History of the Belshazzar and Mountain Chief Mines, Boise County, Idaho

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Staff Report 08-3
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INTRODUCTORY NOTE

This report was prepared under a cooperative agreement with the U.S. Forest Service, Region IV, as part of an ongoing project to identify and describe inactive and abandoned mines in Idaho. The information in this report is from a number of published and unpublished sources in the Idaho Geological Survey's mineral property files.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 production 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 1984; since 1995, the *Minerals Yearbook* has been published by the U.S. Geological Survey. 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. Reports of recent developments are taken from the Idaho Geological Survey's (IGS) annual reports on the developments in mining and minerals in Idaho (from 1984 to present) or from similar reports produced by the Survey's predecessor, the Idaho Bureau of Mines and Geology (IBMG) from 1975 to 1984. Other published sources are referenced in the text. A complete list of references is included at the end of the report. 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.

History of the Belshazzar and Mountain Chief Mines, Boise County, Idaho

Victoria E. Mitchell[1]

Introduction

The Belshazzar Mine is on Fall Creek in secs. 17 and 18, T. 7 N., R. 4 E., on the Harris Creek Summit 7.5-minute topographic quadrangle (Figures 1, 2, and 3). Access to the property is via Forest Service Road 343B, a steep four-wheel-drive road. The principal workings extended more than 400 feet vertically up the hillside from the millsite, and the upper workings and original placers reached to the crest of the hill. At one time, the property had as many as twenty-six unpatented claims (Anderson, 1947). The Mountain Chief Mine is on a tributary to Canyon Creek in secs.18 and 19, T. 7 N., R. 4 E., on the Harris Creek Summit 7.5-minute topographic map (Figures 1, 2, and 3). There is currently no road access to the mine. The property had four adits.

Geology

The Belshazzar and Mountain Chief Mines are at opposite ends of a mineralized shear zone in biotite granodiorite of the Idaho batholith (Kiilsgaard and others, 1997; Figure 4). Numerous northwest-striking dikes in the area are composed of Tertiary rhyolite, dacite, and quartz monzodiorite. Ballard (1924, p. 59-61) described the geology of the Belshazzar in the early 1920s:

> Three prominent fissure veins strike approximately west across the property and dip 45º-50º S. Development has been confined mainly to the centrally located Belshazzar vein, though shallow work has been done on the Centennial vein 300 feet farther north. None worthy of mention has been done on the third vein, some 600 feet north of the Belshazzar. Several wide steeply dipping rhyolite and diorite porphyry dikes strike N. 60º-70º W. across the western portion of the group. They are intersected and displaced laterally from 10 to 20 feet by the three vein fissures. Four small basic dikes, striking approximately northward, occur at 200 to 400-foot intervals in the same locality with little or no

[1]Idaho Geological Survey, Main Office at Moscow, University of Idaho, Moscow.

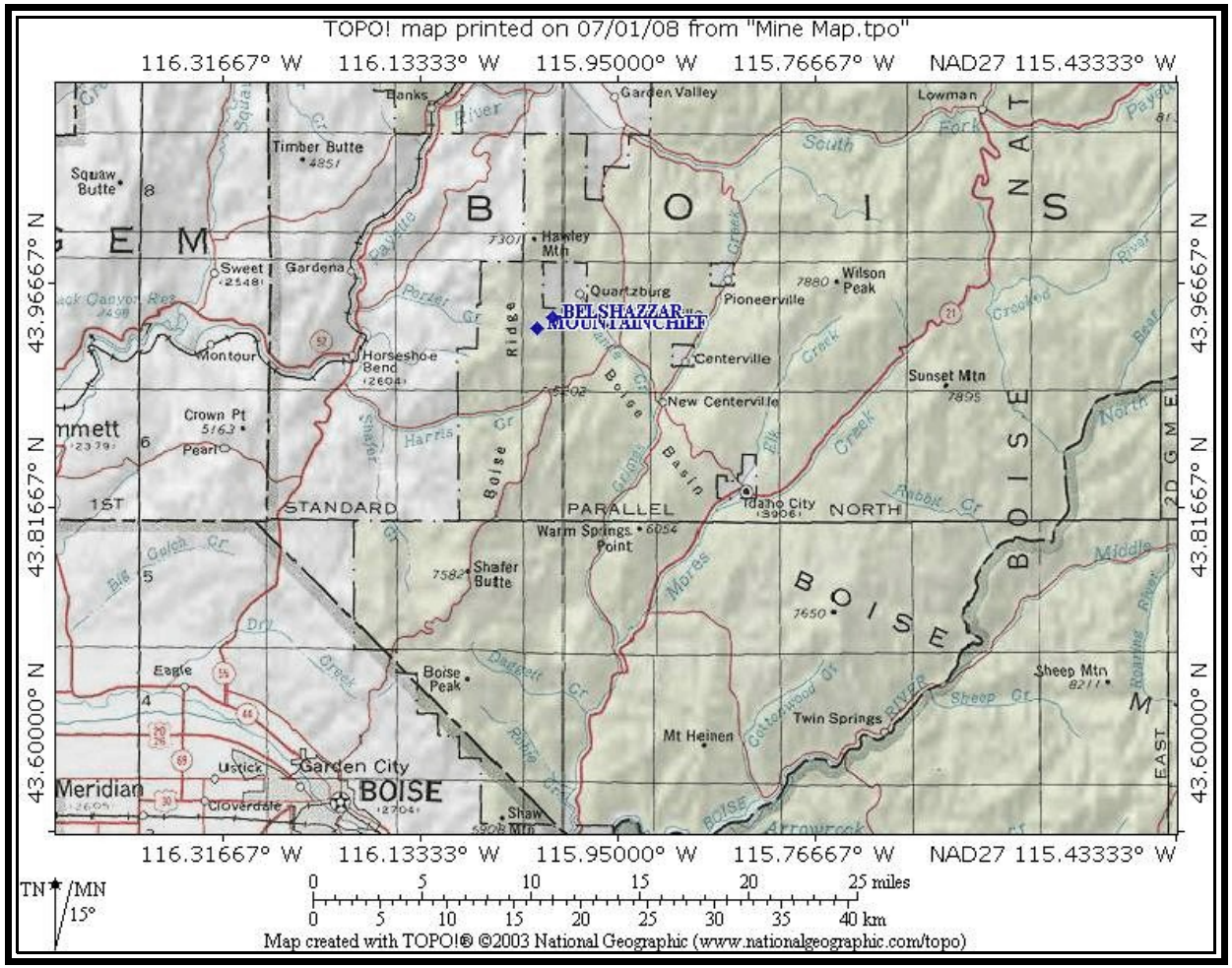


Figure 1. General location of the Belshazzar and Mountain Chief mines, Boise County Idaho, showing location relative to Boise, the Boise River, and other major landmarks (National Geographic Society TOPO! map).

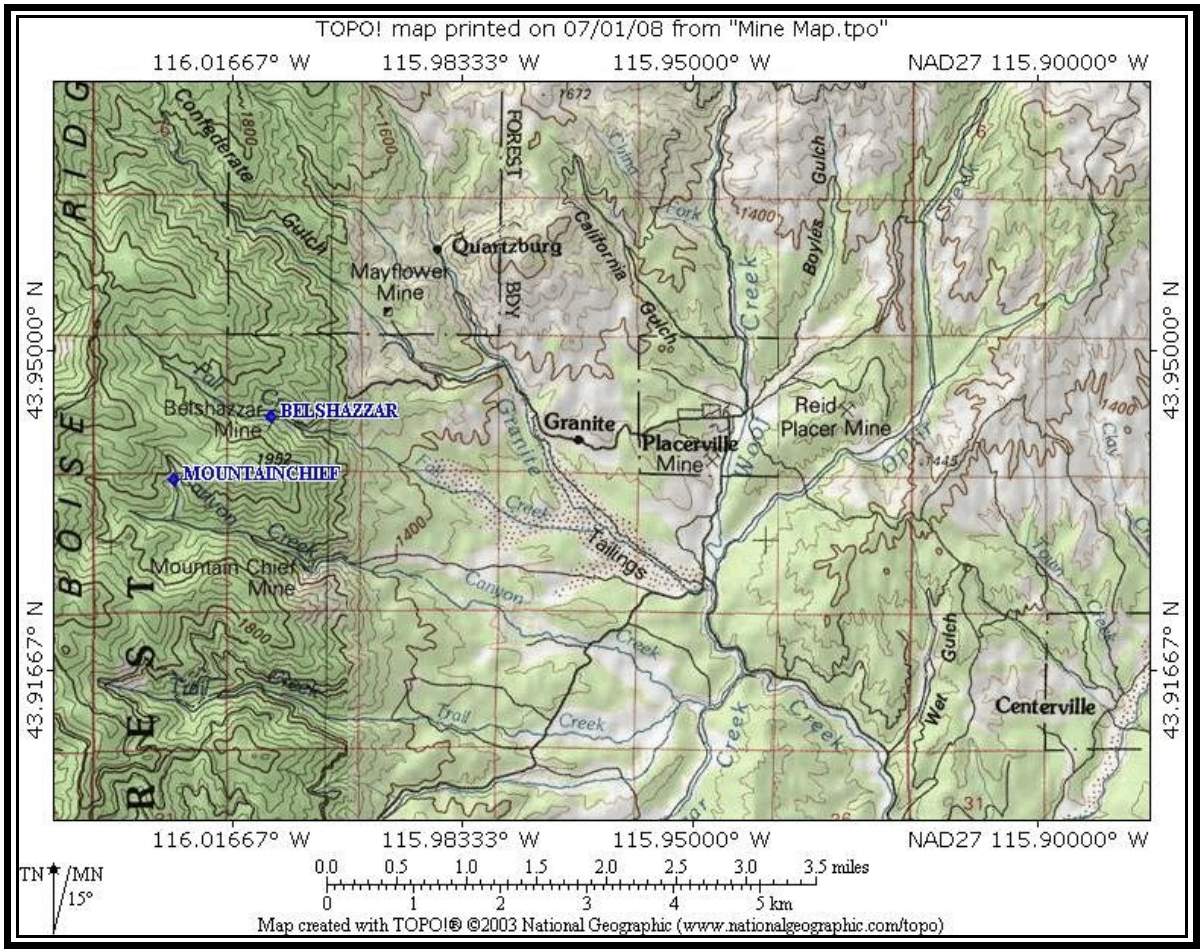


Figure 2. Boise Basin and area surrounding the Belshazzar and Mountain Chief mines (National Geographic Society TOPO! map).

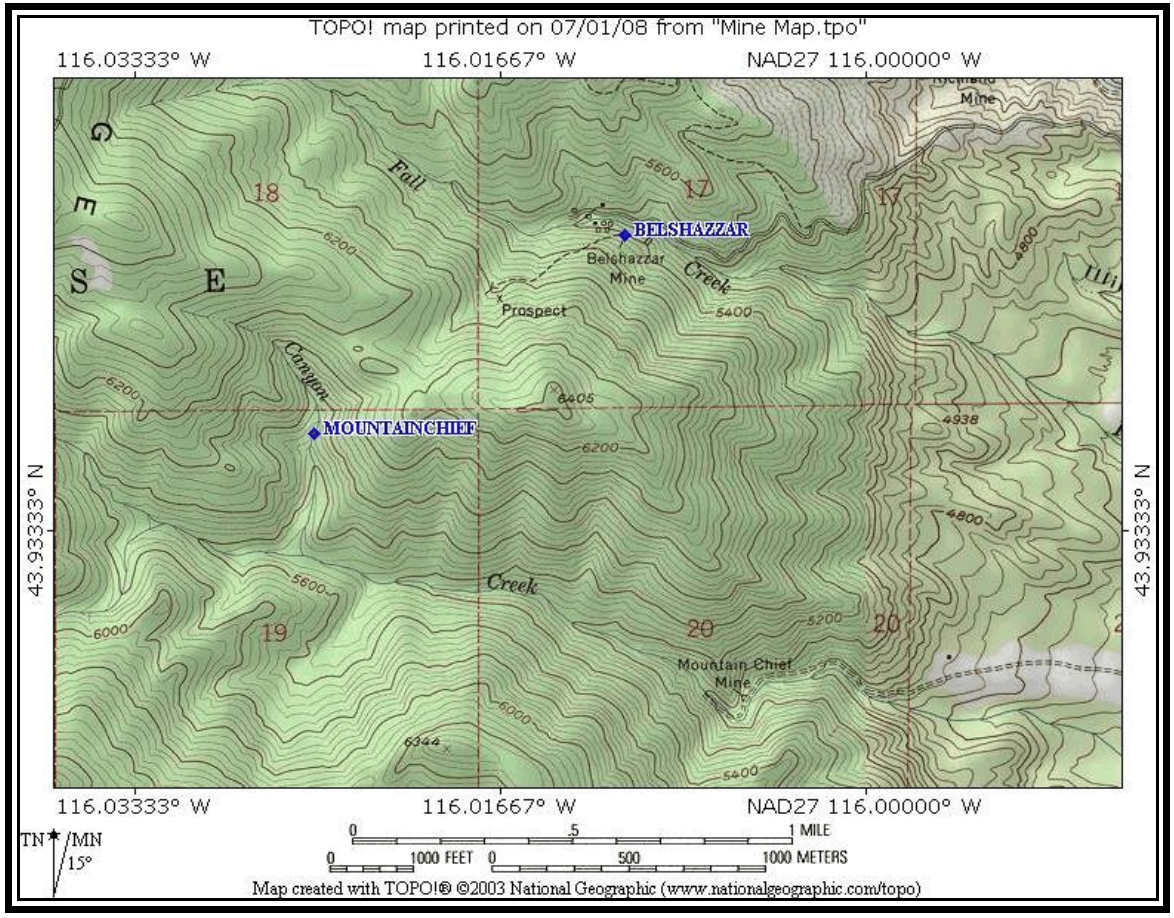


Figure 3. Location of the Belshazzar and Mountain Chief Mines, Boise County, Idaho (National Geographic Society TOPO! map). Note the discrepancy between the map location of the Mountain Chief Mine and its actual location as mapped by Kiilsgaard and others (1997) and Idaho Geological Survey field crews. The mine labeled "Mountain Chief" on the map is the Crown Point Mine.

