worked by Mr. Huffacker (Table 14), yielded at the rate of $74.90 per ton. Several smaller lots of a few tons each yielded from $70 to $85 per ton. The crevice is 5 feet wide the ore-streak 2 feet. Gold predominates largely.

The Tahoma runs parallel to the former, at a distance of 250 to 300 feet, 12 to 14 feet wide, and carries from 2 to 3 feet of ore, in which silver predominates. Several tons were

[3] The Empire State was just south of the Tahoma (Figure 11). It is not known whether these workings were later combined with the Tahoma or the Big Lode, or if they were abandoned entirely.
### Table 14. Companies and individuals at the Tahoma Mine and related properties.

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Officer</th>
<th>Date Incorporated</th>
<th>Charter Forfeited</th>
<th>Year(s) at Mine</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tahoma Mine</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I. N. Pedder and James Davis</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1873-1881</td>
</tr>
<tr>
<td>Davis, Casey, Dolan &amp; Newton</td>
<td>---</td>
<td>---</td>
<td>(1874)</td>
<td></td>
</tr>
<tr>
<td>Doolan and Newton</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1875-?</td>
</tr>
<tr>
<td>Tahoma Company</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1881-1885</td>
</tr>
<tr>
<td>Spears American Syndicate</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>(1901?)-1909</td>
</tr>
<tr>
<td>Tahoma Mining Company</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1909-1915?</td>
</tr>
<tr>
<td>Tahoma Gold Mines Company</td>
<td>Robert L. Owen, President</td>
<td>August 27, 1915</td>
<td>1</td>
<td>19157-1922?</td>
</tr>
<tr>
<td>Richards and Steunenberg</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1922-1926</td>
</tr>
<tr>
<td>W.P. Richards</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1927, 1929-1937+</td>
</tr>
<tr>
<td>J. Steunenberg estate</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>1928</td>
</tr>
<tr>
<td>Coronado Gold Mines, Inc.</td>
<td>H. Tracy Rogers, President</td>
<td>July 7, 1933; reinstated: December 18, 1934</td>
<td>1934; 1936</td>
<td>1934-1936</td>
</tr>
<tr>
<td>Atlanta Gold Corporation</td>
<td>Olaf Tolpinrud, President</td>
<td>March 6, 1985</td>
<td>1997</td>
<td>1994-</td>
</tr>
</tbody>
</table>

The Tahoma Mine has been part of the Atlanta Gold property (Table 5) since 1994.

**Empire State Mine**

Mr. Huffaker

---

(1872)

**Stanley Lode**

“English capitalists”

---

(1872)

Ostrom and Marshall

---

1874-

Baxter & Orr (lessees)

---

1875-

1Information not available in Idaho Geological Survey’s files.
worked and yielded pretty fairly; the exact amount could not be ascertained. The developments on the lode consists of a couple of cross-cut tunnels, which intersect the vein at a depth of 40 to 50 feet.

The Stanley\textsuperscript{14}, owned to a great extent by English capitalists, is believed to be the extension of the Tahoma. A tunnel 400 feet long has been run partly on the lode, showing it to be from 16 to 20 feet wide. The ore occurs in bunches, the vein being considerably broken up. Small test runs yielded about $100 per ton, and it is expected that more developments will prove this to be a very valuable lode. Ruby silver is frequently met with in the ore, which carries only very little gold.

By the following year, these properties were being actively developed. According to Raymond (1874, p. 247):

The Stanley lode has been worked a little this summer, and some 40 or 50 tons of ore have been mined, which yielded moderately in the mill. The ore was obtained by sinking a shaft from the surface, the crevice having been lost in the adit started above the level of the creek. Several samples of ore from this mine were assayed, and seem to indicate an average value of $50 to $60 per ton for the whole.

The Tehama\textsuperscript{15} lode, discovered last spring, was being developed at the time of Mr. Wolters's\textsuperscript{16} visit, by a shaft which showed a large, well-defined crevice 8 feet wide, with a strong body of good-looking silver-ore in it. Since then some ore has been tested in the mill, with very satisfactory results.

The work continued in 1874. Raymond (1875, p. 310-311) described the year's activities:

On the Tahoma lode, the shaft, 6 by 12 feet, has been sunk down 96 feet. The vein was left at a depth of 63 feet, in order to get a perpendicular hoisting-shaft. Down to a depth of 20 feet the whole vein was taken out, and yielded at the rate of $25 per ton. The south wall is well developed. The north wall has never been reached, though the shaft was started 8 feet wide. A tunnel has been run which comes in right under the shaft, being 103 feet below its mouth. For about 30 feet it runs on the vein, and some very good ore was taken out while running this portion. Afterward it leaves the vein and runs the whole remaining distance in a zigzag course, the owners having apparently changed their minds many times in regard to the proper course to be pursued, and furnishing a fine example of how tunnels ought not to be run.

In the Stanley lode, Ostrom & Marshall [Table 14] had for about two months four men at work at the surface, sinking the shaft down to a depth of 30 feet. A small portion of the ore obtained was worked, but the yield was not ascertained by Mr. Wolters. From the fact, however, that the rest of the ore still lies in the mill unworked, it may be inferred that the first lot did not pay for milling.

This lode and the Tahoma are on the same vein. The first comprises the original location of 1,000 feet. The first extension, also 1,000 feet, is owned by Davis & Weed, the former having 800, the latter 200 feet; and the second extension, again, 1,000 feet, now known

\textsuperscript{14}The Stanley was on the eastern extension of the Tahoma lode.

\textsuperscript{15}Almost certainly, this is a misspelling of Tahoma.

\textsuperscript{16}Mr. A. Wolters, superintendent of the U.S. Assay Office in Boise, provided most of the material for the Idaho section of Raymond's report.
as the Tahoma, is owned by Davis, Casey, Dolan & Newton [Table 14]. On the first extension
some sluicing has been done, yielding the owners of the Tahoma enough to make a living
while they carry on the necessary dead-work in their lode, though they have to collect water all
day in a small reservoir, in order to get a supply for sluicing from one to two hours. In working
this claim they have uncovered another lode, which they call the Potosi, but nothing has so far
been done with it.

The Stanley was leased to Baxton and Orr in 1875, along with the ten-stamp mill
owned by the Gold-Mining Company of Yuba. The lessees apparently focused their
attention on another claim (the Leonora) that they leased at the same time. Doolan37 and
Newton continued work at the Tahoma (Raymond, 1877).

The 1880 DotMR noted that the “Tehama” was a good producer of both gold and
silver. By the following year, the Tahoma was being touted as one of the best developed
properties in the district. According to the 1881 DotMR (p. 174-176):

The Tahoma, now owned by the Tahoma Company, of Meadville, Pa., is located
about a mile from the town of Atlanta, on the west side of Quartz Gulch, and close to the grade
leading up to the Monarch. It consists of 2,000 feet along the course of the ledge, and is
perhaps one of the best developed claims in the district. Four tunnels have been run,
aggregating 1,150 feet in length, besides a number of drifts and crosscuts. The ledge averages
35 feet in width, lies encaised between two well-defined walls and contains two pay veins
varying from 2 to 12 feet in thickness. No barren ore has been found between the walls. The
company last season purchased a mill in San Francisco, but being late they had to postpone
shipment and erection until the spring of 1882. In developing the mine they extracted about
1,000 tons of ore, from which they selected 300 tons of first class and had it worked in the
Buffalo Company mill, with a reported yield of $100 to $150 per ton. The average value of the
ore in the mine is from $50 to $100 per ton.

In line with the Tahoma, and on the same ledge, are the Silver Moon, Stanley, and
Chrysolite, none of which have been developed to any extent.

Strahorn (1881, p. 38) also contained enthusiastic praise for the Tahoma:

The Tahoma is one of the very best of these [properties]. The vein averages about ten
feet in width, and much of this is ore that yields $35 per ton on an average. The product is
about one-fourth gold and three-fourths silver. The mine is thoroughly developed by four
tunnels, aggregating 1,600 feet along the vein and 300 feet of cross cuts and winzes, all in ore.
There are some 20,000 tons of ore blocked out by these developments that contain from $50 to
$100 per ton. Following are some sample yields taken from the company’s books. All the lots
have been quite recently worked:

<table>
<thead>
<tr>
<th>Tons</th>
<th>Yield</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td></td>
<td>$ 97.50</td>
</tr>
<tr>
<td>24¼</td>
<td></td>
<td>134.50</td>
</tr>
<tr>
<td>53</td>
<td></td>
<td>111.00</td>
</tr>
<tr>
<td>204</td>
<td></td>
<td>63.75</td>
</tr>
</tbody>
</table>

The mine is a monument to the energy and good judgment of Messrs I. N. Peddler
and James Davis, who have so systematically developed it in the last eight years, confident
that the policy of putting all their time in one good claim was better than the method, so much

37 It is not known whether “Dolan” or “Doolan” is the correct spelling of this name.
in vogue, of one firm trying to scatter its efforts on half a dozen or more in the hope of making them all bonanzas. These gentlemen have recently sold the Tehoma, with the ore on hand, to a Meadville, Pa., company for $118,000.

The 1883 DotMR (p. 446) was more restrained in its description of the mine:

The Tehona lode, an old mine, located about 1 mile north [south] of Atlanta, has passed under the control of a Boston company, which has erected a 20-stamp mill and has been working during the year. The ore consists of sulphures, with ruby silver, reduced by roasting machinery on the ground.

The 1884 DotMR (p. 259) noted: “The Tehona has been successfully worked during the past season and has supplied its mills with ore since July 1. The mine is well opened, showing plenty of good ore, and employs 8 men.” However, trouble was brewing at the mine. According to Wells (1983, p. 62):

Another fairly significant source of Atlanta production, the Tehoma, operated profitably for over two years after a $110,000 sale (following eight years of development) to investors in Meadville, Pennsylvania. But by the end of 1884 the Tehona ceased to meet its payroll. Then, after going six months more in accumulating unpaid labor claims, the Tehona default came out in the open when liens were filed for $18,000.

The ensuing round of lawsuits, with unpaid creditors trying to recover their money, triggered a general economic collapse (Wells, 1983).

Hastings (1895) commented that the Tehona was one of the best known mines in the Atlanta district. In addition, he stated (Hastings, 1895, p. 128):

The Tehona vein and contents is similar to the Atlanta, and is said to average 12 ft. in width. . . . When the mines were formerly worked the nearest railway station was 230 miles distant. Almost all the ores not sent East to custom smelters were roasted and leached, and for many years nothing less than $100-ore and finally $50-ore was treated. Experience has since taught that amalgamation and concentration saves 65% of the values, and the Tehona mill, fitted with 10 750-lb. stamps and four Forrester stampers, crushes all the ores from the lode. The concentrates, a high-grade product, are sent East to the large smelters. There is abundance of timber about the camp and the Middle Boise and Yuba rivers furnish ample water supply for power and milling purposes.

Eldridge (1895, p. 254) described a dike in the Tehoma workings: “In the Tehoma mine, which is on one of the lateral fissures, a dike of white decomposed porphyry, 25 to 50 feet thick, cuts the vein at a very acute angle. Its trend is N. 26° W.; its dip, W. 45° to the perpendicular. On some of the levels it has thrown the vein, but this is again brought into line within 50 or 60 feet by a second fault, approximately parallel with the dike, marked by a clay course.”

Anderson (1939) misinterprets this description as a proper name, “the” Boston Company. Also, it is unclear whether the property had been sold a second time (i.e., whether the Tehoma Company of Meadville, Pennsylvania, had sold the property to a company from Boston) or if 1883 DotMR incorrectly reported the address of the company’s office as Boston.
By 1901, the mine was bonded to an eastern syndicate "who are adding to the extensive development work, which has been progressing throughout the year, with most promising results" (1901 IMIR, p. 27). The Baltimore was also undergoing active development. The 1902 IMIR noted (p. 14):

The Baltimore, also in the Atlanta district, is being operated successfully.
The Tehama mine is also a famous property near Atlanta, which is now owned by a syndicate of eastern capitalists, who are pushing extensive development work.

The 1903 IMIR listed the Tehama as one of the important claims in the district that was still idle. The following year, the 1904 IMIR (p. 63) mentioned the mine as one of several properties "near by or adjoining the Monarch that have more or less extensive development and good ore in sight," and that were being further developed.

The 1905 IMIR (p. 60) reported:

This mine is still another adjoining property to the north [i.e., adjacent to and to the north of the Atlanta lode] and was also quite extensively developed during the past season and its minerals subjected to extensive practical laboratory tests for cyanide treatment. A mill run was also made on the ores of this property which is said to have produced very satisfactory results. The Tehama has very large reserves of good ore, and if the negotiations now in progress for its purchase are completed it will doubtless afford employment for a good force of men.

The Tehama was operated in a small way in 1906, and the Spears American Syndicate did some experimental work on the ore, using the mill on the property to run the tests. However, the 1906 IMIR (p. 60) also noted that the Tehama "was unfortunate in getting tangled up by a company of irresponsible promoters. It has been quite extensively developed in former days and produced a good deal of pay ore, and merits reopening and further extensive development."

The mine was inactive for the next two years while its legal affairs were being straightened out. According to the 1909 IMIR (p. 56):

On the Atlanta Hill, but north of the main Atlanta lode, the Tehama Mining Company has recently taken charge of this property, the title to which has been involved for some time, and it is expected will put in active operation shortly. This property was a large producer in the early days and is equipped with a 10-stamp mill, located on the banks of the Boise River three-quarters of a mile from the mine. This property has large ore reserves and is apt to again be a large producer.

The 1911 IMIR (p. 44-45) continued in the same optimistic vein:

The Tehama Mine is one of the well developed properties of this district and was quite a good producer during its early history. It has been taken over by some experienced mining investors, and connected with this enterprise is W. B. Milligan, one of the best practical experts in the metallurgy of refractory gold ore in the west, whose experience in the Black Hills, Colorado, and Nevada, in the successful treatment of such ores will prove an
invaluable asset in the solution of the milling problems of the ores of this mine and district. It is reported on good authority that the Tahoma is to be equipped with milling facilities and its extensive ore resources put to profitable use in the near future.

Despite this optimism, the property remained inactive. Tahoma Gold Mines Company's report to the Idaho Mine Inspector for 1924 listed the address of company President Robert L. Owen and company secretary Henry G. Thomas as "Senate Office Bldg., Washington, D.C.", the address for company treasurer James W. Beller was "Transportation Bldg., Washington, D.C." The following year, the company's report noted that the company had lapsed and that the mine had been sold by the sheriff "a few years ago" to Robert L. Owen. For the period 1922 to 1937, the IMIRs listed the Tahoma claim as the property of Richards and Steunenberg (1922-1926), the J. Steunenberg estate (1928), or W.P. Richards (1927, 1929-1937); claim ownership was not listed in the IMIRs after 1937.