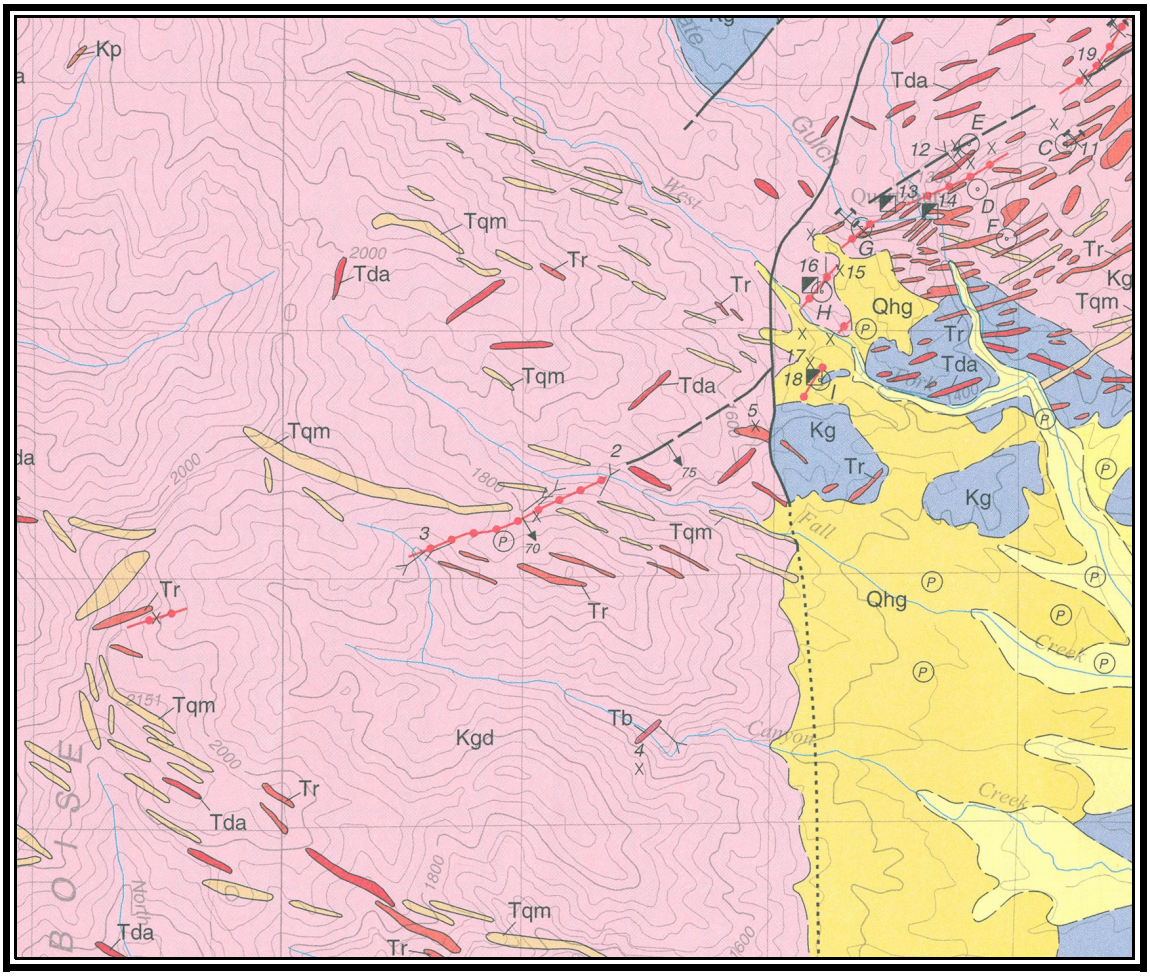


Figure 4. Geology of the Belshazzar (2) and Mountain Chief (3) mines and vicinity, Boise County, Idaho (Kiilsgaard and others, 1997). Qal (pale yellow) = Holocene alluvium; Qtg (medium yellow) = Pleistocene terrace or bench gravel; Qhg = Pleistocene high gravel; Tb = Miocene basalt dikes; Tr = Eocene rhyolite dikes; Tda = Eocene dacite; Tqm = Eocene monzodiorite; Kp = Cretaceous pegmatite and aplite; Kg = Cretaceous muscovite-biotite granite; Kgd = Cretaceous biotite granodiorite. Contacts = Medium-weight lines, dashed where approximately known. Faults = Heavy lines; dashed where approximately known, dotted where covered. Veins = Red lines with dots, arrow showing dip. Placer-mined areas are marked with the letter P in a circle.

displacement at the vein intersections. The only ore of any importance so far discovered has come from about these various intrusives. . . .

The Belshazzar is a typical gouge-filled fault fissure [Figure 5], with abundant pyrite and occasional sphalerite mineralization, varying in width from a few inches in the discovery tunnel, to three and four feet toward the west end of the lowest drift (No. 5). The two shoots of quartz-pyrite ore occur as small kidneys and lenses extending along the fissure in the vicinity of the several dikes. The quartz ore is as a rule considerably fractured and frequently shows mineralization by sphalerite subsequent to the pyrite. Only very small amounts of galena are present. One specimen collected in the raise, showing some galena and considerable sphalerite, contained a small amount of bismuth. Whereas pyrite elsewhere along the vein seldom assays more than 0.10 oz to 0.20 oz. per ton in gold, that which occurs with the quartz very consistently assays 0.50 oz. or more. A sample of material composed of quartz and pyrite in about equal amounts which was selected from the vein near its intersection with a rhyolite dike on the No. 5 level assayed 7.45 oz. gold per ton. The place sampled is fully 700 feet beneath the surface and the ore showed no evidence of supergene enrichment, the lower limits of which are evidently 200 or 300 above. A portion of this material was thoroughly ground and panned, but no gold was revealed.

Ballard (1924, p. 61-63) described the Mountain Chief as follows:

Pyrite characterized the vein throughout its length, but in the shoot which has been described, the gold and silver occurred closely associated with bismuth minerals. Qualitative tests of selected specimens taken from the ore bin and the dumps show bismuth rather abundantly. The ore of this metal occurred as scattered bunches and streaks throughout the gouge and was often accompanied by quartz. Sphalerite was abundant but its quantity or relation to the deposit could not be learned. Two unusual features characterize this deposit: (1) the six basic dikes cutting diagonally across the vein at intervals of 50 to 75 feet, and (2) the localization of the ore in that portion of the vein intersected by these dikes [Figure 6]. Two rhyolite dikes were cut elsewhere on the property by the same vein, but the bismuth was apparently not related to that intrusion. On account of timbering the age relations between the basic intrusives and the fissure could not be determined underground. Little if any displacement of the basic intrusives is evident whereas the rhyolite has been displaced several feet. The later rhyolite intrusion mentioned under the description of the Gold Hill property is about one mile to the south.

Recent work on this property has been confined to a mill-level drift, 200 feet below No. 4 tunnel, also on the Mountain Chief vein. This drift as yet lacks a few hundred feet of being beneath the original ore shoot, the downward extension of which is the objective. Ore was encountered near the present face at an intersection with a rhyolite porphyry dike; a small basic dike also occurs in the vicinity of the intersection. The ore is a sulphide, shows no oxidation, and consists mainly of pyrite, sphalerite, and some arsenopyrite. The vein is slightly over three feet wide and consists of the usual gouge filling of crushed, altered, and mineralized country rock with occasional streaks of mineralized quartz. A specimen of apparently clean arsenopyrite, selected near the face of this lower drift, assayed as follows:

Gold	1.36 oz.
Silver	0.70 oz.
Bismuth	2.0 %
Lead	0.3 %
Zinc	0.0 %
Copper	0.0 %
Antimony	0.6 %

Arsenopyrite is not the most abundant sulphide at the place the specimen was selected but it is fairly common in the vicinity. Pyrite predominates, and sphalerite is next in order of abundance. Quartz and occasionally calcite occur as small bunches or lenses. The ore is reported to assay 0.53 oz. in gold across the 3-foot fissure.

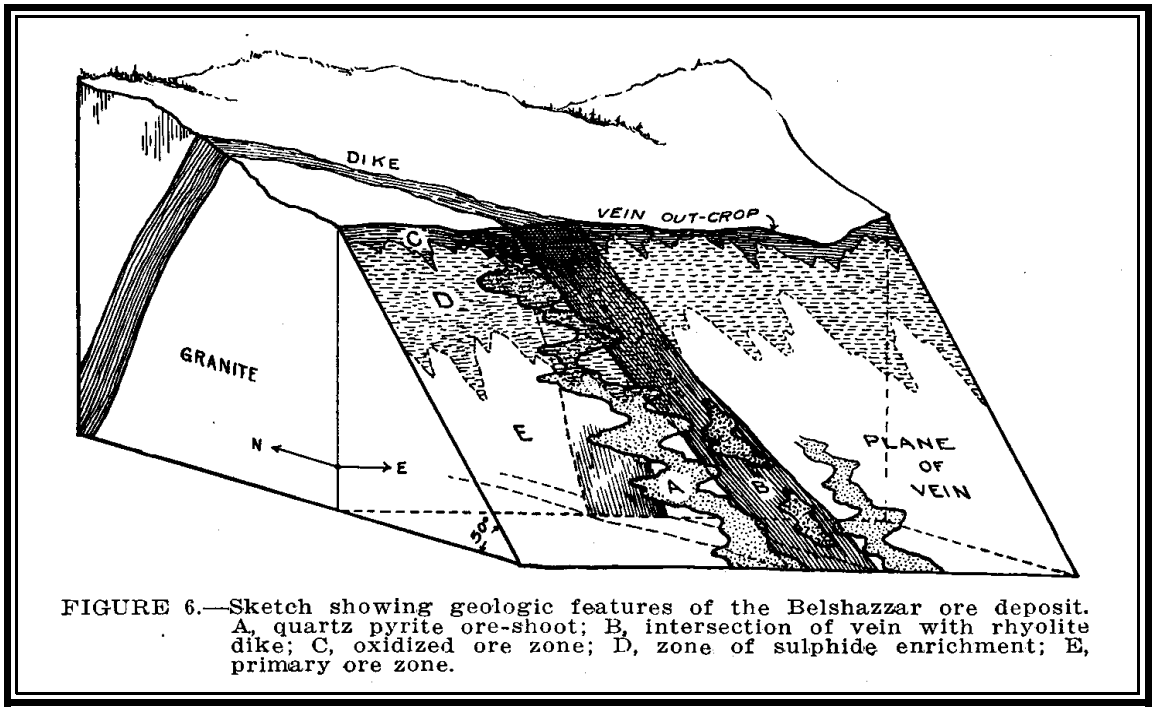


FIGURE 6.—Sketch showing geologic features of the Belshazzar ore deposit. A, quartz pyrite ore-shoot; B, intersection of vein with rhyolite dike; C, oxidized ore zone; D, zone of sulphide enrichment; E, primary ore zone.

Figure 5. Sketch showing the underground features of the ore vein at the Belshazzar Mine (Figure 6 from Ballard, 1924).