The 1933 IMIR noted that the Tahoma had been reopened for sampling. The work was under the direction of former Idaho Mine Inspector Stewart Campbell. Coronado Gold Mines acquired the property in 1933 (Anderson, 1939); the purchase price was 100 percent of the company's stock. Two adits at creek level, one on either side of the creek, were either driven or rehabilitated. The tunnel on the west side of the creek had 1,150 feet of crosscuts and drifts, several raises, and a winze in 1936. The adit on the east side of the creek had 855 feet of workings (Anderson, 1939). Coronado forfeited its charter in 1936.

Gold-silver smelting ore was shipped from the Tahoma in 1950. Small shipments were also made in the early 1970s. Some development work was carried out at the mine in 1977.

Early in 1994, Atlanta Gold Corporation purchased the Tahoma Mine, including 53 acres of patented land, for $50,000. During that summer, two zones on the property were explored by a 14,000-foot surface-drilling program.

Sporadic production from the Tahoma between 1905 and 1976 produced 190 tons of ore, which contained 169 ounces of gold, 2,636 ounces of silver, and 400 pounds of lead. In 1901 and 1902, the Baltimore produced 131 tons of ore, which yielded 317 ounces of gold and 251 ounces of silver. It is not known whether there was any production by lessees for which there is no record during this period. Although some rich ore was produced from the mine before 1900, there are no accurate records of tonnage and quantities of metals produced.

WASHINGTON, GOLD NUGGET, AND WONDER LODES

The Washington, Gold Nugget, and Wonder lodes are in lower Quartz Gulch about ½ mile from Atlanta (Figures 3 and 5). These lodes were known in the early days of the Atlanta district, but by 1936, they were part of a group of six unpatented claims held
by Atlanta Gold Mine Corporation (Anderson, 1939). Anderson (1939, p. 68) described the geology of the property:

The lodes belong to the west-northwest system, and are spaced about a few hundred feet apart, the Washington on the north and the Wonder on the south. The Washington is reported to be from 2 to 22 feet thick, but the richer ore was in a layer 12 to 18 inches wide which assayed about $40 in gold [1884 DotMR, p. 259]. The Wonder is probably the largest and most conspicuous of the three lodes and may be traced by the alignment of old cuts for more than 1,500 feet in the east side of the creek. It is also known to extend on the west side of the creek, but beneath considerable overburden. The lode is reported to be from 2 to 12 feet thick in the tunnel and it appears equally thick in cuts and tunnels higher up the slope. The ore is a breccia of the fine-grained, gray quartz containing arsenopyrite in a matrix of comb and drusy quartz. The ore in the croppings is partly oxidized.

The relations of the Gold Nugget vein are somewhat obscure. There appear to be two fracture zones, one of which strikes N. 30° W. and dips 50° N.E., the other of which strikes N. 75° W. and dips vertically. That with the more northerly strike is considered to be the Gold Nugget, the other a cross fracture. The width of the Gold Nugget fracture zone ranges up to 12 feet and contains bunches and lenses of ore, in places from 1 to 2 feet thick. The other one is from 4 to 5 feet wide and contains scattered thin veins of quartz. Two tunnels driven to intersect the Gold Nugget were apparently on the cross lode. In the upper tunnel the lode is cut off by a fault which strikes N. 40° E. and dips vertically. The continuation of the lode beyond this fault has not been found.

Nothing is known of the early days of the mine. The 1884 DotMR (p. 259) described the Washington:

The General Washington is opened by a tunnel and shows from 12 to 18 inches of $40 gold sulphides ore. The new steam hoisting works, with pumps, are about completed, which will facilitate the working of the mine. The company's 20-stamp mill has been running for the past two months on ore exclusively from their own mine. Twelve men are employed at the mine and 8 at the mill and 10 on the new hoisting works. The total yield for 1884 was about 6,406 ounces.

The 1903 IMIR listed the Washington as one of the important claims in the district that was still idle. It remained idle for the next three decades.

In 1935, Atlanta Gold Mine Corporation (Table 11) acquired six unpatented claims that covered parts of the Wonder, Gold Nugget, and Washington lodes. When Atlanta Gold Mine purchased the property, it had one 115-foot tunnel. Anderson (1939, p. 67-68) described the property in 1936:

The property of the Atlanta Gold Mines Corporation39 lies in lower Quartz Gulch about half a mile above the town of Atlanta. It consists of 6 unpatented claims and covers three or four lodes, all of which were known and worked in the early days. These lodes are the Washington, Gold Nugget, and Wonder, but only the Gold Nugget was being developed in 1936; the others have apparently been idle for many years. The Washington has been opened by several tunnels driven at least several hundred feet in the lode, but the workings are now

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39This version of the company name is incorrect. The company was the Atlanta Gold Mine Corporation.
Development continued until World War II (Table 15). After 1941, most of the company's activities were confined to assessment work. Atlanta Gold Mine Corporation forfeited its charter in 1954. Between 1936 and 1940, the Washington and Gold Nugget are credited with the production of 92 tons of ore. This material yielded 50 ounces of gold and 49 ounces of silver. There are no accurate records for production before 1900.

RECENT OPERATIONS

Preliminary Assessments

By 1975, A.H. Burroughs, Jr., had died and the property was held by a trust. A report on the trust's holdings, apparently written to help the trustees promote the property, contained the following information (Nugent, 1975, p. 6-11):

The Atlanta lode is a major shear structure in quartz monzonite (granite) rock of the Idaho batholith, which underlies much of central Idaho. The lode is at two miles long and from 40 to 120 feet wide. The lode contains six principal ore shoots from 200 to 800 feet long and from 400 to 800 feet high. The minerals are chiefly gold and silver-bearing oxides, and sulphides and free gold in veins, lenses, and interlacing bands of quartz between the walls of the lode, though chiefly along the footwall and hanging wall sides. The best ore has historically been mined above the 600 level, especially near the surface, where the silver and gold values were enriched and of bonanza caliber. The mineralization was described as epithermal (shallow-seated) by A.L. Anderson in 1939 because of the nature of the mineralization and because "the deep development, undercutting all the known ore shoots along the lode ---- showed that commercial mineralization was confined to shallow shoots from 400 to 800 feet beneath the surface". In 1953, P.T. Peterson, Talashke geologist, confirmed Anderson's statement: "I can fully agree --- that the Atlanta deposit is epithermal. It is my opinion that prospecting should be carried on at the elevation of 600 level." The 900 level is the lowest level of the lode.

Mining on the lode started in 1865, when unusually-rich silver ore was found along the outcrops of the Buffalo, Monarch, and Pettit ore shoots and on lateral veins oblique to the Atlanta lode. Over the years from 1865 to 1953 the development and mining of the lode was subjected to cycles of boom and bust depending upon the price for gold and silver and the efficiency of ore concentration. Ore shoots were mined selectively -- low grade ore was left.

The copy of this report in IG8's mineral property files is not complete. The extract that is in the files is quoted here in full, including the historical summary, for the insight into the approach taken by the trust to interest companies in leasing or purchasing the mine.

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Table 15. Cumulative development at the Atlanta Gold Mine Corporation property, by year. Information is from company reports to Idaho Inspector of Mines; discrepancies in numbers reflect inconsistencies in the original data.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Development (ft)</th>
<th>No. of Tunnels</th>
<th>Total Length of Tunnels, Crosscuts, and Drifts (ft)</th>
<th>No. of Shafts</th>
<th>Total Length of Shafts (ft)</th>
<th>No. of Rises</th>
<th>Total Length of Rises (ft)</th>
<th>No. of Crosscuts</th>
<th>No. of Drifts</th>
<th>Length of Principal Tunnels (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No. 1</td>
</tr>
<tr>
<td>1935</td>
<td>115</td>
<td>1</td>
<td>115</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>115</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1937</td>
<td>195</td>
<td>1</td>
<td>195</td>
<td>—</td>
<td>—</td>
<td>2</td>
<td>1</td>
<td>195</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1937</td>
<td>422</td>
<td>2</td>
<td>422</td>
<td>—</td>
<td>—</td>
<td>3</td>
<td>3</td>
<td>195</td>
<td>227</td>
<td>—</td>
</tr>
<tr>
<td>1941</td>
<td>590</td>
<td>3</td>
<td>550</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>261</td>
<td>150</td>
</tr>
<tr>
<td>1950</td>
<td>600</td>
<td>3</td>
<td>600</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>—200</td>
<td>250</td>
</tr>
<tr>
<td>1952</td>
<td>505</td>
<td>5</td>
<td>489</td>
<td>1</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>130</td>
<td>90</td>
</tr>
</tbody>
</table>

1 This report was filed in April 1937.  
2 This report was filed in June 1937.  
3 This information was not reported to the Idaho Inspector of Mines.
Until 1932, when St. Joseph Lead acquired the entire lode by purchase and lease there had been no systematic development of the lode.

St. Joe drove the 600 level for more than 5000' along the lode, drove the 900 level to the Monarch line, built a modern amalgamation-flotation concentrator, and mined selectively from 1932 until 1936, producing 286,931 tons of ore having a recovered average grade of 0.30 gold and 1.1 oz. silver. Operations were suspended when mining and milling costs caught up with the 1933 advance in the gold price from $20.67 per oz. to $35 per oz. and all known ore containing more than 0.4 oz. gold per ton had been mined. Selective mining costs could not be improved and mill recovery could not be economically bettered than 90%.

Talache Mines bought the property and concentrator in 1937. There were no ore reserves, so in a sense all they bought was a concentrator and an opportunity to explore for more ore. They were successful in locating ore, chiefly in veins splitting away from the lode. Talache, also, mined selectively (excepting for 39,000 tons of open-pit rock from the Monarch in 1944) between 1937 and 1952, producing in that period 526,794 tons of ore with a recovered grade of 0.24 oz. gold and 1.1 oz. silver per ton.

St. Joe and Talache mined at a daily rate between 250 and 300 tons per day. The gold-silver ratio of the production from the two companies was 1.0 oz. gold to 4.2 oz. silver. So, even though the price of silver was relatively low during those years, the content would have been attractive at the current price ($4.50/oz.). Talache records show that, from 1938-1953, 47% of the gold and 93% of the silver were in the flotation concentrate and 53% of the gold and 7% of the silver were recovered as bullion from the amalgamation.

More than twenty years have elapsed since the Talache Mines operation was closed. Mr. A.H. Burroughs, Jr. has died and the holdings are in the custody of three trustees: A.H. Burroughs, J. Roger Mendenhall, and Robert L. Troxell. The mine workings are presently inaccessible, all machinery has been removed and sold, and the mill and mine building are worthless. Chief assets of the trust, under Article V, are the tailings and the supposedly worked-out Atlanta lode. The recent rise in the price of gold has changed the economics, as it did in 1933, and there is hope of reviving the operation. However, it seems likely that, with a fixed range in price of gold ($150-$200 per oz.) and ever-inflating cost of operation, a time will come when the economics are again marginal. For that reason it appears advantageous to arrive at an agreement with an operator without too much delay.

Mr. Burroughs has stated that much of the mine and mill data may have been damaged or destroyed since 1953. A careful economic analysis of the holdings would require good factual data on tonnages and grades, which possibly could be reconstructed from old records. If not, then data must be determined by auger hole sampling of the tailings and diamond drill hole core samples at intervals across the lode and adjacent walls. No doubt that is partly the reason that prospective operators want an initial payment-free period. However, for the purposes of this report, some assumptions have to be made and the conclusions are only guide lines for the benefit of the trustees.

ASSETS

The trustees have four assets to offer an operator:
1. St. Joe and Talache tailings
2. An area possibly amenable to open-pit mining
3. Six orebodies accessible for underground mining
4. Sufficient fee ground for tailings disposal and mine-building sites

TAILINGS

The tailings have been estimated to amount to 1,000,000 tons containing an average of 0.05 oz. gold and unspecified amount of silver per ton. The recorded mine production of St. Joe and Talache, for the years 1932-1952, was 813,725 tons (see Table 1 [missing from IGS's partial copy of this report]), but it appears that 300,000 additional tons were milled from other
sources — such as the Last Chance Mine, and the Tahona mine. Some tailings were lost from the lower pond when a spring runoff, a few years ago, broke through the dike [Figure 49].

The percentage of recovery of the metals has varied considerably. In 1941, Skidmore said that mill tailings averaged less than 0.02 oz. gold per ton between 1938 and March 1940; when the Monarch and Buffalo ores were treated in 1939-40 losses were as high as 0.093 oz.; in 1941 they had dropped to 0.04 oz. Spot checks of tailing losses during 1948-1951 show a range from 0.04 to 0.17 oz. So, in lieu of compiling milling records or sampling the tailing piles, we may assume that the tailings will average 0.04 oz. gold and 0.17 oz. silver and that there are 1,000,000 tons in the piles. On good authority, it is estimated that 80% (or more) of the gold and silver values can be recovered by inexpensive heap-leaching by cyanide solution.

At an assumed price of $150 per oz. gold and $4.50 per oz. silver, there would be recovered, as bullion, 32,000 oz. gold worth $4,800,000 and 136,000 oz. silver worth $612,000 -- a total gross metal value of $5,412,000, equal to $5.41 per ton of tailings.

Open Pit

In 1944 Talache Mines started an open pit on the Monarch ore shoot. Ore reserves carried on the 1953 records show that 185,000 tons containing 0.15 oz. gold could be mined from the pit. At an assumed price of $150 per oz. gold, the in-place value of this ore is $4,162,500 in gold and $462,000 in silver (at $4.50 per oz.). The NSR is shown as Table 3 [missing from IGS’s partial copy of this report].

The Monarch is only one of six ore shoots and if each ore shoot is amenable to low-cost open-pit mining and low milling costs, the potential is staggering. The combined lengths of the six ore shoots is 3000 feet. A weighted average measurement of the lode width for the six shoots is 67 feet wide on the 600 level, or say 70 feet at surface. A trimmed pit 400 ft. wide at the top and 200 feet deep would produce 6,667 tons of rock per foot of trench (assuming 12 cu. ft. per ton), of which 2,200 tons would be waste and 1,167 tons ore -- a stripping ratio just under 2:1. The total tonnage of ore produced from the 3000 feet of combined ore shoot lengths would be 3,500,000 tons. Assuming an average grade of 0.1 oz. gold and 0.4 oz. silver per ton and price of gold at $150 per oz. and silver at $4.50 per oz., the net smelter and mint value of the ore is $39,625,000 or $11.32/ton (see Table 5 [missing from IGS’s partial copy of this report]).