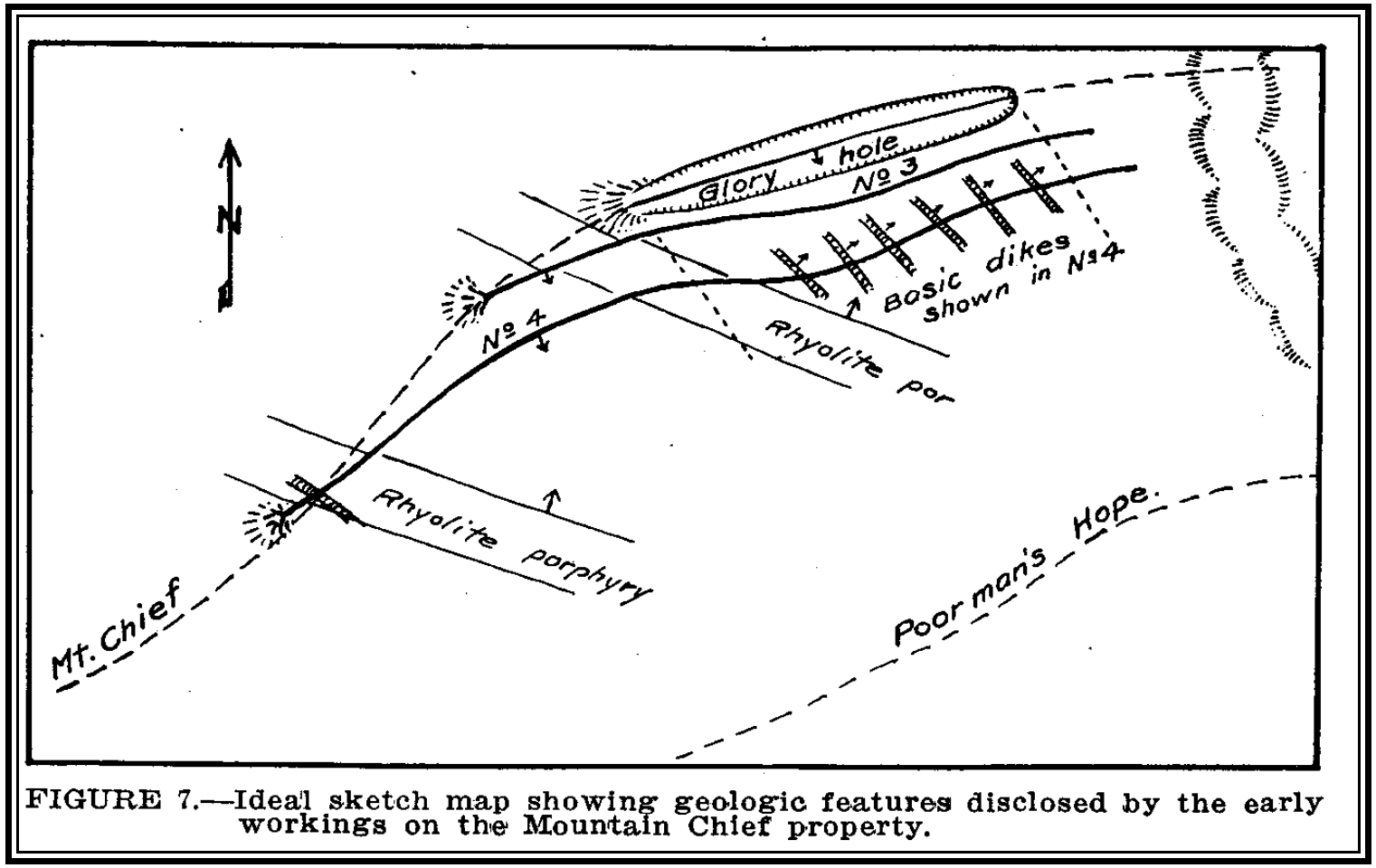


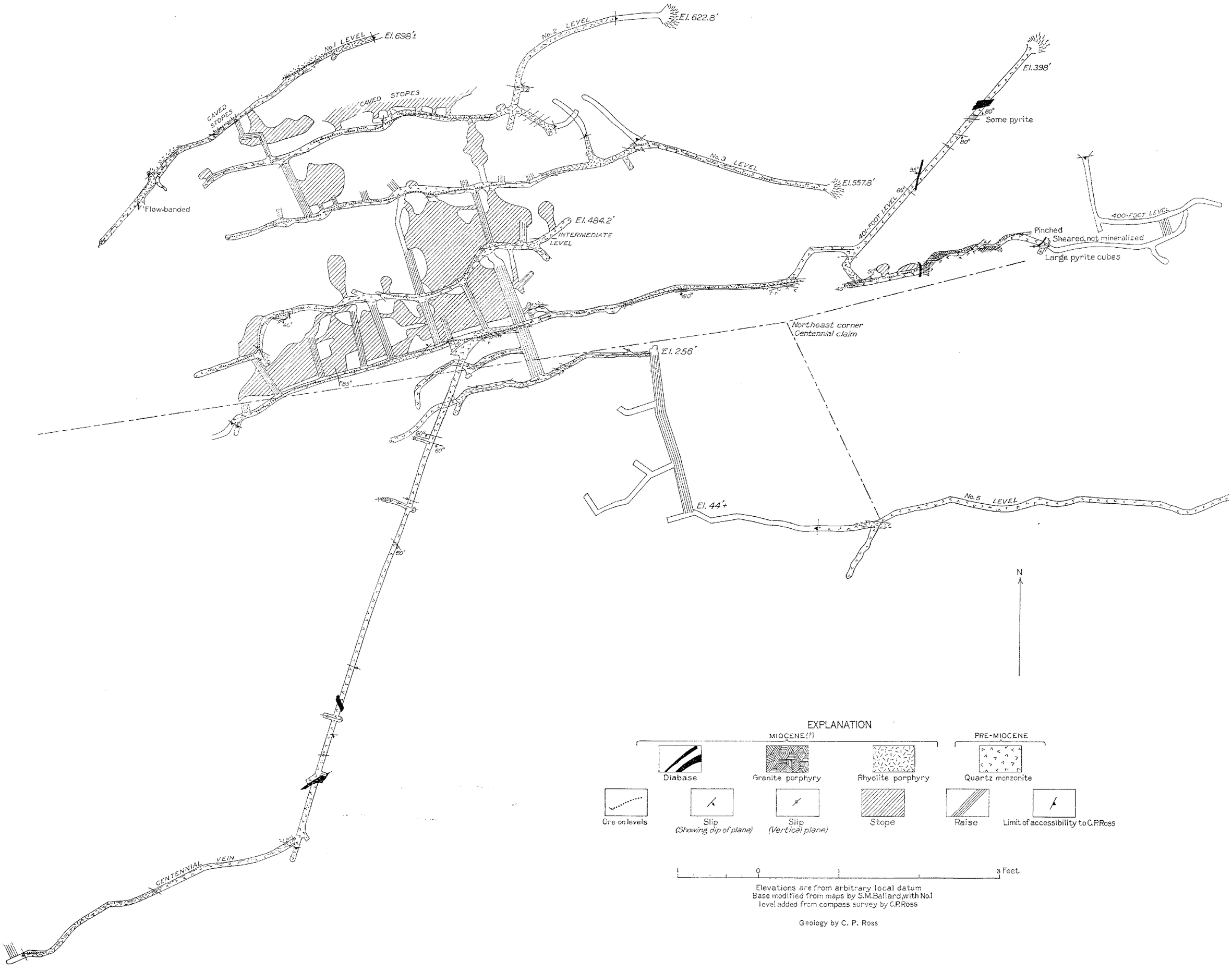
FIGURE 7.—Ideal sketch map showing geologic features disclosed by the early workings on the Mountain Chief property.

Figure 6. Sketch showing relationship of geologic features to the workings at the Mountain Chief Mine (Figure 7 from Ballard, 1924).

Ross (1934, p. 265-267) provided the following information on the geology of the Belshazzar:

> The quartz monzonite of the Idaho batholith, containing a few pegmatite stringers, is the principal wall rock and is cut by later dikes of at least three kinds. The most abundant of these dikes underground in the mine is a light-colored rhyolite porphyry similar to but somewhat more calcic than the rhyolite porphyry of the Gold Hill mine. Sericitized phenocrysts of sodic plagioclase, 3 to 15 millimeters long, compose 25 percent of the rock. Quartz phenocrysts are absent except in a few places. Altered mica, in part originally biotite, makes up 5 or 6 percent of the rock. The groundmass is a fine granular aggregate of quartz and sericitized feldspar in roughly equal amounts. This rock forms irregular branching dikes, which are cut by the lodes (pl. 47 [Figure 7]). One dike, with a maximum width of about 60 feet, extends diagonally through the mine, mainly to the east of the principal stopes. It has a curved course averaging somewhat north of west, and its dip ranges from nearly vertical to 45° S. More irregular and smaller masses of similar rock are exposed at intervals in and west of the stoped area. They doubtless represent branches of the large dike. The drift on the 401 level well to the south of the other workings cuts two masses of the rhyolite porphyry, one of which appears to be part of a dike considerably wider than any exposed elsewhere in the mine.
>
> In the drift on the 401 level that exposes the eastern extension of the main vein there is a pinkish porphyry dike which evidently corresponds to the granite porphyry on the surface (pl. 40 [Figure 8]), although underground it is rather fine grained and probably of smaller dimensions, being perhaps an offshoot of the large mass above. It contains altered phenocrysts of feldspar and mica (mainly biotite), with a few of quartz, in a groundmass consisting mainly of micropegmatite. Like the rhyolite porphyry, it was intruded prior to the mineralization.
>
> Several small dark-colored diabasic dikes from a few inches to 8 feet in width are disclosed in the workings and apparently are everywhere later than the ore. Near the west end of the intermediate level above the 401 level stringers of diabase follow faults that offset pyrite seams.
>
> Two lodes, the Belshazzar and Centennial, are exposed in the mine, but the Centennial has been followed only on the 401 level (pl. 47 [Figure 7]) and has not been stoped. The lodes strike N. 70°-75° E. and dip south. A parallel lode about 600 feet north of the Belshazzar has received almost no development.[1] The average dip of the Belshazzar lode, as judged from the mine workings, is about 30° from level 1 to the intermediate level below level 3, and 50° to over 60° thence downward. The shearing planes along the Centennial lode are steeply inclined. All three lodes correspond in attitude to the main system of postdike fissures. . . .
>
> As plate 47 [Figure 7] shows, there are numerous slips of diverse trends independent of the shearing followed by the lodes. Some of these trend essentially parallel to the main shearing, but others strike across it, commonly without appreciable displacement. Some of the crosscutting slips correspond in trend to the second set of fractures mentioned in the discussion of the regional structure . . . , but so far as the present workings show this set is less well developed here than in the Gold Hill mine. Some of the slips are mineralized, but most are not. Some postore movement has taken place, but the displacements are small, and it is probable that nearly all the fractures originated prior to the mineralization. Most of the dike contacts show evidence of movement, and some of these have been mineralized.
>
> The Belshazzar lode is a shear zone from a few inches to 4 feet wide. As is indicated on plate 47 [Figure 7], it is not continuously mineralized, there being considerable stretches along the drifts in which the lode is marked only by shearing and a little gouge. The irregular shape of the ore bodies in the Belshazzar lode is illustrated in plate 47 [Figure 7], although the mapping of the stopes is somewhat incomplete. Stoping had not yet commenced below the 401 level at the time of visit in 1930, but some ore had

[1]Ballard, 1924, p. 58-59. [Format of footnote modified from that in the original.]



GEOLOGIC MAP OF THE BELSHAZZAR MINE.

Figure 7. Geologic map of the workings of the Belshazzar Mine in 1930 (Plate 47 from Ross, 1934). Note the stopes on the upper levels and the significant number of caved workings.

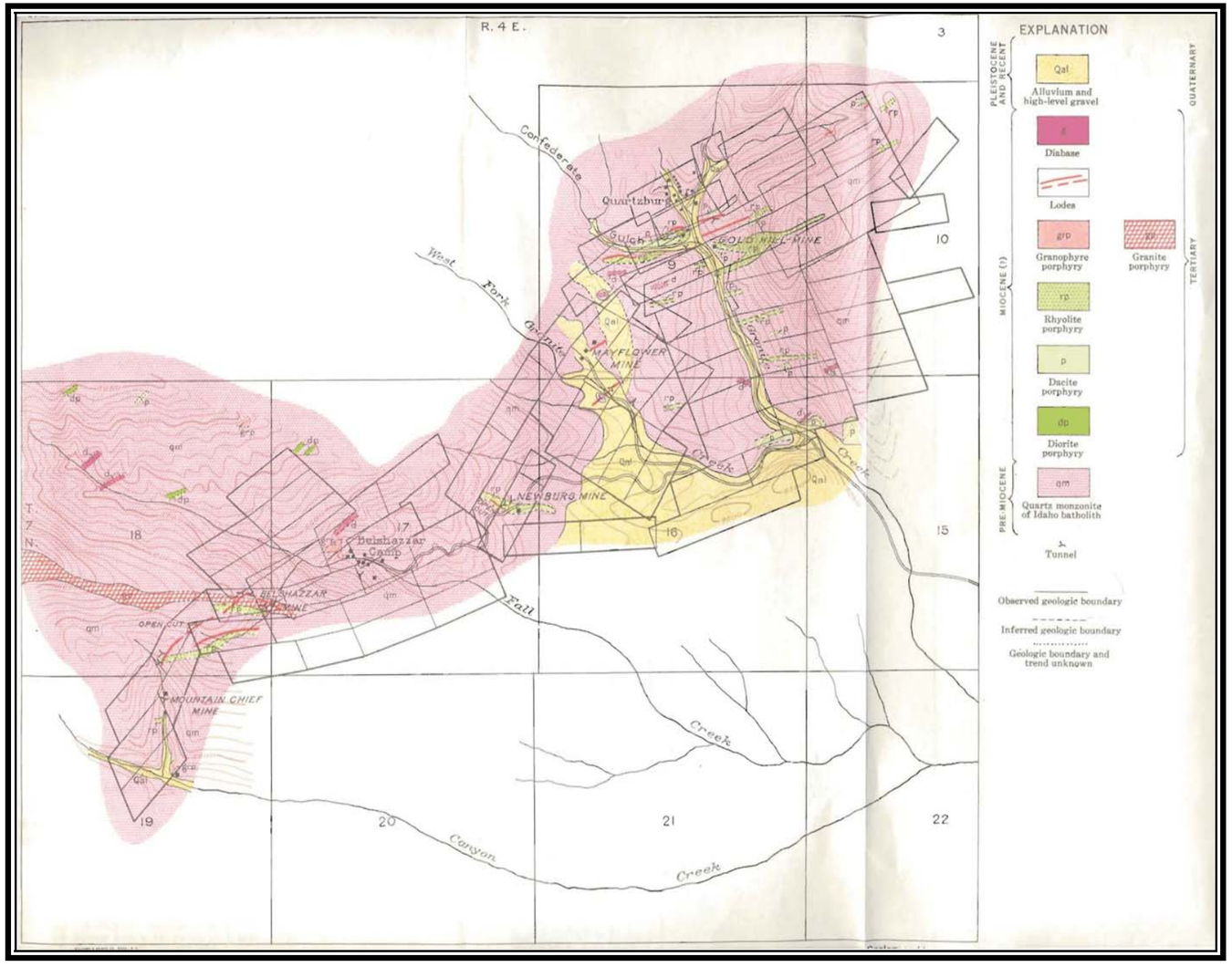


Figure 8. Geologic map of the Quartzburg area, Boise Basin, Idaho (Plate 40 from Ross, 1934). Map shows outlines of the mining claims as well as the topography of the area mapped in detail. This is one of the first detailed geologic maps of this area.

been mined in driving the intermediate drifts in that part of the mine. Ballard[2] has pointed out that the known ore bodies lie close to intersections between the lode and dikes. The dikes in this vicinity are, however, so numerous and irregular that such rough correspondence as exists has little bearing on the localization of ore shoots. Much of the ore is in the granitic rock. Premineral cross fracturing may have had quite as potent an influence as dike intersections in the localization of ore shoots. Hence it may be that here, as in the Gold Hill vein, it is not necessary to confine exploration to the immediate vicinity of dikes. On the other hand, ore bodies analogous to those in the Pioneer workings have not yet been sought in the Belshazzar mine. The general geologic conditions are so similar that it is quite possible that ore bodies of the Pioneer type may lie somewhere in the larger rhyolite porphyry dikes in the hanging wall of the Belshazzar lode.