UNDERGROUND

Selective Mining

Talache underground ore reserves of January, 1953 and their present value at an assumed price of $150 per ounce of gold are:

<table>
<thead>
<tr>
<th>Oreshoot</th>
<th>Tons</th>
<th>Oz/T</th>
<th>Gross Metal Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boise-Rochester</td>
<td>59,800</td>
<td>0.32</td>
<td>$2,870,400</td>
</tr>
<tr>
<td>Monarch</td>
<td>148,752</td>
<td>0.35</td>
<td>7,809,480</td>
</tr>
<tr>
<td>Total</td>
<td>208,552</td>
<td></td>
<td>$10,590,630</td>
</tr>
</tbody>
</table>

The net smelter returns expected from this reserve has been calculated as Table 4 [missing from IGS’s partial copy of this report] and amount to $8,718,776 -- $41.81 per ton of ore. This figure includes an estimated silver content of 1.3 oz. silver. Silver was not included in the 1953 ore reserve calculation; the price of silver then was $0.85 per oz.; now it is approximately $4.50 per oz.

Low Cost Mining

A bolder possibility is to mine the entire length of the lode, along the length of each oreshoot, from the bottoms of the open pits to the bottom of the oreshoots, by a modern, low-

41Production, mostly by lessees, from the Talache property between 1953 and 1963 totaled 23,089 tons of ore, according to U.S. Bureau of Mines records. Presumably most of this production came from ore that was part of Talache's 1953 reserves, rather than from new discoveries. Therefore, the 1953-1963 production should have been subtracted from this estimate.
Figure 49. Contour map of the Talache tailings piles at Atlanta. The sharp indentation in the eastern (upper) tailings pile is the scar of the 1997 blowout. The indentation in the lower tailings pile may mark the site of the earlier failure of the lower impoundment (Terracon/Hubble Engineering, Inc., map).
cost method -- such as sub-level caving employing trackless equipment. Much of the higher-grade ore has been stoped, but gobs and unmined stringers and blocks of minus 0.3-oz. ore, mentioned above, may "sweeten" the low-grade. If each oreshoot is open-pit as extensively as envisaged, the average grade of ore over the width and length of the sections along the lode will be established. Of course, prior to open-pit work, many diamond-drill holes may have to be drilled across the lode -- not only in the oreshoots, but also in the unmined sections of the 5000-ft. explored length of the Atlanta lode.

For the present purpose, ore blocks have been calculated for each of the six shoots from the bottom of the open pit to the bottom of the stoped area -- to the 600 level or the 900 level. The calculations in Table 6 (missing from IOB's partial copy of this report) show the possibility of 9,302,000 tons of low-grade (0.1 oz. Au, 0.4 oz. Ag per ton) ore, having a total net smelter value of $105,312,000 and a net smelter value of $11.32 per ton of ore.

These figures are merely estimates -- wishful thinking, in a way. They represent the upside limit of the range, just as the 1953 Talaiche ore reserve estimate represents the low limit of range of ore grades and tonnages.

**BUTLER RANCH**

The fourth asset of the Article V Trust is the Butler Ranch, a 107-acre homestead lying adjacent, on the east, of the town of Atlanta. This ground has a potential for homestead and is presently valued at $2,500 per acre. The trustees consider the tract as independent of the mining property. However, a large mining operation will almost certainly require the ground for tailing disposal and for plant sites.

J.R. Simplot Company evaluated the property from August to December 1976 using photogeology, photogrammetry, field geology, magnetic surveying, and drilling. This project cost $25,726, excluding salaries, and did not locate substantial quantities of economic ore (Jemmett, 1977). The description of Simplot’s program and a summary of its results are as follows (Jemmett, 1977, p. 1-8):

A photogeologic interpretation was made of the area. This interpretation suggested that Atlanta Hill consisted of an triangular, uplifted block bounded by faults up Quartz Gulch, Grouse Creek, and Montezuma Gulch respectively. The uplift area is, in turn ruptured by a series of northeast trending southeast dipping normal faults. Two major silicified zones, the Atlanta and the John Bascom zones, were found to be antithetic in respect to the northeast trending normal faults. These two zones are 40 to 59 feet wide and are inclined steeply northwest.

The Atlanta zone has produced much rich ore down to the 900 level with the production coming from both the footwall and hanging wall. Individual ore shoots were of large magnitude. However, values near the surface were much higher than those at depth. There is much to suggest that these values become negligible below 900 feet.

Some rich ore was found along a northwest trending set of fractures sympathetic to the Atlanta zone. Generally speaking these were narrow veins and, consequently, expensive to mine.

Surface samples of the Atlanta ore zone from the section between the hanging wall and footwall (that part of the zone still intact) showed reasonable values (up to .225 oz/Au/ton). This sparked our original interest in the total silicified zone as a possible large, low-grade deposit. Surface samples of the John Bascom zone likewise showed reasonable values (.060 oz/Au/ton and 0.3 oz.Ag/ton). Surface samples of this type of deposit are unreliable due to leaching of the silver and con-current enrichment of gold. Drilling would be needed to evaluate.

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Magnetics

There is a small amount of pyrrhotite (magnetic iron pyrite) in the ore zones. It was reasoned that this might make them and other possible buried zones amenable to detection by magnetometer. Trial traverses across the known mineralized zones showed no discernable magnetic responses. Apparently the magnetizing effects of pyrrhotite in the ore zones is equal to the effect of the magnetite in the wall rocks. Plans for a systematic magnetic survey were therefore deleted.

Mill Tailings

There are two areas of mill tailings [Figure 3]. The smallest of these is located northwest of town near the river bank. These tailings represent the earliest milling venture and undoubtedly carry the greatest non-recovered values. The largest tonnage is located southeast of town on the east side of Montezuma Gulch. These tailings represent the last milling interval. It might be expected that these would be lower in grade than the older tailings. At least this seems a logical deduction in that less mixed oxide-sulfide ores would have been treated and ore dressing technology should have improved over time.

The tonnage is not great—an estimated 30,000 tons of the old tailings and 800,000 tons of the new tailings. There is a report of at least one assay of .150 ounces gold per ton taken of the old tailings. The grade of the new tailings can be estimated. The grade of the average mill heads and the mill recoveries were about .40 oz/ton/Au and ninety percent respectively. Thus we might expect these tailings to run .030 to .040 ounces gold per ton. For all the tailings the silver values are probably in the range of 4 ounces per ton.

The values in the tailings might be recovered by leaching. The cost of a plant designed specifically to treat the tailings is an unknown quantity. If they could be heap leached this cost would be a minimum. However, mill tailings are not particularly permeable (particularly oxidized tailings) and recoveries would also be minimum. Even with ideal leaching conditions the recovery will be less than 70%. A counter-current plant would not require a grinding circuit; hence the investment charge would be less than normal. Supposing the cost only two-thirds normal we would still be looking at $6,600/ton/day capacity, or 3.3 million for a 500/ton/day plant. This represents $3.98/ton costs not counting interest. If we assume a 90% recovery, the recoverable value at $140.00 gold is $5.04/ton. Surely operating costs would exceed the $1.06 difference.

No attempt has been made to further evaluate this possible mill feed. However, the tailings would constitute an asset for any leaching plant that might come into existence for some other reason.

Initial Conclusion

Finding enough high-grade underground ore for a viable operation seems a futile undertaking. The best we could hope for would be ore shoots at the intersections of the Bascom and Atlanta zones with the Montezuma Fault. In both instances these areas are concealed by alluvium. Drill investigation and mining might expect heavy ground and extreme costs.

High-grade underground ore might be found by detailed prospecting of sympathetic fractures of the Bascom and Atlanta zones but ore from these zones alone are too limited in volume to constitute a viable operation. All ore shoots found in the past were narrow and sporadic [sic] in distribution.

Past mining at Atlanta showed a deterioration of values with depth. Hence, there seems no apparent justification for the cost of a deep exploration drilling program in the hope of finding economic ore below the old workings. This is further indicated by our structural interpretation which indicated that the Atlanta zone is anthropic structure which should terminate at a relatively shallow depth.

The best and seemingly only economic chance appeared to be the possibility of sufficient grade existing in the Bascom zone and in the unmined core of the Atlanta zone.
allow a large-volume milling operation. This was considered a good bet on the basis of surface samples. A drilling program was planned. The other potentials would be considered as adjuncts if this program was a success. A milling grade of .150 ounces gold per ton was considered as the minimum qualification.

**Drilling**

Four holes were drilled which intersected the Atlanta zone. Hole No. 1 was designed to intersect a brecciated zone in the hanging wall granite as well as the Atlanta zone at depth in the vicinity of the General Petit ore shoot. The hole intersected 25 feet of the Atlanta zone before entering an old stop on the footwall. Values were very low in the intact rock (.005 to .050 oz/gold/ton and negligible silver). The last five feet prior to entering the stop gave an assay of .130 oz/Au/ton. This indicates some dissemination of values into the wall rock near the ore shoots. The granite of the hanging wall, while fractured, was unaltered and unmineralized.

Holes Nos. 2 and No. 3 were drilled from the same location approximately 250° west of Hole No. 1. Hole No. 2, drilled at an inclination of 45°, was encouraging. Twelve feet of ore grade material (.370 oz/Au/ton) was found between 32 and 44 feet. This intersection can be identified as a sympathetic structure which had at one time been mined by underhand stopping methods from the surface. The zone was intersected at an acute angle and is therefore much narrower than the drill intercept. The surface widths are about two feet.

The main Atlanta zone was intersected between 75 and 118 feet in Hole No. 2. There were 10 feet of high values (.40 oz/Au/ton) on the footwall. No high-grade hanging wall section was found, but the entire intercept (excluding the footwall high-grade) ranged from .040 - .065 oz/Au/ton (weighted average: .060 oz/Au/ton for 33 feet).

Hole No. 3, drilled at an inclination of 65° was designed to substantiate the continuity of values found in Hole No. 2. The Atlanta zone was intercepted between 170 and 189 feet. The weighted values were 19° of .072 oz/Au/ton. No high-grade footwall was found. The sympathetic zone found in Hole No. 2 was also cut between 37 and 47 feet giving an inclined width of 10 feet and values of .22 oz/Au/ton.

Hole No. 4 was drilled 520 feet east of the site of Holes Nos. 2 and 3 and essentially at the east extremity of the old open-pit. The hole was angled at 50°. The sympathetic zone found in Holes Nos. 2 and 3 was cut at between 20 and 25 feet. The assays were .080 oz/Au/ton and .46 oz/Ag/ton.

The Atlanta zone was intersected between 220 and 275 feet. Assays varied from traces up to .060 oz/Au/ton with negligible silver. The weighted average was .028 oz/Au/ton. The entire intercept was "nearly" which may indicate possible stope fill.

Hole No. 5 was drilled to intercept the Bascom zone. Extremely heavy ground was experienced and the hole was abandoned at 187 feet with lost tools in the hole. This was not before 20 feet of the zone was penetrated. Two ten foot intervals assayed .020 and .040 oz/Au/ton respectively. The core recovery was between 10 and 15%, hence, the samples are not the best. However, negligible silver values indicate a lack of ore values.

**Conclusions**

Analysis of the drill results leaves much to be desired as the core recovery was not the best. However, it was good enough to form certain conclusions:

1. The sympathetic ore zone in the hanging wall is surprisingly persistent over a strike distance of 520 feet. This is the same zone that can be seen at the surface where it has been mined by underhand stopping. A small tonnage of fairly high-grade (.2 to .4 oz/Au/ton) could undoubtedly be mined here. There may be other such zones. If the larger Atlanta zone were of sufficient grade this small tonnage would serve as a welcome sweeter (sic). The small operation that might be developed on the basis of this tonnage alone does not seem worth the considerable risk and expense of development.
(2) There are some high-grade sections of the main Atlanta zone still intact as indicated by the intercept in Hole No. 2. These would add value to any ore mined by bulk methods from the core of the Atlanta zone, but for purposes of planning, such values cannot be considered.

(3) The core of the Atlanta zone and the John Bascom zone are persistently too low in grade to allow utilization. Values of 0.06 oz/Au/ton would appear to be maximum. This is considering a possibility (not probability) that the low core recovery resulted in less than full assay values. While considering this possibility one must also consider the real probability of considerable dilution in mining. It is also obvious that the tonnage of this grade material is limited. Much of the zone would have to be rejected as waste.

Conclusions and Recommendations

It is concluded that there is little chance, at the present market value of gold and silver, to establish a economic operation. The chance is so slight that the expense of entering into the second phase is not justified and the terms of our agreement with Burroughs preclude speculating on possible futures. It is recommended that we terminate our agreement. In anticipation that this recommendation be approved, we have seeded the drill sites according to Forest Service specifications and, at their request, ditched the roads for anti-erosion control. A copy of this report, complete with topographic and geologic map, drill hole logs, copies of assays, and the air photos, is being delivered to Mr. Hammond Burroughs, III. All information furnished this office by Mr. Burroughs is being returned at this time.

The mine was leased to Simcor Co. of Osburn, Idaho, from 1977 to at least 1979. This company seems to have done little more than assessment work.

Yanke Machine Shop

In 1981, the property was leased to the Yanke Machine Shop (Kilsgaard and Bacon, in preparation). In 1982, Yanke started a mapping and sampling program. About 600 feet of drifts on the upper level of the mine were reopened. Also, 15 tons of high-grade ore, which averaged 20 ounces per ton gold and 80 ounces per ton silver, was mined.

Yanke continued exploring the mine in 1983. Development work was started on a newly discovered gold-silver vein that was 6 to 8 inches wide and ran 2-3 ounces of gold and 150-200 ounces of silver per ton. This vein was close to the old Talache Mine workings.

In 1984, Yanke sunk a winze about 160 feet from the company's new 200 level and explored a narrow, high-grade gold vein. In the early part of the year, leach tests were run on samples of the old tailings. The agitation leach test extracted 62.9 percent of the gold and 73.8 percent of the silver, while the column leach test extracted 55.9 percent of the gold and 91 percent of the silver (McDonald, 1984). McDonald also noted that regrinding or additional processing might improve recovery, and that additional tests would be needed to determine the best system for a full-scale operation to reprocess the tailings.

In 1985, the property was subleased to Atlanta Gold Corporation. Total production from the property by Yanke Machine Shop between 1983 and 1986 was 123
tons of ore containing 364 ounces of gold and 10,503 ounces of silver (Kiiisgaard and Bacon, in preparation).