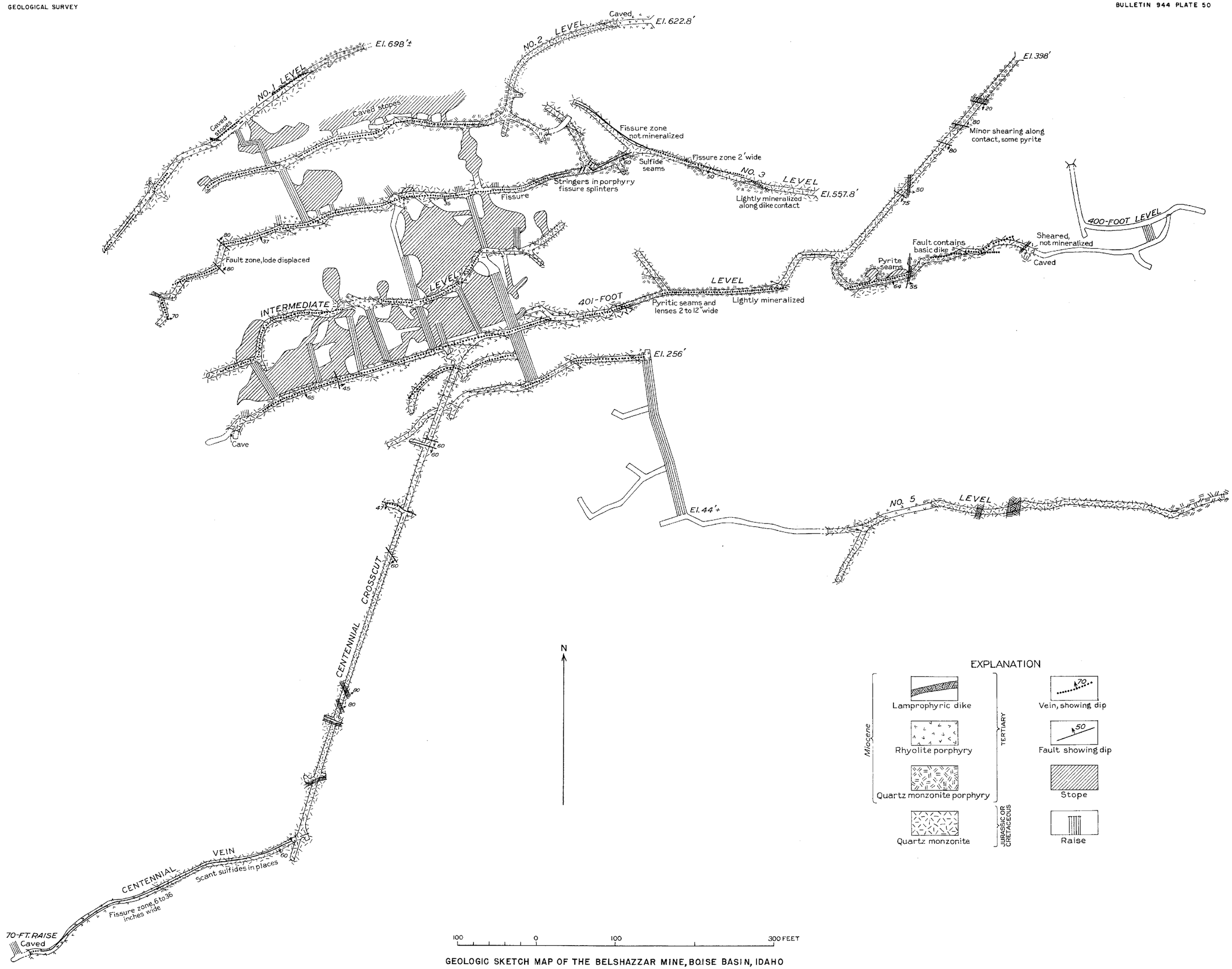
Ross (1934, p. 268) noted the following on the geology of the Mountain Chief:

> The country rock is quartz monzonite cut by rhyolite and granophyre dikes (pl. 40 [Figure 8]). In a crosscut near the portal of tunnel 4 rhyolite porphyry is cut by stringers of a dark diabasic rock. The lode in tunnel 4 strikes N. 60° E. and dips 50° SE. It is probably the western extension of the Belshazzar.

Anderson (1947, p. 278-280) described the structural setting of the Belshazzar as follows:

> The Belshazzar mine is about centrally located within the "porphyry belt," and dikes of quartz monzonite porphyry, rhyolite porphyry, and lamprophyre are exposed in the underground workings as well as on the surface, and, except for the lamprophyres, are cut by the Belshazzar and Centennial lodes (pl. 50 [Figure 9]). The quartz monzonite porphyry dikes are long and have, barring slight offsets, been traced for more than a mile. One passes beneath the camp along the bottom of the canyon, but the most prominent extends from the summit of Boise Ridge east-southeast through the mine. Another body of quartz monzonite porphyry is also exposed in the crosscuts and drifts in the No. 3 and No. 401 workings and two others in the No. 5 crosscut. The two bodies in the upper levels are somewhat irregular in thickness and are separated by reefs of quartz monzonite. Both cross diagonally through the workings. The rhyolite porphyry dikes are smaller and are not so conspicuous on the surface as the quartz monzonite porphyry dike. At least three irregular rhyolite porphyry dikes have been cut in the western part of the workings and still another in the Centennial drift. These dikes are of variable size and locally appear to branch. They also pass diagonally through the workings and curve somewhat south of east and dip steeply north to vertical. Where the rhyolite and quartz monzonite porphyry dikes have been cut by the lodes their rock is considerably altered, and one variety is difficult to distinguish from another. The lamprophyric dikes may be recognized from fragments in the soil debris but cannot be mapped, except underground. Several of them are exposed in the workings, particularly in the west part of the mine and along the 401 and Centennial crosscuts. They have diverse trends, but most of them strike somewhat north of west, locally north. They range from a few inches to 8 feet in thickness. Their rock is bleached, though younger than the lodes which they cut, and identification as to type is difficult.
>
> There is a third lode on the property in addition to the Belshazzar and the Centennial, but neither this lode, which lies parallel to and 600 feet north of the Belshazzar, nor the Centennial, which also lies parallel to and 680 feet south of the Belshazzar, has been stoped. These lodes occupy fissure zones that trend approximately N. 70°-75° E., but the Belshazzar lode is curved at a considerable angle. It is supposed to be an easterly extension of the Mountain Chief lode on the opposite side of the Fall Creek-Canyon Creek divide, but the strike of the Mountain Chief lode is about N. 45° E. until it nears the common end line of the two mines, and then it curves in a broad arc as its strike changes to N. 60° E. and then to N. 70°-75° E. as it continues across the Belshazzar

[2]Ballard, 1924, p. 41-42, 60. [Format of footnote modified from that in the original.]



GEOLOGIC SKETCH MAP OF THE BELSHAZZAR MINE, BOISE BASIN, IDAHO

Figure 9. Geologic map of the workings of the Belshazzar Mine in 1932 or 1933 (Plate 50 from Anderson, 1947). Note the slight extension of the workings over that shown in Figure 7 and the variations in the geology.

732858 O - 47 (In pocket)

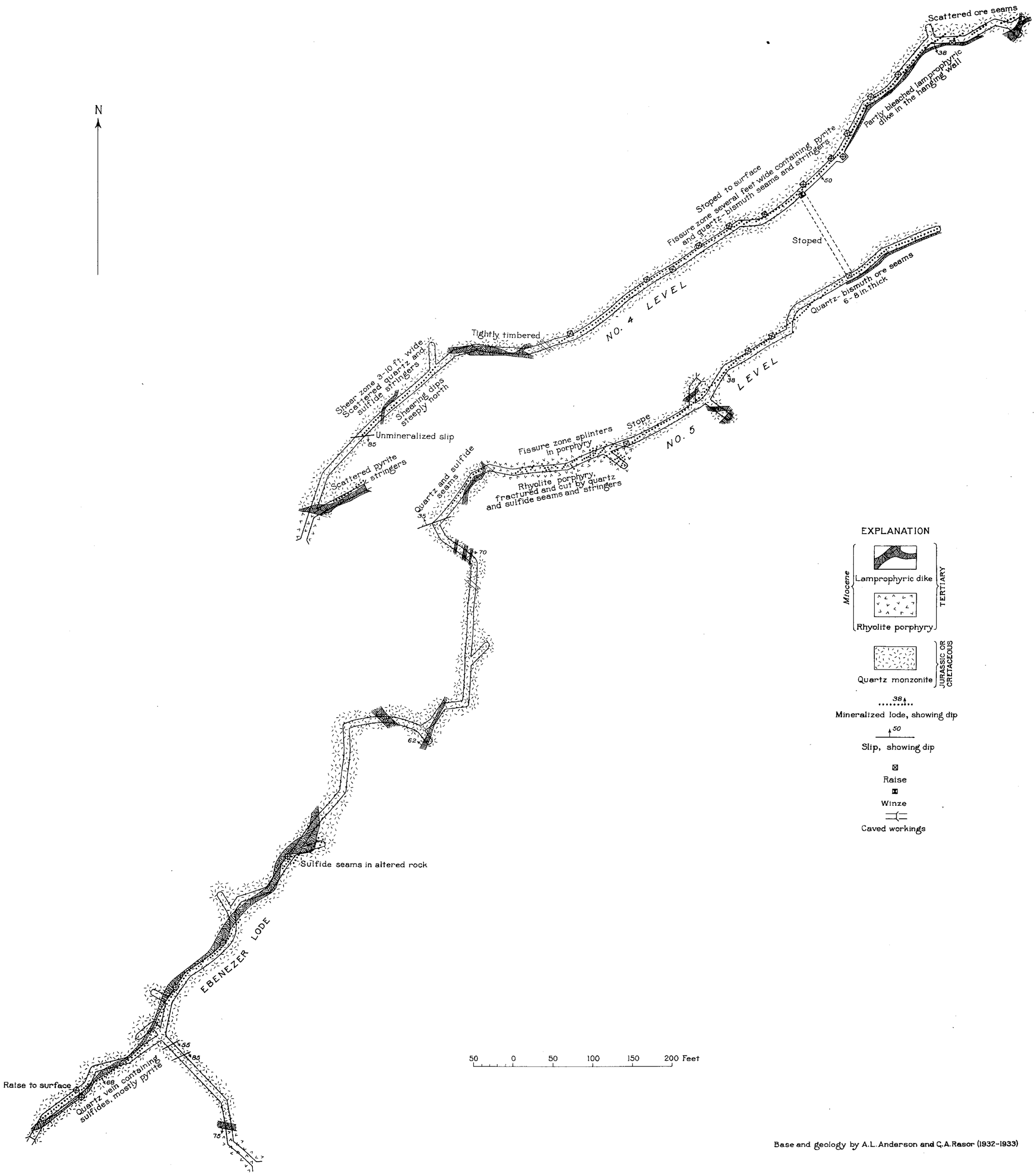
ground. The dip of the Belshazzar also shows a marked change with depth. Near the surface its dip is relatively flat, but between the No. 3 and 401 levels it increases from 30° SE. to nearly 70° SE. and remains unchanged to the lowest level. The dip of the Centennial is steeply southeast on the 401 level. There are also numerous fractures and slips of parallel and diverse trend, which are independent of the main fissuring. Some of these are shown on the maps of the underground workings (pl. 50 [Figure 9]). The No. 3 crosscut is partly along a minor fissure zone of west-northwest strike and steep southwest dip. Some of the fractures along the Belshazzar fissure zone strike N. 35°-55° E. and extend for some distance into the walls. Near the far end of the No. 3 drift one of the mineralized fractures strikes N. 20° W. and dips 70° NE. Similar cross fractures may be observed along the 401 level, some of them mineralized, others barren. Most of the dike contacts show evidence of movement, and some of the fractures alongside contain thin seams of ore. Movement has also taken place subsequent to ore deposition, but the displacements are of minor magnitude, commonly no more than a few inches, and are mostly along the planes of the older faults. One fault in the east workings on the 401 level has, however, offset the Belshazzar lode for several feet. This particular fault strikes N. 10º E. and dips 55º SE.

The fissure zone occupied by the Belshazzar lode ranges from a few inches to 4 feet in width but lacks continuous mineralization and contains stretches in which the lode is marked only by shearing and a little gouge. Much of the ore along the fissure zone is confined to relatively small shoots where the fissuring is most pronounced. These shoots are irregular and characteristically swell and pinch on strike and dip. The richest ore has apparently been in the widest swells, and the principal swells were found between the 401 and No. 3 levels where the dip is notably flat. The distribution of the ore has apparently been controlled by premineral fracturing, and the most extensive ore deposition has been in the zones where the rock was most fractured and rendered most permeable to the ore solutions, especially in openings produced by movement along a curved or irregular fault plane. The most favorable site for mineral deposition has been in the granitic rock of the batholith and not in the porphyry dikes or at lode and dike intersections. As elsewhere, the rhyolite porphyry tended to splinter rather than fissure, and, although wider zones of fractures were produced, the ore in them is more widely dissipated and the value, therefore, is not so high. On the No. 3 and 401 levels the ore in the larger bodies of porphyry was left unmined, and the stoping was confined to the more compact and better-defined fissure veins in the granitic rock and across some of the smaller rhyolite porphyry dikes. Stoping has been carried along the strike at intervals for a distance of more than 200 feet. Much of the ore occurred in more or less compact veinlike bodies, few of them more than 12 inches thick, but commonly surrounded by a fringe of smaller seams and stringers. In some places the ore occurred only as stringers and seams in the fractured rock. In and along the lode, and particularly along the ore shoots, the country rock has been intensely sericitized, locally permeated by carbonates, and widely impregnated with crystals of pyrite.

Of the Mountain Chief, Anderson (1947, p 275-276) reported:

The mine lies well within the “porphyry belt,” and rhyolite porphyry and lamprophyric dikes are exposed in the workings underground (pl. 49 [Figure 10]) and on the surface. The lamprophyric dikes are too narrow to be recorded, however, except on the maps of the underground workings. The maps show that the lodes, of which there are two, the Mountain Chief and Ebenezer, are largely contained in the porphyritic quartz monzonite of the Idaho batholite. The lodes also cut rhyolite porphyry dikes, but are cut by the lamprophyric dikes. The lamprophyric dikes are erratic in distribution, trend, and size, lie along or across the lodes, and swell abruptly into chimney-like masses and within a short distance disappear entirely. Where they lie in or against the lodes they have been somewhat fractured and bleached but contain no ore. In the granitic rock the lodes occupy fissure zones, but where the lodes enter the rhyolite porphyry dikes the fissures splinter up into broad zones of fractures.

The fissure zone occupied by the Mountain Chief lode strikes about N. 45° E. where first encountered underground and then gradually changes its strike to about



GEOLOGIC SKETCH MAP OF THE NO. 4 AND NO. 5 TUNNELS OF THE MOUNTAIN CHIEF MINE, BOISE BASIN, IDAHO

Figure 10. Geologic map of the lower (No. 4 and No. 5) levels of the Mountain Chief Mine (Plate 49 from Anderson, 1947).

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N. 60° E. toward the northeast end line of the property (pl. 49 [Figure 10]). Its dip is 50° to 60° SE. and may steepen somewhat with increasing depth. The Ebenezer lode, exposed near the portal of the No. 5 tunnel, strikes about N. 40° E. and dips about 60° SE. Both lodes show the complex fissuring and fracturing of the Miocene shearing and have one principal plane of displacement with irregularly fractured rock alongside, in places accompanied by subordinate more or less closely spaced parallel sets of fractures. The fissure and fracture zones range from a few inches to 6 feet or more in thickness, and the ore occurs as fissure and fracture fillings. The Ebenezer lode occupies a prominent fracture zone 3 to 4 feet thick, which contains much gouge and scattered stringers of ore, some of it rich enough to be stoped (pl. 49 [Figure 10]). The principal ore bodies, however, are contained in the Mountain Chief lode, which had two ore shoots in the upper working, one about 150 feet long and the other about 400 feet long. The ore shoots are reported to pitch northeast and to be confined to the most highly fractured and permeable parts of the fissure with no relation to fissure-dike intersections. For the detailed relations of the lodes to the fissuring and fracturing and for the general structural relations the reader is referred to the geologic sketch map of the No. 4 and No. 5 tunnels, plate 49 [Figure 10].

Much of the ore in the upper workings on the Mountain Chief lode is reported to have occurred in more or less compact veinlike bodies, with seams and stringers in the wall rock alongside. The two ore shoots occurred as lenticular veins that pinched and swelled from a few inches to 2 feet or more, whereas the fissure zone between contained small stringers and bunches of ore.[3] Similar characteristics were observed along the No. 5 tunnel, where lenticular seams as much as 12 inches wide in the main fissure were accompanied by smaller seams and stringers for several feet in the altered rock on each side. The lode has an average thickness of 2 feet, although in places the zone of fractures spread outward to 10 feet or more across. In an open stope about midway between the No. 5 and No. 4 levels where ore was being mined in 1932, the lode was made up of about 5 feet of fractured rock with numerous ore seams, some of which paralleled the lode and others of which extended diagonally across.

Ore Characteristics

In addition to gold, the ore at the Belshazzar Mine contained a number of other minerals (Anderson, 1947, p. 280-281):

> The lode filling varies considerably in its composition from place to place, but most of it is a composite admixture of sulfide seams and nests cut and penetrated and in part included in younger seams and lenses of quartz, which also contains an essentially contemporaneous assemblage of pyrite, arsenopyrite, scattered small grains and tufts of bismuth and antimony minerals, dolomitic carbonate, and free gold. The distribution of the ore shoots, therefore, conforms with the distribution of the quartzose lenses and stringers and is largely independent of the older generation of sulfides.
>
> The older sulfide filling is dominated by pyrite, and many seams and stringers contain pyrite alone. In places the pyrite is cut by small nests and granules of sphalerite and galena and locally by a little pyrrhotite, marcasite, tetrahedrite or tennantite, enargite, and chalcopyrite. These sulfides as a group have been rather extensively brecciated and in part cemented by siderite, possibly of the same depositional stage, and are commonly engulfed as scattered fragmental inclusions in the younger generation of quartz. Most of the stringers in the subordinate fractures in the walls and in the larger rhyolite porphyry dikes consist of pyrite alone and contain insufficient gold for profitable extraction. Reopening of the lode has apparently been confined to the more prominent fissures and failed to disturb appreciably the minor fractures that were sealed by the early sulfides. The second generation of minerals was deposited only where the structural conditions

[3] Jones, 1917, p. 99-100 [format of footnote modified from original].

were especially favorable, and these minerals are not as widely distributed as the sulfide seams and stringers.

The younger quartz is rather coarsely crystalline and is not entirely massive. The needles and tufts of bismuth minerals generally lie in small openings between the quartz crystals or extend into and replace the earlier brecciated sulfides, particularly the galena and to lesser extent tennantite (?) and enargite. Galenobismutite appears to be the most abundant of the bismuth minerals but is accompanied by minor amounts of bismuthinite. Some boulangerite is also associated with the bismuth minerals and is present in the dolomitic carbonate as curved feathery laths and as similar laths in the galena. In places coarse crystals of pyrite and arsenopyrite are notably abundant in the quartz. Gold was observed in polished sections of the ore, mainly as very small grains associated with the galenobismutite and bismuthinite. In contrast to the extreme fineness of much of the gold, pockets containing coarse pieces were found, particularly near the intermediate level between the No. 401 and No. 3 levels. Some of the high grade ore specimens consisted of coarse arsenopyrite crystals projecting into open cavities with gold deposited on the surface of the crystals and also intricately intergrown with them in the walls of the cavities.[4]

The Mountain Chief ore was similar to that at the Belshazzar but less uniform (Anderson, 1947, p. 276-277):

The Mountain Chief lode varies markedly in the character of its filling from place to place. The two main stages of ore deposition are strikingly represented, though the ore of each is not uniformly distributed. In some places the ore seams are composed of sulfides and have but low values in gold; in other places the seams are made up almost wholly of coarsely crystalline and in part drusy quartz relatively high in gold content. The main ore shoots are the quartzose veins and seams. The early sulfides include abundant pyrite and some coarse granules and crystals of sphalerite, and locally minor amounts of tetrahedrite, chalcopyrite, and galena. Ross[5] also reports pyrrhotite. Much of the early base-metal filling has been brecciated and is cut and penetrated by the minerals of the younger generation or is contained in them as scattered fragmental inclusions. Most of the younger filling is composed of quartz accompanied in places by minor amounts of barite and sideritic carbonate, by pyrite, locally much arsenopyrite in coarse crystals, and by thin needles and tufts of bismuthinite and associated galenobismutite and tetradymite, which lies between the quartz crystals or project into and across small open vugs lined by drusy quartz crystals. The bismuth minerals also project into and replace inclusions of earlier pyrite and galena. The gold, which accompanies the young quartz, appears for the most part to be intimately associated with the bismuth minerals, but some is free in the quartz and some is held with the pyrite and arsenopyrite. The younger quartz and associated minerals were apparently most abundant in the upper workings but are still well represented in the lowest level.

The earlier sulfides appear to be more widely distributed than the younger quartzose seams and are more commonly found as fillings of fractures in the rock alongside the fissures, whereas the quartz stringers are fewer and most of the quartz is in lenses along the main fissure zone. Most of the wall-rock stringers, therefore, are of little value. The rich ore is pockety, but the values are invariably highest in the quartzose ore. Picked ore samples may assay several ounces in gold per ton and 5 to 10 ounces in silver. Only the higher-grade ore has been mined, and much of it, according to the mine management, averaged between 0.5 and 2 ounces of gold per ton.

By far the greater part of the production has come from above the No. 4 level, and development below has been disappointing. Quartz, pyrite, arsenopyrite, and bismuth minerals are still visible below the No. 4 level and are plentiful on the No. 5, but the gold

[4]Ross, 1934, p. 267-268 [format of footnote modified from original].

[5]Ross, 1934, p. 268 [format of footnote modified from original].

appears to have had a higher and more restricted range of deposition and apparently appears in progressively decreasing amounts below the No. 4 level.

History of the Belshazzar and Mountain Chief Mines, Boise County, Idaho

Belshazzar Mine

The Belshazzar Mine was discovered in 1875 when disintegrated vein material near the divide between Fall and Canyon creeks was placered (Jones, 1917). This material was reported to have yielded either $60,000 (Ballard, 1924) or $65,000 (Jones, 1917). The area placered covered about 30 acres (Ballard, 1924). In 1884, the Belshazzar had about 200 tons of mostly high grade ore on the dump. The exposed vein was 15 feet wide and "a large portion of it" was uncovered (Director of the Mint, 1885). Lindgren (1898, p. 690) noted:

> The Belzazzar claim lies on the Fall Creek side and has been opened by sluicing and a tunnel, 200 feet below the summit. Bodies of heavy sulphurets, chiefly pyrite, are exposed along the vein. The western part of the vein lies in hornblende-porphyrite, while the eastern end has granite in the foot wall and the same porphyrite in the hanging wall.
>
> A slightly divergent vein, called the Centennial, lies a few hundred feet southeast of the Mountain Chief, on the summit of the ridge. This vein carries more silver than gold, and shows heavy iron pyrite in a 6-inch seam.

By 1905, the "Belshazzar and Centennial property" was attracting more attention than any other mine in the district. The mine had three tunnels, the longest of which was 850 feet. All showed a good grade of ore. The ore from the upper two tunnels was free milling in the and produced some very handsome specimen ore. The ore also yielded very satisfactory mill results, with values of $8.00 to $12.00 per ton in free gold, from the 10-stamp mill moved to the mine from the Iowa mine the previous fall. However, in the third level the ore contained considerable iron pyrite, which was proportionately rich in gold, but the extraction by amalgamation was not complete. Experiments were made to treat the ore with cyanide. The operators suspended operations because of a break in the aerial tramway during the last part of October. (See Table 1 for individuals and companies working at the mine.) The three tunnels exposed a large reserve of ore.

The Belshazzar Gold Mining Company was incorporated on July 6, 1906. The Belshazzar continued operations in 1906 and developed considerable ore during the year. Enough ore was taken out from all parts of the mine to make a number of milling tests. This ore ran $10.20 per ton, but proved only forty per cent free milling. The company planned a new 100 tons-per-day (tpd) mill with a cyanide plant attached to treat the tailings. Contracts were let in the fall for six hundred feet of work on three different tunnels, and the work was expected to be completed by spring.

In 1907, the Belshazzar operated in a small way, but shipped gold and silver bullion. By the following year, the mine had 1,000 feet of tunnels. The property again shipped bullion. A small amount of bullion was also shipped early in 1909, but the mine was closed after that. The Belshazzar Gold Mining Company forfeited its corporate charter on December 1, 1912.

In 1915, the mine was owned by George Tew, Lewis Klein, and associates. Up to that time, total production was about 4,000 tons of ore, which had been treated in the 10-stamp mill; this ore had an average value of $10.48 a ton. Half the gold was recovered on

Table 1. Companies and individuals operating at the Belshazzar Mine.

Company Name	Officer	Date Incorporated	Charter Forfeited	Year(s) at Mine*
original locators	[1]	[1]	—	1875-?
Dale Congernour and George Tew	—	—	—	(1905)
Belshazzar Gold Mining Company	Pedro Hahn, president	6 July 1906	1 December 1912	1906-1912
George Tew, Lewis Klein, and associates	—	—	—	(1915)
Idawa Gold Mining Co.	S. A. Zimmerman, president	3 January 1919	30 November 1961	1919-?[1]
Ternan-Belshazzar Mines, Inc.	A. L. Ternan, president	19 March 1942	30 November 1982	1942

*Years in parentheses indicate a known date that was probably part of a range of dates.
[1]Information not present in Idaho Geological Survey's files.

the plates; the rest was in the concentrates, which were mostly pyrite. This material assayed from $21 to $100 per ton, but had not been shipped. The mine had three tunnels driven at intervals of 100 feet on the dip of the vein. The No. 1 tunnel was 550 feet long, the No. 2 adit was 600 feet long, and the No. 3 adit was 512 feet long (Jones, 1917).

In 1918, the Belshazzar Mine was taken over by the Idawa Mining Company and worked by a small crew of men supervised by Fred W. Brown. These men cleaned up the workings and tested the ore resources of the mine. The property's main feature was a pay shoot 500 feet long of good stoping width and values that had one stretch over twenty feet wide, which could be mined as a square-set stope. Development work continued the following year. Exploration extended the main ore shoot a considerable distance to the east, and the vein was also cut 400 feet below the current workings. Drifting outward for a main working tunnel was started at this level.

By 1921, the new tunnel was 1,400 feet long. It was Idawa's major development project at the mine and had succeeded in intersecting the vein. The mine employed seven men (IMIR). According to Ross (1934), the No. 5 adit was driven in 1921 at a reported cost of $250,000. The No. 5 adit, including its crosscuts, eventually had a combined length of over 3,000 feet (Ross, 1934). The No. 5 adit was about 535 feet vertically below the No. 3 tunnel. The No. 5 adit intersected the Belshazzar vein about 1,000 feet from the portal and drifted westward along the vein for more than 1,700 feet. The amount of ore discovered was small (Anderson, 1947). The 401 tunnel was started soon after the main work on the No. 5 adit was completed (Ross, 1934). The 401 tunnel was about 135 below the No. 3 adit, and much of the ore mined in the 1920s came from between the 401 and the No. 3 levels. The 401 adit also connected to the No. 5 adit, and a small amount of ore was mined from two intermediate levels (Anderson, 1947).

Development work continued in 1922. The mine had five tunnels and approximate total development of 4,300 feet. When Ballard (1924, p. 59-60) visited the mine in 1922 or 1923, he described the workings as follows:

> The original workings on the Belshazzar vein consist of three drifts extending westerly into the hill at 60 foot intervals; they have developed the ground for a maximum distance of about 800 feet and a maximum depth of about 200 feet. Sulphides show up rather plentifully on the lowest or No. 3 level, though stains of iron and manganese oxides are fairly abundant at many places. The ore obtained from these workings was treated locally in a 10-stamp mill. A recovery of $10.50 per ton was made by amalgamation, with a total production of $25,000. The concentrates obtained were piled on the dump for future treatment.
>
> The present owners have driven a shallow crosscut tunnel to the Belshazzar vein at a point about 300 feet east of and 135 feet below No. 3 tunnel. Drifting along the vein for about 200 feet revealed some high-grade gold ore. This exploratory work attained a maximum depth of about 50 feet. Later a crosscut was started several hundred feet east of No. 3 tunnel and about 535 feet below it to explore the vein at depth. This crosscut encountered the vein about 1,000 feet from the portal, and a drift followed it westward for 1,700 feet. Two small ore shoots were encountered in the last 700 feet, and work is now being confined to raising on the second one of these near the face of the main drift. The vein at this point has an average dip of 52° and the raise has been driven approximately 300 feet toward a known ore shoot in the old workings above. A drift to the west from the top of the raise encountered sulphide ore at 25 feet and followed it 45 feet further to a narrow barren rhyolite porphyry dike. The average value shown by sampling this 45-foot ore body is reported as 0.45 oz. in gold across an average width of 2½ feet. Ore was again encountered in the drift on the opposite side of the dike and was followed for the next 110 feet. Samples taken every 5 feet along this 110 feet of drift for widths of 2½ to 3 feet are reported to show a gold content ranging from 0.50 oz. to 0.90 oz. per ton. There is yet

about 360 feet of stoping ground above the drift before the old workings will be encountered.

Development work continued in 1923 and 1924. The company was working to drive its No. 5 tunnel. In 1924, a 285-foot raise was driven to connect the No. 5 and No. 4 tunnels. A 25-tpd amalgamation mill was constructed in 1924, paid for by stock assessments. The following year, the company did a small amount of work in the mine and treated some test lots of ore in the mill. The Belshazzar operated for eight months in 1926 and produced considerable ore. However, Idawa still levied stock assessments.