Atlanta Gold Corporation

Atlanta Gold Corporation subleased the Talache Mines, Inc., property from Yanke Machine Shop, which was leasing the property from the A.H. Burroughs's estate. In 1985 and 1986, Atlanta Gold Corporation drilled the property to evaluate its potential as a heap-leach gold operation. This program included 15 diamond drill holes and over 175 reverse circulation holes, which were drilled along the Atlanta mineralized zone. A total of 3,300 feet of diamond drill holes and 48,821 feet of reverse circulation holes was drilled (Figure 50), concentrating on the area of the Monarch mine. The reverse-circulation holes were an average of 265 feet deep. This drilling indicated reserves of 14 million tons of ore with a grade of 0.05 ounce of gold per ton. Preliminary plans called for a 250,000-ton-per-year heap leach operation using permanent leach pads and a 60-day leach cycle. The mine life was estimated to be 10 years. Work continued in 1987, with the company investing about $3 million in the property. According to Federspiel and others (1987), the then-current plans for the mine called for it to include two open pits (Figure 51), cyanide leach pads, a precious metal recovery plant, and associated support facilities. Atlanta Gold's holdings included about 150 patented and unpatented claims (Figure 52), several mill sites, and some land managed by the U.S. Forest Service.

In 1988, Atlanta Gold did 46,000 feet of reverse circulation drilling in the East Pit area, which increased reserves to 9.18 million tons of ore containing 0.072 ounce per ton (opt) of gold, for a reserve of 661,000 ounces of gold. Forty percent of this ore was leachable. Some deep drilling was done early in the year in the East pit area, and the company was encouraged by the results. The West pit area contained 1.3 million tons of ore that had 0.051 opt gold and 0.087 opt silver. About 75 percent of this material was sulfide ore. Overall, ore reserves were increased 46 percent to 861,000 ounces of gold and 2,256,000 ounces of silver. The stripping ratio for the proposed open-pit operation was 3.98 tons of waste to 1 ton of ore. Atlanta Gold was considering both open-pit, cyanide-heap-leach and conventional milling operations.

Company geologists spent the 1989 field season doing detailed surface mapping to help understand the ore controls and structure at the 3,100 acre property. A feasibility study by Behre Dolbear-Riverside, Inc., was completed during the year. This study indicated that the proposed East pit had reserves of 8.27 million tons of 0.087 opt gold. Operating costs for the open-pit mine were projected at $248 per ounce, with most of the ore being concentrated by flotation and then treated by bio-oxidation and cyanidation. The remainder of the ore would be heap leached with cyanide. The gold would be recovered from solution using a carbon-in-leach process, reactivating the carbon, stripping and electrowinning the gold and silver onto steel wool, and then smelting the metals to produce doré. Annual production for the first six years was estimated at 101,180 ounces.
Figure 50. Drilling at the Atlanta Gold project in 1986 (photograph by Earl H. Bennett, Idaho Geological Survey).
of gold and 258,100 ounces of silver per year with a recovery rate of about 84 percent. The West pit contained an additional 6.2 million tons of 0.049 opt gold with a recovery rate of 80.4 percent; this ore would extend the mine's life 2½ to 4 years.

The management of Atlanta Gold spent most of 1989 in a legal shoot-out with U.S. Gold Corporation for control of the company. In January, U.S. Gold started a hostile takeover attempt by buying Atlanta Gold stock on the open market. U.S. Gold was joined in May by Ventures Trident Limited Partnership, whose holdings in Atlanta Gold were controlled by one of Atlanta Gold's officers. Together, U.S. Gold and Ventures Trident controlled about 25 percent of Atlanta Gold's stock. U.S. Gold claimed Atlanta Gold had not shown sufficient diligence in opening up the Atlanta Hill property and offered its proprietary bio-oxidation technology to Atlanta to process the refractory sulfide ores at the site; Atlanta Gold claimed U.S. Gold wanted to use the property to test an unproven process. Atlanta won the first round in mid-June at its stockholders meeting when a board of directors that supported the company's long-standing management team was elected. A court battle in British Columbia was in turn won by U.S. Gold, who challenged the validity of some of the proxies that were voted in favor of Atlanta Gold's existing management. The final appeal in the Court of Appeals of British Columbia was heard in December, and Atlanta Gold once again prevailed.

Due to these legal problems, start-up of the mine was postponed. The company began looking for a buyer or a joint-venture partner for the Atlanta Hill project. Financial projections predicted that the initial investment for the mining and milling operation, which were estimated at nearly $42 million, would be repaid in 2.4 years with gold selling at $375 per ounce. Atlanta Gold had invested about $10 million in the venture.

In 1990 Atlanta Gold Corporation continued to seek a joint venture partner or a buyer for the property, which contained one million ounces of mineable gold. Early in the year, Atlanta Gold made a private placement in Europe of 1.25 million shares at $1 per share and 1.25 million warrants for an additional 1.25 million shares at $1.25 per share. The money was used to replenish the working capital that was exhausted by the court fight with U.S. Gold. Late in the year Newmont Exploration signed an agreement with Atlanta Gold that allowed Newmont to earn a 51 percent interest in the Atlanta property by making cash payments totaling $5,000,000 to Atlanta Gold and spending $10,000,000 on exploration and development.

During 1991, almost a mile of core drilling and 12,000 feet of reverse circulation drilling in twelve holes were done. Eleven of the twelve holes hit the silicified shear zone. The best intercept was 11 feet of 0.318 opt gold at a depth of 1,100 feet, and Newmont was rumored to have quite a few intercepts running about 0.6 opt gold over very narrow widths. Other interesting intercepts included 2 feet of 0.71 opt gold at a depth of 1,013 feet, 2.8 feet of 0.60 opt gold at 1,395 feet, and 15 feet of 0.32 opt gold at 1,105 feet, which included visible gold. Newmont was looking for high-grade gold veins located below the known low-grade deposits on the top of Atlanta Hill. After completing nearly $500,000 worth of drilling, Newmont had not substantially increased known reserves.
Consequently, the company dropped its option and returned the property to Atlanta Gold. Immediately, Atlanta Gold raised money with a private placement of stocks and warrants, which were sold to Consolidated Ramrod Gold. Atlanta Gold used this money to start its own $375,000 drilling program to evaluate the full length of the shear zone. Drilling started in the fall and continued into the next year. The holes were combined reverse circulation-core angle holes.

In late May, high water on the Middle Fork of the Boise River washed out the Kirby Dam, which housed Atlanta's small hydroelectric plant (operated by Atlanta Power). The dam had been strengthened by an emergency stabilization program the previous year. Of greater concern than the power plant were the millions of tons of old mill tailings that were confined behind the dam. An estimated 40 percent of the tailings washed down the Middle Fork when the dam failed. The Department of Health and Welfare issued warnings about drinking the metal-tainted water, although the disaster was not expected to have any lasting effects on water quality. The Forest Service and the Bureau of Reclamation announced in October that they would build a new rock-filled sediment-containment dam at the site. This dam had a projected cost of $1.5 million. In mid-November, the Boise National Forest awarded a $334,450 contract to Western Construction Company of Boise for the first phase of work on the dam. Federal emergency funds were obtained by the Boise National Forest to pay for the new dam, which was to be completed prior to spring runoff. The Forest Service owns the dam, and Atlanta Power installed new generating equipment 350 feet downstream from the dam. A new bridge, purchased "used" in the Midwest, was installed in November to replace one that washed out when the Kirby Dam failed.

In 1992, Atlanta Gold drilled 23 reverse circulation holes totaling 6,580 feet on the west side of their property. These holes were in parts of the West Pit area where topography had made earlier drilling difficult. The results were still being evaluated at the end of the year. The company had planned to reopen the 900 level adit, but this was delayed after the Environmental Protection Agency decided that the company would need a National Pollution Discharge Elimination System permit because water was draining from the adit. The company caught up on reclamation work during the summer. Early in the year, Atlanta Gold sold 675,676 shares of stock to finance the ongoing exploration work. Evaluation of the project continued, and the company was still seeking a joint venture partner at the end of the year.