In 1927, the Belshazzar Mine maintained capacity production throughout the year. It produced over half the gold production from Boise Basin and was the second largest gold producer in the state. All work was done through the No. 4 tunnel, which connected to the mill (Figure 11) by an aerial tramway. Idawa greatly improved its mine camp, buildings, and equipment. The 1927 IMIR (p. 38-39) contained a description of the mill:

> The principal new mill in Idaho to begin operations for the recovery of gold during 1927 was that of the Idawa Gold Mining Company at its Belshazzar mine, which ranks for the year as second largest gold producer in the State, being surpassed only by one large dredge. The Belshazzar's milling process consists of amalgamation and table concentration; the interesting feature of the enterprise is that it is based on the recovery of free gold from a sulphide ore.
>
> The company's mine is located in the extreme western part of Boise Basin, Boise County, about 35 miles northeast of the State capital; it is four miles west of Placerville and about two miles southwest of the famous Gold Hill & Iowa mine at Quartzburg; its shipping point is New Centerville, the present terminus of the Intermountain Railroad, seven miles from the mine. Geographically, the mine is located on Fall Creek near the top of the divide between Fall and Canyon creeks, at an elevation of approximately 6500 feet. Geologically, it is located within the Gold Hill shear zone. The principal tunnel, through which all mining operations are conducted, is known as No. 400, as it is 400 feet higher than the mill, to which it is connected by a 1600-foot aerial tramway.
>
> The ore consists mainly of pyrite associated with a complex lead-bismuth-silver sulphide (as yet unidentified), arsenopyrite, and occasionally sphalerite, in a quartz gangue. The gold is closely associated with the lead-bismuth sulphide and arsenopyrite; although the larger part of it is coarse, it varies in size from extremely fine particles to large nuggets; one nugget was found which yielded $244.50. The association of the gold with the lead-bismuth sulphide is so dependable that panning is more satisfactory than assaying in making a quick determination of the quality of the ore. In the mill, the width of this streak of sulphide on the tables is a very dependable gauge of the amount of gold in the mill feed.
>
> The mill is the conventional amalgamation-concentration type, electrically driven, with a daily capacity of 25 tons. The ore is fed from the mill ore-bin to a 24x12-inch[6] Blake type crusher which reduces it to pass a 2-inch ring. It then goes to a set of 12x20-inch[7] rolls which crush it to ½-inch mesh; thence to a 4½ x16[8] Hardinge ball mill, where it is ground to 4 per cent on a 20-mesh screen. The ball mill discharges through a Hardinge amalgamator; thence onto two 4½x10-foot[9] amalgamation plates, from which the ore passes through a hydraulic classifier, and then to two concentrating tables. The

[6]The gape of the jaw crusher [Footnote added].

[7]The diameter and the face (length) of each cylinder of the roll crusher [Footnote added].

[8]The diameter, in feet, and the length, in inches, of the cylinder in the ball mill [Footnote added].

[9]The width and length of the amalgamation plates [Footnote added].

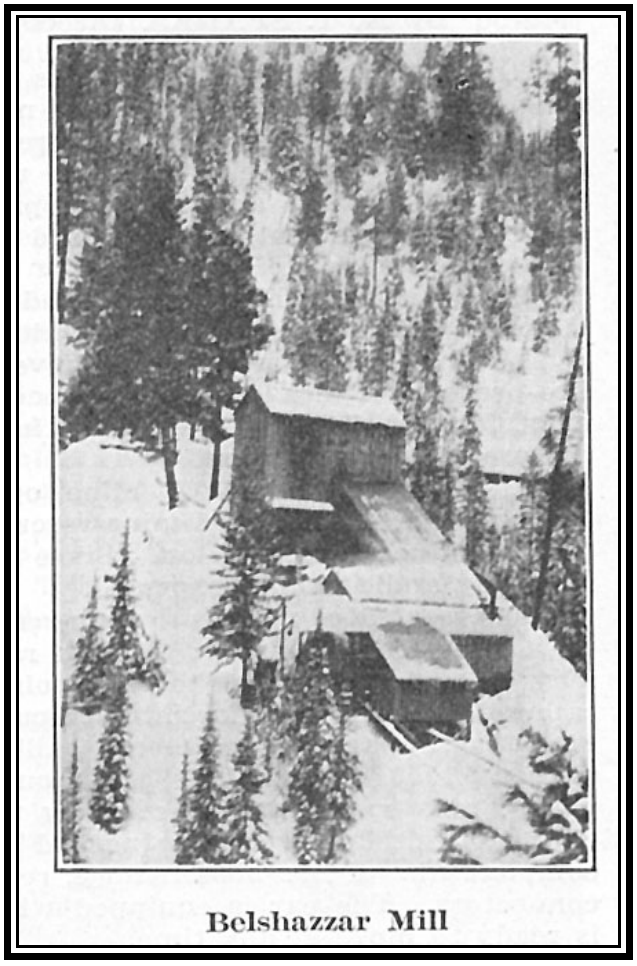

Figure 11. Photograph of Belshazzar Mill in 1927 (Campbell, Stewart, 1928, Twenty-ninth annual report of the mining industry of Idaho for the year 1927, p. 39).

concentrate from these tables is re-ground in two small cast-iron arrastres placed in series, each discharging into launders lined throughout with small amalgamation plates. Amalgam traps are placed at every convenient location from the Hardinge amalgamator to the lower end of the mill. From the arrastres the concentrate passes into a storage-bin for shipment to the smelter.

From 70 to 75 per cent of the gold in the ore is recovered by amalgamation, approximately 33 per cent of this being recovered when the concentrate is re-ground. A part of the unamalgamated gold is so intimately locked up in the sulphides that its recovery is problematical except by smelting. The principal milling loss is in fine-flaked gold having a tendency to float which makes re-grinding difficult. This gold will not amalgamate even when brought into intimate contact with a freshly dressed plate, but passes to the concentrate bins.

The concentrating tables in the mill were Wilfley tables.

In 1928, Idawa shipped gold bullion valued at about $133,000 to the Boise assay office and several hundred tons of concentrates containing gold and silver to a smelter in Utah. Some ore, which was discovered in 1928, was so rich it was shipped directly to the assay office without treatment. The mine was the largest producer of gold in Idaho, and the company paid an initial dividend of $50,000 (IMIR) or $56,000 (USBM) in December. The mill was remodeled and its size increased to 30 tpd. A flotation cell was added as the final step in the process (Mining Truth, 1929). Development consisted of 728 feet of tunneling.

In 1929, the mine again sent gold bullion to the Boise assay office and several hundred tons of concentrates containing gold and silver to the smelter at Midvale, Utah. However, output from the Belshazzar decreased about 25 percent in 1929, although development work consisted of about $8,000 in drifting and tunneling. Ballard (1929, p. 15) reported the following on the property:

Several specimens of fairly pure metallic gold have been recovered throughout the past two years that exceed $500 in value, with the largest worth approximately $900. So far there has been no evidence of oxidation found in the vicinity of the high grade here mentioned; the lower limits of oxidation, as disclosed by lower work, is roughly 100 feet above the horizon of the rich ore.

At the mine, the ore is sorted underground and the waste used for back-fill in the stopes. Regarding the recovery, approximately 80 per cent of the gold and silver in the ore is obtained by amalgamation and 10 to 12 per cent in concentrate.

The milling consists of crushing in a No. 3 Blake crusher, followed by 12x20-inch rolls and a 4½-foot by 16-inch Hardinge ball mill. In the latter, 3-inch[10] forged chrome steel balls are used for grinding. From the mill the feed passes through a Hardinge amalgamator into a trap, thence to two 4-foot by 10-foot plates in parallel. The two plates discharge into a hydraulic classifier from which the underflow passes to a No. 6 Wilfley table and the overflow to a Deister slimer. The slimes from both tables are dewatered and sent to a small flotation cell.

Reground in Arrastres.

The concentrate from both tables is sent to two 4-foot[11] castiron arrastres for regrinding, each followed by a 3x12-foot plate. These arrastres are placed in series rather than in parallel as better results are thus obtained. The final concentrate passes from the mill to an outside storage bin for summer shipment to the smelter.

Regarding the recovery made by the process outlined, approximately 80% of the gold and silver in the ore is obtained by amalgamation and 10% to 12% in the

[10]The diameter of the balls used in the ball mill [Footnote added].

[11]The diameter of the arrastre [Footnote added].

> concentrate. Of that recovered by amalgamation, about 30% is caught on the plates below the two arrastres, due largely, it is believed, to the regrinding. It has been fairly well proven at this plant that the gold requires a very thorough scouring to permit satisfactory amalgamation.

Bell (1929, p. 6) described some rich, hand-sorted ore that came from the mine:

> The ore occurs in shoots varying from 50 to 150 feet in length and consists of rather massive sulphide mineral with a good deal of talcy gouge along the wall margins. Its sulphide contents are practically identical with those of the Gold Hill Mine and consists predominantly of pyrite and arsenopyrite with an occasional rich sprinkling of lead, zinc, bismuth and antimonial sulphide, the latter associated with some phenomenal specimen gold occurrence.
>
> Rich Nuggets Sweeten the Ore.
>
> The average tenor of the ore as stoped is $25.00 per ton. During the past year, however, this has been sweetened by some remarkably rich segregations of native gold, the latter occurring in a section of the vein between the 400 and the 300 foot levels, where the dip flattened off to 15 or 20 degrees. In this section of the stope the ore body was ten to fifteen feet thick for a strike length of 40 feet. About eighteen inches above the foot wall it carried a band of hard quartz several inches thick with occasional vuggy cavities associated with some remarkable gold results.
>
> Several hand-sorted lots of this almost pure nugget gold encountered in this stope gave values ranging from $1,000 to $9,000 with one nugget weighing 105 ounces of pure metal, a much larger segregation of native gold than was ever found in any of the early day placer operations, which is a convincing proof that the erosion that produced the placers did not exhaust the source of the gold by any means in this instance,.
>
> The Belshazzar 400-foot level is approximately 1500 feet vertically above the bottom level of the Gold Hill Mine, on one of the same controlling fissure courses. According to Ballard, it is probable that some block faulting has occurred along the strike of the zone, whose movement is undetermined, but this relation of the two properties gives an encouraging prospect for the deeper persistency of the ore values in this mine.

The USBM noted the company had some legal trouble in regard to the above-mentioned high-grade material, which it described as gold associated with crystals of arsenopyrite. In 1929 the company paid a dividend of $24,000.

In 1930, Idawa employed an average of twenty-eight men and operated all year. An active development program consisted of 1,600 feet of drifting and crosscutting. Additional machinery for table concentration was installed in the mill, which improved the grade of the concentrates. In spite of this, gold production was 30 percent less in 1930 than it was the previous year. Gold bullion was sent to Boise, and the concentrates were shipped to Utah for smelting. The mine camp was also enlarged and improved.

The gold production from the Belshazzar was 27 percent less in 1931 than it was in 1930. The mine was closed late in the year. According to Anderson (1947), all known reserves of ore had been exhausted. Operations were suspended while the company readjusted its financial and corporate affairs. In an attempt to raise funds for further development, a stock assessment of 2½ cents per share was levied July 5, 1932. The returns from this were not adequate to resume operations. At the close of 1932, the company was negotiating to obtain funds from other sources. Only one watchman was employed at the property. In 1933 few concentrates from mill cleanup were shipped for smelting from the Belshazzar property. A stock assessment of 1½ cents per share was levied on August 10, 1933.

Money-raising activities continued in 1934. The mill was overhauled. A small amount of ore was milled in July and August, and rich gold concentrates were shipped.

The company did some work on the lower, or No. 5, tunnel, and plans were made to clean out the tunnel and advance it to the west. About 300 ft. of development work was completed on the 401 and 460 levels. The U.S. Government raised the official price of gold to $35 an ounce in 1934.

In 1935, it was reported that some Minneapolis people were interested in opening the Belshazzar. The following year, a crew of twelve men under the supervision of E. A. Nordquist of Boise worked to rehabilitate and develop the mine. By 1938, the property was reported as being in shape to be leased. No further mention of the mine was made before all gold-producing mines were closed in October 1942 by order of the War Production Board Limitation Order L-208.

In 1989, Westmin Resources was exploring the Belshazzar Mine. Nothing seems to have come of this venture.

The site was examined in June 1994 by an Idaho Geological Survey field crew. At that time, a two-story boarding house, a core shack , and a tailings pile (Figure 12) were noted in the area of the of the mine camp. A cabin was near the mine entrance, and a shed was on the dump of the No. 5 adit. The No. 5 adit was open, and the 401 tunnel (Figure 13) was boarded up.

An extended site examination by the Idaho Geological Survey was made in the summer of 2002. In addition to the boarding house (Figure 14) and the core shack (Figure 15), a one-story building (Figure 16) and several collapsed buildings were found in the camp area. The core shack was removed from the site sometime before late July 2002. The collapsed lower station for the aerial tramway was located a short distance upstream from the camp area. The one-story building (Figure 17) still stood at the site entrance, and the ruins of the mill (Figures 18 and 19) were on the dump to the east of the No. 5 adit. Both the No. 5 adit (Figure 20) and the 401 adit (Figures 21and 22) were open; the No. 3 level was completely collapsed (Leppert and others, 2007).

Total production from the Belshazzar Mine from 1905 to 1941 was 27,423 tons of ore and 2 tons of reprocessed tailings. This material yielded 26,352.87 ounces of gold, 44,788 ounces of silver, 13,749 pounds of copper, and 11,862 pounds of lead. Placer production in 1935 from an unknown amount of material yielded 2.46 ounces of gold and 1 ounce of silver. From 1926 until 1931, the mine shipped 28,680.59 ounces of crude bullion to the United States Assay Office in Boise. This bullion was valued at $426,464.03 at the then-current prices for gold ($20.67) and silver ($0.290-$0.624). The mine also shipped concentrates which yielded $68,954.75, of which $53,035.63 was from gold and $15,019.12 was from silver (Anderson, 1947, citing data from Ross, 1934).

Mountain Chief Mine

The Mountain Chief Mine was discovered in 1870, according to Ballard (1924). However, Raymond (1887, p. 219) noted the following for the year 1875:

> In Cañon Creek, 4 miles from Placerville, some new lodes were discovered in July, which, by the extraordinary richness of their surface-ore, created a considerable excitement throughout the Boise Basin. The principal locations are the Chief and Ebenezer and some placer claims below the former. So far very little progress has been made in the development of these lodes, but next spring will probably witness a great deal of activity. A lot of ore was to be taken over to the Boise Mining Company's mill for crushing, but I have not learned anything about the result.

Figure 12. Small tailings pile at the Belshazzar Mine (Idaho Geological Survey photograph by Earl H. Bennett). The tailings are close to Fall Creek. They are pinkish-white and smell of sulfur.

Figure 13. Boarded-up entrance to the 401 Adit of the Belshazzar Mine (Idaho Geological Survey photograph by Earl H. Bennett). Rust-colored water (visible through the leaves on the lower right) is draining from the adit.

Figure 14. Two-story boarding house at the Belshazzar Mine (Photograph P5310005 from Leppert and others, 2007).

Figure 15. Core shack at the mine camp area of the Belshazzar Mine (Photograph P5310008 from Leppert and others, 2007).

Figure 16. One-story building near the boarding house at the Belshazzar Mine (Photograph P5310006 from Leppert and others, 2007).

Figure 17. Cabin near the entrance to the Belshazzar Mine (Photograph P5310002 from Leppert and others, 2007).

Figure 18. Distant view of Belshazzar millsite (Photograph P5310003 from Leppert and others, 2007). Note the distance debris from the collapsed buildings is scattered down the hillside.

Figure 19. Close-up of the remains of old equipment at the Belshazzar millsite (Photograph P5310012 from Leppert and others, 2007).

Figure 20. Open entrance to adit No. 5 at the Belshazzar Mine (Photograph P5310016 from Leppert and others, 2007. Water leaking out of the plastic pipe which discharges at the entrance. The gate is blocked open. There is a mine car in the adit, but it was too dark to show up in the photograph.

Figure 21. Open portal to the 401 Adit at the Belshazzar Mine (Photograph P5310017 from Leppert and others, 2007). The tunnel is well timbered and open as far as the eye can see.

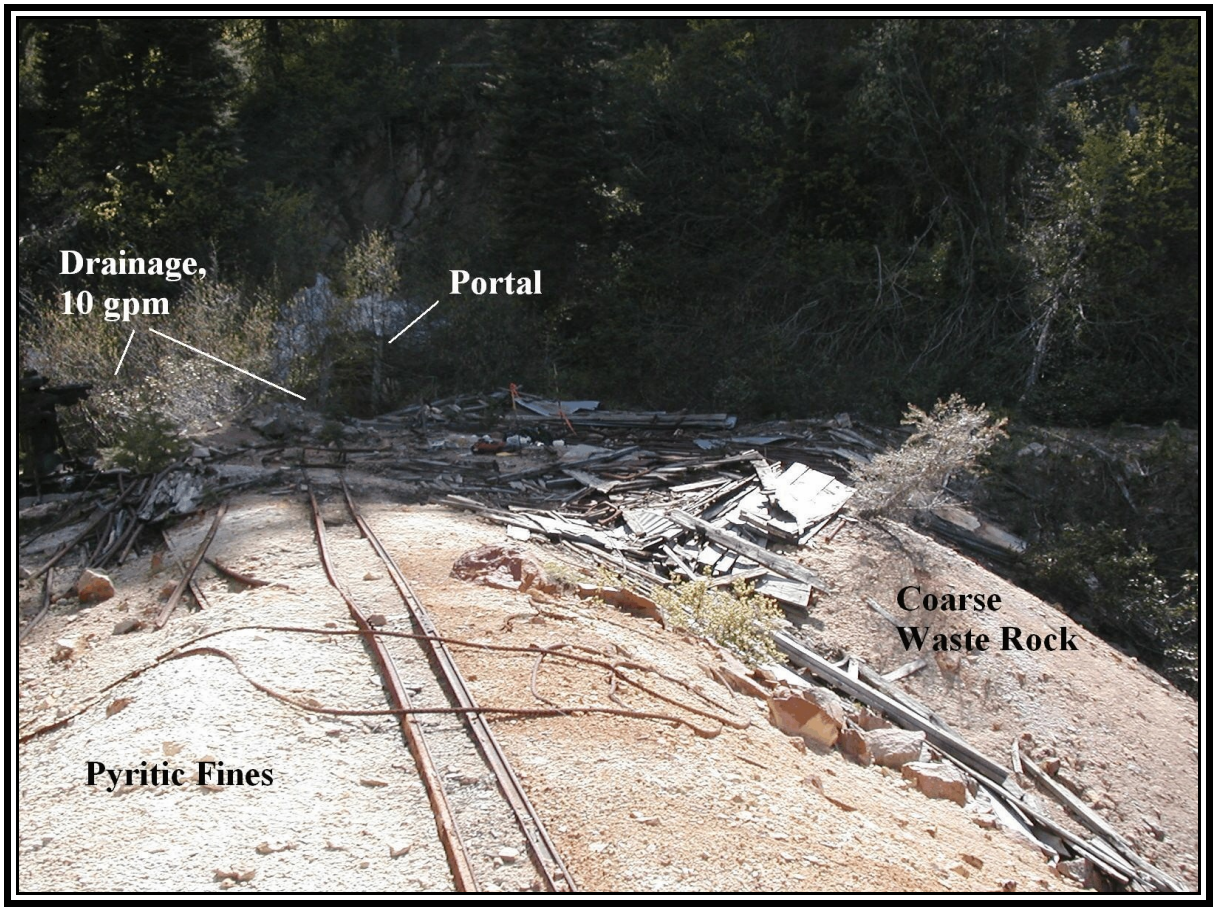

Figure 22. Dump for the 401 level of the Belshazzar Mine (Photograph P5310025 from Leppert and others, 2007). The dump consists primarily of waste rock with a smaller amount of processed fine material. The open portal is hidden behind the willows, and water flows out of it.

By 1881, both the Mountain Chief and Ebenezer lodes had been worked off and on, producing "some very rich ore." However, as the lodes were mined to greater depths, the ore became refractory and could not be treated with a simple milling process (Director of the Mint, 1882). Lindgren (1898, p. 690) also described the property:

> *The Ebenezer vein*.-This vein is continuous for a distance of nearly a mile across the gap in the ridge between Canyon and Fall creeks, and three important claims are located on it. The Ebenezer claim lies on the Canyon Creek side, and is said to have produced $150,000 from sluicing and surface workings. The vein strikes northeast and southwest and dips to the southeast, and is encased in granite. It is about 5 feet wide, and consists of sheeted granite traversed by many small and rich quartz veins. The surface ore was very rich, but at a slight depth the gold was contained in sulphides, which did not readily yield it to simple amalgamation. Only assessment work has been done during the last years.
>
> The Mountain Chief claim adjoins on the northeast, extending to the summit of the ridge, at an elevation of 6,000 feet, and the vein is similar to the one just described. It is stated that 10 tons of its ore were milled in 1895, yielding $100 per ton, and much gold has been obtained by sluicing the surface. Sulphurets appear here also in depth. In a surface cut the section of the vein was as shown in fig. 63 [Figure 23].

The National Mining and Development Company, Limited, was organized on September 23, 1911. (See Table 2 for individuals and companies working at the mine.) A 10-tpd amalgamation and gravity concentration mill was built at the mine in 1912 and operated for about 60 days that year. It produced bullion and concentrates, and the concentrates were stored at the mill for later treatment with cyanide (USGS). The 1912 IMIR (p. 67-68) noted:

> About three miles west of Quartzburg, the Mountain Chief Mine was under active development during the year by the National Mining and Development Company.
>
> This property has been opened on a well-defined and richly mineralized fissure vein. It is joined on the east by the Belshazzar Mine and on the west by the Ebenezer Mine.
>
> These three properties would work well in combination through a deep tunnel from either side of the hgh mountain divide they traverse, as they are on the same vein and present a remarkablly continuous fissure in granite formation, and would likely afford a number of shoots of profitable ore if opened by a deep tunnel through the combined length of the three properties.
>
> The Mountain Chief claim has several adit tunnels driven on the vein, which disclosed an ore shoot at the time of my visit 150 feet in length, and carrying in thickness from one to three feet of pay ore, and carrying high values in gold.
>
> This is a quartz filled fissure, containing in the ore shoot quite a massive iron sulphide ore, associated with a little zinc and lead mineral and some antimony sulphide.
>
> A 20 ton lot of the base sulphide ore taken from this operation during the summer was tested in the Mineral Hill mill and gave a result of $100.00 per ton in free gold to simple plate amalgamation.
>
> This property was being equipped with a five stamp mill last fall and additional work on the mine, to put the ore body in shape for economical extraction, should afford a profitable gold mining venture as the merit of the deposit is substantially indicated by the present development which in combination with the adjoining Belshazzar and Ebenezer claims and their numerous shallow tunnels and development openings are reputed to have already produced a total output of fully $300,000 in gold bullion since their discovery.

The company's report to the Idaho Mines Inspector stated the mill equipment consisted of a stamp mill with five stamps, a Blake rock breaker, and a 9'x15'[12] Wilfley

[12]The width and the length of the surface of the table's surface.

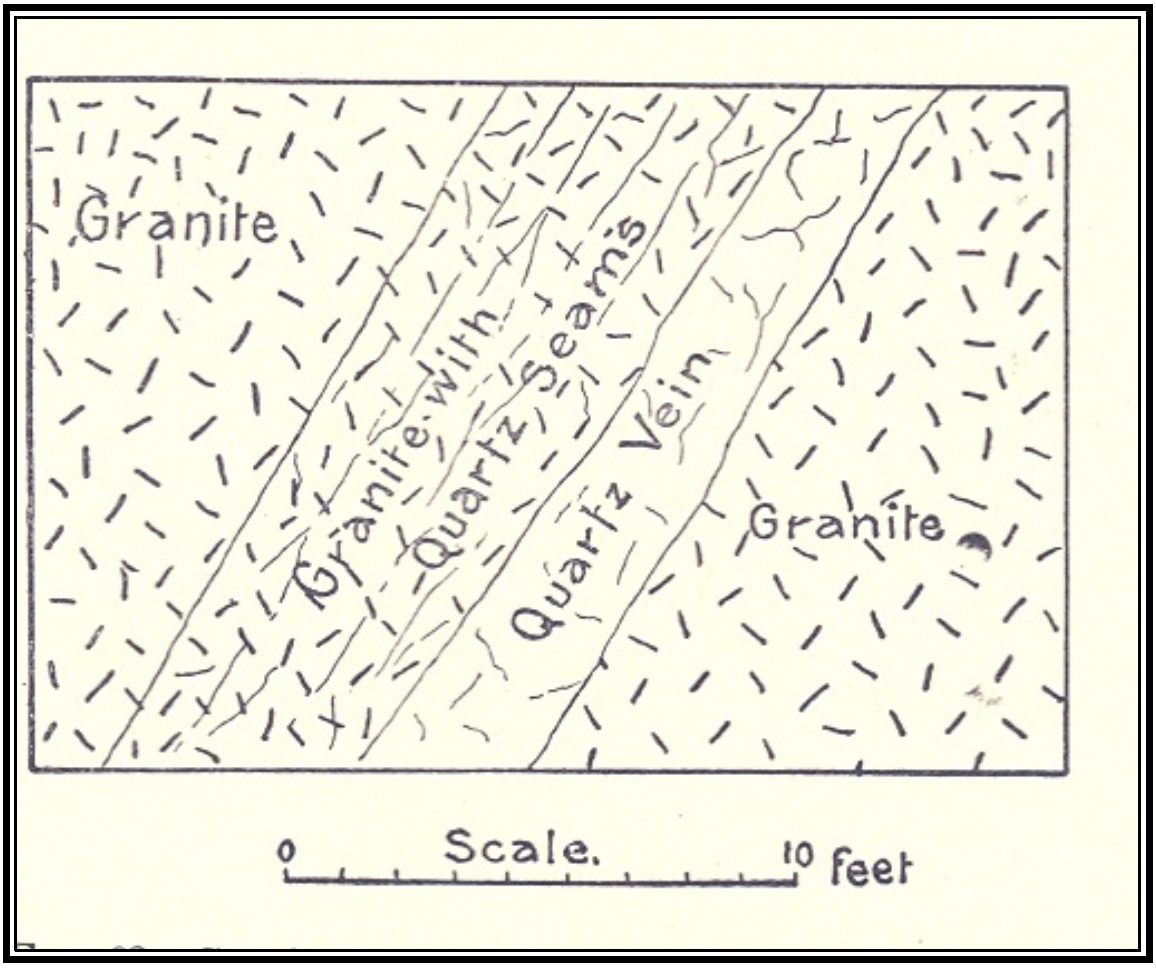

Figure 23. Section of the Mountain Chief vein (Figure 63 from Lindgren, 1898).

Table 2. Companies and individuals operating at the Mountain Chief Mine.

Company Name	Officer	Date Incorporated	Charter Forfeited	Year(s) at Mine
original locators	—	—	—	1875-?[1]
National Mining and Development Company, Limited	A. C. Gallupe, president	23 September 1911	30 November 1982	1911-1982
Idaho Mines and Metals Company, Limited	Cornelius Dorr, Jr., president	27 January 1920	30 November 1923	1920
Mountain Chief Mining Company	Henry Legler, president	19 November 1923	1 December 1924	1923-1924
Federated Mines Company	William W. Dey, president	26 June 1928	1 December 1930	1928-1929
Ideal Mining Company	H. P. Taylor, president	17 September 1927	30 November 1932	1931-1932

[1]Information not present in Idaho Geological Survey's files.

table. The mill (Figure 24) was powered by a 50-horsepower boiler and engine. The company treated 1,000 tons of ore with an average gross value of $40.00 per ton during the year. This ore was reduced to 17½ tons of concentrates with a recovery rate of about 40 percent. The gross metal content of all material shipped during the year was 1,576.88 ounces of gold and 199.86 ounces of silver per ton. The company received $25,534.70 from the sale of bullion and $2,278.70 from the sale of concentrates during the year.

The mine was the largest producer of gold in the district in 1913, and the mill operated most of the year. (See Tables 3 and 4 for information on development at the mine.) The following year, the mine operated for six months, and a 25-tpd cyanidation plant was added to the mill. The company mined 3,326⅓ tons of ore and claimed a recovery rate of 84 percent in bullion and concentrates. For the year ending May 31, 1914, the company's report to the Idaho Mines Inspector noted that it had received $20,507.31 from the sale of bullion and $36,683.24 for the sale of concentrates. A considerable quantity of this material was shipped to Salt Lake City area smelters.

The 1915 IMIR (p. 88-89) contained the following information:

> A few miles further southwest [of the Gold Hill and Iowa Mine] the National Mining and Development Company successfully operated the Mountain Chief Mine during the year and made an important production of gold with a five stamp mill. This mine carries a pronounced fissure on the margin of the same big porphyry zone, and in contact with a black dike, that contains an ore shoot 400 feet long, from a foot to three feet wide, that has been operated for several years and given average milling results of $20 to $30 per ton in gold. The resources of the two upper adit tunnels on this vein have been pretty well exhausted and a new tunnel 200 feet deeper has been extended in. In this new opening the old ore shoot was encountered nearly 200 feet earlier than was anticipated in the course of the vein, which would indicate a lengthening of the ore body to that extent or a sudden change in pitch. The same rich values have been found in this new tunnel, which characterized the ore course above, and the enterprise gives decided promise of continued profitable operations.
>
> The ore of this vein is heavy iron pyrite with a distinct association of very fine crystals of antimony sulphide that are associated with high values of both gold and silver, but difficult to save in the milling operations. Flotation attachments in the mill are being tried out and some concentrates are being made from this method that are giving returns of several hundred dollars per ton in gold and silver.
>
> On the opposite margin of the big porphyry zone, which is several hundred feet wide on this property, a narrow vein, rich in silver, has been proven by some shallow development and will probably be tested during the coming year by a cross-cut from the new deep level.
>
> In the strike of the Chief vein to the northwest the Ebenezer Mine, owned by the same company, noted for the production of high grade gold ore to the amount of over a hundred and fifty thousand dollars that was largely worked by sluicing by early day placer miners, the soft outcrop of the ore shoot for several hundred feet along its course is now being developed by leasors, who are finding some decided encouragement in the form of rich gold ore at a point considerably short of the position of the main ore shoot in a deep tunnel they are driving, and it is very probable that the Ebenezer will shortly be put into profitable mining account.