The U.S. Food and Drug Administration issued a warning about consuming fish caught in the Middle Fork of the Boise River and in Arrowrock Reservoir. The agency was concerned that the fish might be contaminated with methylmercury, which had washed down the river with the thousands of tons of old mine tailings that spilled into the Middle Fork when the Kirby Dam failed.

The only activity at the mine in 1993 was some surface mapping. In November, Atlanta Gold entered into a joint venture agreement with Ramrod Gold USA, Inc., a subsidiary of the Vancouver-based Consolidated Ramrod Gold Corporation.
agreement gave Ramrod the option to earn a 51 percent interest in the project by spending $9.5 million by May 30, 1997. The companies planned a major exploration effort on the Atlanta property.

The 900 level of the old Talache Mine was reopened in 1994 (Figure 53), and 2,500 feet of drifting was completed. This included 685 feet of rehabilitated workings and 1,880 feet of new tunnel. In addition, crosscuts for underground drill stations were put in. A 12,000-foot underground drilling program was started in the fall to test mineralization at depth.

Early in the year, the Tahoma Mine, located on 53 acres of patented land, was purchased for $50,000. Two zones at the Tahoma were tested by a 14,000-foot surface drilling program during the summer. The West Tahoma was drilled by nine widely-spaced holes over a strike length of 1,000 feet, and the East Tahoma was defined by four holes along a 700-foot length. Gold was intersected in both zones. Other holes (Figure 54) detected mineralization in the East Extension area of the main Atlanta shear and on the Bascom Shear Zone.

In 1995, Ramrod completed a $2.5 million drilling program that included 50 surface holes, totaling 13,300 feet, and 24 underground holes, totaling 5,847 feet. There were 32 intercepts in 20 of the underground holes, with values between 0.1 and 1.0 opt gold over widths from 1 to 7 feet. Ramrod planned to drill another 12,000 feet to prove the underground reserves, which were estimated at 800,000 tons averaging 0.34 opt gold. Proven open-pit reserves were 1.15 million ounces of gold and 3 million ounces of silver in two pit sites. Permitting was under way, and the company hoped construction could start in mid-1997, contingent on financing. In May, Ramrod attempted to gain 100 percent ownership of the Atlanta gold project by offering one common share of stock for every five shares of Atlanta Gold stock (17.7 million shares outstanding); this exchange was apparently not completed. In October, the company announced plans to reorganize and change its name to Ramrod Gold, Ltd. A year later, Consolidated Ramrod Gold changed its name to Quest International Resources.

During 1996, Quest conducted a feasibility study on the Atlanta project. Plans called for mining 1 million ounces of gold and 2.55 million ounces of silver from 162 unpatented and 34 patented claims on 2,678 acres. The property had three mineralized areas, two of which were amenable to open-pit mining and one that would be mined by underground methods. The company was planning a cyanide heap-leach operation.

In February 1997, Atlanta Gold and Voisey Bay Resources, Inc., formed a new company, Twin Gold Corporation, by exchanging one share of stock in the new company for two shares of Atlanta Gold stock or one share of Voisey Bay stock. In mid-1997, Twin Gold signed an agreement with Quest giving Quest a 20 percent interest in the Atlanta property for its $3.8 million investment in the property since 1993. Twin Gold planned to spend $6.5 million to develop the property, with the immediate goals of upgrading reserves and resources, updating permits and completing the final environmental impact statement, and conducting a feasibility study. Plans called for
Figure 53. Portal of the 900 level of the Boise-Rochester Mine in 1994, with equipment parked near the entrance (Idaho Geological Survey photograph).
Figure 54. Reverse circulation drilling in progress near the Monarch shaft in 1994. The Monarch headframe is in the center of the photograph, and the open pit extends up the hill on the right side of the picture (Idaho Geological Survey photograph).
placing the mine in production by the year 2000 at a cost of $50 million. Production was planned at 100,000 ounces of gold per year from both underground and surface workings. The mine had near-surface reserves of 1 million ounces of gold and 3 million ounces of silver. Underground reserves were 784,174 tons of ore at a grade of 0.31 opt gold, while the open-pit reserves totaled 15.5 million tons at a grade of 0.07 opt gold. The company planned an underground exploration program with the goal of doubling reserves. The mine’s reserves fall into three categories: oxide, transition, and sulfide ore. About half the gold can be processed with cyanide, but the remainder is in arsenopyrite and requires oxidation to liberate it. Metallurgical testing showed that both pressure oxidation and bacterial oxidation could recover between 96 and 98 percent of the gold from the concentrate, but bacterial extraction could be done for lower capital and operating costs. Late in the year, Twin Gold signed confidentiality agreements with two companies specializing in bio-oxidation technology, BacTech Metallurgical Solutions, Ltd., and BioHeap Technologies, Inc.

In May 1997, flooding occurred when a heavy snow pack melted quickly. An estimated 30,000 yards of mill tailings from the Talache mill (Figure 55) was washed into the East Fork of Montezuma Creek and then into the South Fork of the Boise River. The Riverside Campground just east of Atlanta was closed because of concern over the arsenic and lead in the tailings. Dams (Figure 56) and diversion channels were built to keep the tailings out of the active waterways, and Monarch Greenback, the owner of the mine, signed an agreement with the Idaho Division of Environmental Quality in July. The estimated 1 million cubic feet of material still on the tailings piles is a threat in future floods.

In 1998, Twin Gold Corporation announced the results of a scoping study by Behre Dolbear & Company of Denver, Colorado, on the Atlanta Gold project, which suggested that the property shows sufficient promise to justify continued feasibility studies. The most likely mining scenario is based on producing 754,000 ounces of gold at a cost of $177 per ounce, for a net value of $50.8 million. The mine would have a seven-year life span at a gold price of $325 per ounce. Resource estimates show that the property contains some 22.1 million tons of ore with a grade of 0.06 opt gold. Twin Gold completed a lease/option agreement for the Monarch Greenback, LLC, Atlanta claims in May. Twin Gold continued to seek financing for the project throughout the year.

In June, the Environmental Protection Agency issued a Unilateral Administrative Order to Monarch Greenback to begin immediate cleanup of the tailings area. Of major concern was the need to stabilize the tailings piles to prevent further collapse and to prevent more tailings from reaching the Middle Fork of the Boise River. In addition, a large amount of the tailings from the May 1997 blowout remained in the wetlands below the tailings piles.

A considerable amount of cleanup was done later in the summer of 1998. This work included removing over 9,000 cubic yards of tailings by hand from the wetlands below the tailings impoundment, as well as removing tailings from other areas. Also, a system of monitoring wells was installed to study the water geochemistry and the interaction of the groundwater and surface water at the site. A major unanswered question is the source of the metals in the water discharging from the site. Data from the
Figure 55. Failed tailings impoundment at the Talache millsite at the Boise-Rochester Mine on May 15, 1997 (Terracon photograph).
Figure 56. New embankment below the Talache tailing piles at Atlanta in October 1997, looking east (Terracon photograph).
monitoring wells may determine whether the most of the metals are from springs feeding through the tailings or if the tailings are the source of the metals (Jim Curtis, 1999, personal communication).

This concludes the history of 135 years of development of the mines in the Atlanta district. It seems likely, given the known reserves and the interested mining companies, that the district will someday be active again. When this will occur depends on the price of gold and the miner’s persistence in freeing the yellow metal from the ground on Atlanta Hill.

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