Rich concentrates, crude ore, and – presumably – bullion[13] were shipped during the year.

The Mountain Chief operated throughout 1916, and a change in the composition of the ore in the deeper levels of the mine required the company to make a number of changes in the milling process. The ore was treated by cyanidation, and the company

[13]Bullion production, but *not* bullion shipment, was mentioned by the USGS.

Figure 24. Mountain Chief mill, 1912 (opposite p. 67 in Bell, R. N., 1913, Fourteenth annual report of the mining industry of Idaho for the year 1912).

Table 3. Development work, number of men employed, and operating companies at the Mountain Chief Mine, by year. Information is taken from companies' annual reports to the Idaho Inspector of Mines, unless otherwise noted.

Year	No. of Men employed	Tunnels (feet)	Sinking (feet)	Cross-cutting (feet)	Drifting (feet)	Raising (feet)	Operator
1913	24	—	—	600[1]	—	400	National Mining and Development Company, Limited
1914	35	—	240[2]	1,200[1]	—	—	National Mining and Development Company, Limited
1921	4	—	—	350[4]	—	—	National Mining and Development Company, Limited
1922	?[3, 17]	80	—	—	—	—	National Mining and Development Company, Limited
1923	?[3]	100	—	—	—	—	National Mining and Development Company, Limited
1923	?[3]	120	—	—	—	—	Mountain Chief Mining Company
1924[5]	?[3]	—	—	—	—	—	National Mining and Development Company, Limited
1925[6]	?[3]	—	—	—	—	—	National Mining and Development Company, Limited[7]
1928[6]	?[3]	—	—	—	—	—	National Mining and Development Company, Limited[8]
1928	10	—	—	—	—	—	Federated Mines Company
1931	?[3]	—	—	—	—	—	National Mining and Development Company, Limited[9]
1932	10	—	—	—	—	?[10]	Ideal Mining Company
1943	0[11]	—	—	—	—	—	National Mining and Development Company, Limited
1944	0[11]	0	0	—	0	—	National Mining and Development Company, Limited
1950	?[12]	—	—	—	—	—	National Mining and Development Company, Limited
1954	?[13]	—	—	—	—	—	National Mining and Development Company, Limited
1957	?[14]	0	0	0	0	—	National Mining and Development Company, Limited

Table 3 (continued). Development work, number of men employed, and operating companies at the Mountain Chief Mine, by year.

Year	No. of Men employed	Tunnels (feet)	Sinking (feet)	Cross-cutting (feet)	Drifting (feet)	Raising (feet)	Operator
1962	?[14]	0	0	—	0	—	National Mining and Development Company, Limited
1963	?[15]	—	0	—	—	—	National Mining and Development Company, Limited
1964	2[16]	0	0	—	0	—	National Mining and Development Company, Limited

[1]Number is combined total for crosscutting and drifting.
[2]Number is combined total for sinking and raising.
[3]Number of men employed was not reported to the Idaho Inspector of Mines.
[4]Although this number was reported as crosscutting and drifting combined, the cost was reported only in the drifting category.
[5]The company's report to the Idaho Inspector of Mines stated that it was preparing to resume operations after the expiration of Mountain Chief Mining's lease.
[6]Only assessment work was done during the year.
[7]The property was under option to G. F. Hildbradt (spelling uncertain) and associates of Chicago.
[8]According to National Mining and Development, the property was under option to John D. Crimmins.
[9]According to National Mining and Development, the property was under option to Ideal Mining Company.
[10]Ideal Mining Company reported that its work for the year consisted of raising, but it did not report how many feet of work it had done.
[11]War Production Board Limitation Order L-208 closed all "non-essential" (gold-producing) mines in October 1942 for the duration of World War II.
[12]The company reported that the mine had been leased to "a Mr Casey of Portland" on a long term lease and option to purchase. No other information was recorded. The IMIR noted the property was leased to "Max Casey," but this appears to be a misreading of the handwriting on the company's report to the Idaho Mines Inspector.
[13]The company reported that the mine had been leased to H. J. Casey of Portland, Oregon, on a long term lease and option to purchase. No other information was recorded.
[14]The company's president and statutory agent, who filed the company's annual report with the Idaho Mines Inspector, stated that information on men employed was unknown to him.

Table 3 footnotes, continued. Development work, number of men employed, and operating companies at the Mountain Chief Mine, by year.

[15] The company employed a "couple [of] men for assessment" work during the year. All assessment work was done on the surface.
[16] These men were employed for the summer to do assessment work. All assessment work was done on the surface.
[17] Although no employment figures were given, wages were listed for miners, helpers, and blacksmiths.

Table 4. Cumulative development at the Mountain Chief Mine, by year. Information is from company reports to Idaho Inspector of Mines; discrepancies in numbers reflect inconsistencies in the original data.

Year	Total Development (ft)	No. of Tunnels	Total Length of Tunnels, Cross-cuts, and Drifts (ft)	No. of Shafts	Total length of shafts (ft)	No. of Raises	Total Length of Raises (ft)	No. of Cross-cuts	No. of Drifts	Length of Principal Tunnels (feet)				
										No. 1	No. 2	No. 3	No. 4	No. 5
1913	3,600	—	—	—	—	—	—	—	—	—	—	—	—	—
1914	9,640	—	—	—	—	—	—	—	—	—	—	—	—	—
1921	5,000	—	—	—	—	—	—	—	—	—	—	—	—	—
1922	?[1]	4	4,000	1	100[2]	18	2,000	5	?[3]	300	1,400	1,200	?[1]	2,300
1923[4]	?[5]	1	2,500	—	—	2	—	—	—	2,000	—	—	—	—
1923[6]	4,000	5	4,000	2	—	2	—	3	7	—[7]	500	600	750	2,700
1924	8,000	5	—	1	—	—	—	—	—	2,300	—	—	—	—
1925	600	5	—	—	—	—	—	—	—	800	200	900	120	2,200
1928	600	5	—	—	—	—	—	—	—	900	200	900	900	2,200
1928	?[1]	5	6,000	—	—	—	—	—	—	400	600	800	1,300	2,000
1931	4,300	2	3,200	1	500	—	—	—	—	caved	—	caved	900	2,800
1932	—	5	—	—	—	—	—	—	—	—	—	—	—	—
1943	?[1]	5	—	—	—	—	—	—	—	800	90	900	1,100	1,900
1944	?[1]	4[8]	—	—	—	—	—	—	—	—	—	—	—	—

Table 4 (continued). Cumulative development at the Mountain Chief Mine, by year.

Year	Total Develop-ment (ft)	No. of Tun-nels	Total Length of Tunnels, Cross-cuts, and Drifts (ft)	No. of Shafts	Total length of shafts (ft)	No. of Raises	Total Length of Raises (ft)	No. of Cross-cuts	No. of Drifts	Length of Principal Tunnels (feet)				
										No. 1	No. 2	No. 3	No. 4	No. 5
1957	?[9]	5	—	0	—	—	—	—	—	3,000	1,500	1,800	400	500
1962	?[9]	5	—	0	none	—	—	—	—	3,000	1,500	1,800	400	500
1963	?[9]	5	—	0	none	—	—	—	—	3,000	1,500	1,800	400	500
1964	?[9]	6	—	0	none	—	—	—	—	3,000	1,500	1,800	400	500

[1]Information not reported to Idaho Inspector of Mines.
[2]This was an inclined shaft.
[3]The company also reported a total 1,800 feet of short tunnels, shafts, and other workings at various places on the property.
[4]Information taken from National Mining and Development Company's report to the Idaho Inspector of Mines.
[5]The report noted that about 4,000 feet of tunnels had been abandoned because all of the ore had been worked out.
[6]Information taken from Mountain Chief Mining Company's report to the Idaho Inspector of Mines.
[7]Information given indicates this tunnel probably had been excavated to form an open cut.
[8]The company reported that all the tunnels were in bad conditions and that all but the lower tunnel were completely caved.
[9]The company's president and statutory agent, who filed the company's annual report with the Idaho Mines Inspector, stated that information on total development was unknown to him.

shipped bullion and concentrates rich in gold and silver. The company treated a considerable amount of ore on 1917, but was practically idle in 1918 because of the high cost of supplies.

The 1919 IMIR (p. 108) noted:

> At the west end of the belt [started by the Gold Hill and Iowa Mine] the Mountain Chief Mine, near the head of Canyon Creek, has been developed 300 feet deep and produced over a quarter of a million dollars from a straight fissure vein near the margin of a big porphyry zone and accompanied with a dike of black basic igneous rock which is also an associated phase of the mineralization at several other points along the belt. This property is now being developed at an additional depth of several hundred feet through a long adit tunnel that has now attained the length of 1,300 feet and has disclosed a variety of interesting porphyry contacts in the main zone, several of which are believed to carry commercial values, and further cross-cutting development on this interesting zone gives good promise of virgin ore resources in addition to the main ore channel that the tunnel is designed to develop and which was so productive in the shallow levels above. This ore shoot was mined from a foot to five feet wide, averaged $25 gold per ton and consisted of a quartz gangue with very massive iron sulphide and a little antimonial sulphide, the latter always indicating the better gold values and also some rich silver values associated. I am advised this property has recently been optioned by its owners to a development company and that a more vigorous demonstration of its deeper resources will be made.

The Idaho Mines and Metals Company, Limited, was incorporated on January 27, 1920. In March, the company reported it had a four-year bond and lease on the Mountain Chief for annual payments totaling $150,000 and promised a complete report on the company's activities after it had concluded financing arrangements, which were pending. Two years later, the company's financing was still pending, and the company noted doing only assessment work on unspecified properties. Idaho Mines forfeited its corporate charter on November 30, 1923.

In 1921, National Mining and Development resumed work on the Mountain Chief. According to the 1921 IMIR (p. 30): "This company owns the old Mountain Chief group and is actively engaged in extending the lower tunnel, which will give considerable depth below the old workings." In contrast, the company's report to the Idaho Mines Inspector noted: "No new equipment is contemplated at this time, work of developing the ore bodies will be continued for about a year before milling operations are resumed, in fact not until conditions get back to near a pre war basis." The mill equipment included a 40-tpd all-slime cyanide plant, a Rockbreaker, stamps, a Hardinge ball mill, an Akins classifier, Dorr thickeners, a Dorr agitator, and an Oliver filter.

By 1922, the Mountain Chief's lower, or No. 5, tunnel was 2,300 feet long. The 1922 IMIR (p. 49) stated: "All work done in recent years has been devoted to the extension of No. 5 tunnel." In addition, the company's report to the Idaho Mines Inspector noted that several raises between the No. 5 and the No. 4 tunnels were being planned to connect the two adits. The No. 5 tunnel had 500 feet of working depth on the mine's ore bodies. A supply of mine timbers were laid in, and plans called for development to continue throughout the winter.

When he visited the property in 1922 or 1923, Ballard (1924, p. 61) said the following about the property:

> The Mountain Chief property, consisting of 11 unpatented claims, lies at the head of Canyon Creek immediately west of the Belshazzar group. It is the most westerly property that has been developed on the Quartzburg shear zone. It was located in 1870

> and worked almost continuously from that date until 1915. The exhaustion of the known bodies of oxidized ore and the inadequacy of the mill to handle sulphide ore, necessitated closing down pending further development.
>
> Until 1915 work was confined mainly to the Mountain Chief vein, which is the westward continuation of the Belshazzar vein, near the eastern end of the group of claims. Four adit drifts were extended eastward into the divide which crosses the property in the vicinity of the common endline which separates the Mountain Chief from the Belshazzar group. The lowest drift (No.4), over 1,000 feet long, attained a maximum depth of about 380 feet; the last half, with the exception of the 50 feet nearest the face, was in ore. This ore has been stoped to the surface and carried by aerial tram to the mill 3,000 feet south. At the time the property was visited by the writer No. 4 drift was accessible, though the stopes above were not. On account of the timbering and of the deep sediment which covered the floor of the drift, satisfactory ore specimens could not be obtained.

Ballard (1924, p. 63) also described the mill as follows:

> The 30-ton amalgamation plant [Figure 25] which was originally built on the Mountain Chief property to treat the ore, sufficed until the zone of oxidation was bottomed in the mine. Concentrates were then made and shipped for a short time but freight costs were prohibitive. Later an all-slime cyanide addition was made, but it was not suitable to the complex bismuth-bearing sulphide ore which was encountered at greater depth. The mill treated ores from the intermediate sulphide-oxide zone and normally recovered between 75 and 80 per cent of the precious metals.
>
> The Mountain Chief mine has a recorded production slightly over $240,000 and an additional estimated production close to $70,000 under a former management whose records are not available.

The Mountain Chief Mining Company registered with the State of Idaho on November 19, 1913. According to the 1923 IMIR, Mountain Chief Mining acquired the mine in the last months of the year and began development immediately. In its report to the Idaho Mines Inspector, the company listed amalgamation plates, a 30-tpd "Denver Quartz Mill," and concentrators as prospective new equipment for the mill, and "General improvements to tunnels, New equipment, Compressor, Fans, ect." were needed in the mine. National Mining and Development's report to the Mines Inspector said the mine had been sold under bond and lease, but when the lease expired the following year, it was not renewed. Mountain Chief Mining forfeited its corporate charter on December 1, 1924. Although National Mining and Development said it was preparing to resume development, it only did assessment work in 1924. The following year, the mine was optioned to G. F. Hildbradt (spelling uncertain) and associates of Chicago, Illinois, and again, only assessment work was done.

In December 1927, D. W. Southworth acquired a lease and option on the Mountain Chief and began repairing and reopening the main tunnels. The Federated Mines Company registered with the State of Idaho on June 26, 1928. In July, Federated Mines took control of the Mountain Chief Mine and several nearby claims. This company installed new mine machinery, repaired the 2,000-foot aerial tramway connecting the No. 4 tunnel and the mill building[14], repaired the roads, did 500 feet of development work, and rehabilitated the mill building and installed a pilot amalgamation, concentration, and flotation mill. Company general manager Frank T. Day (1928, p. 1-2) described the mine's potential in glowing terms to the person in charge of the group financing the operation:

[14]This is the first mention of this tramway. When it was built is not known.

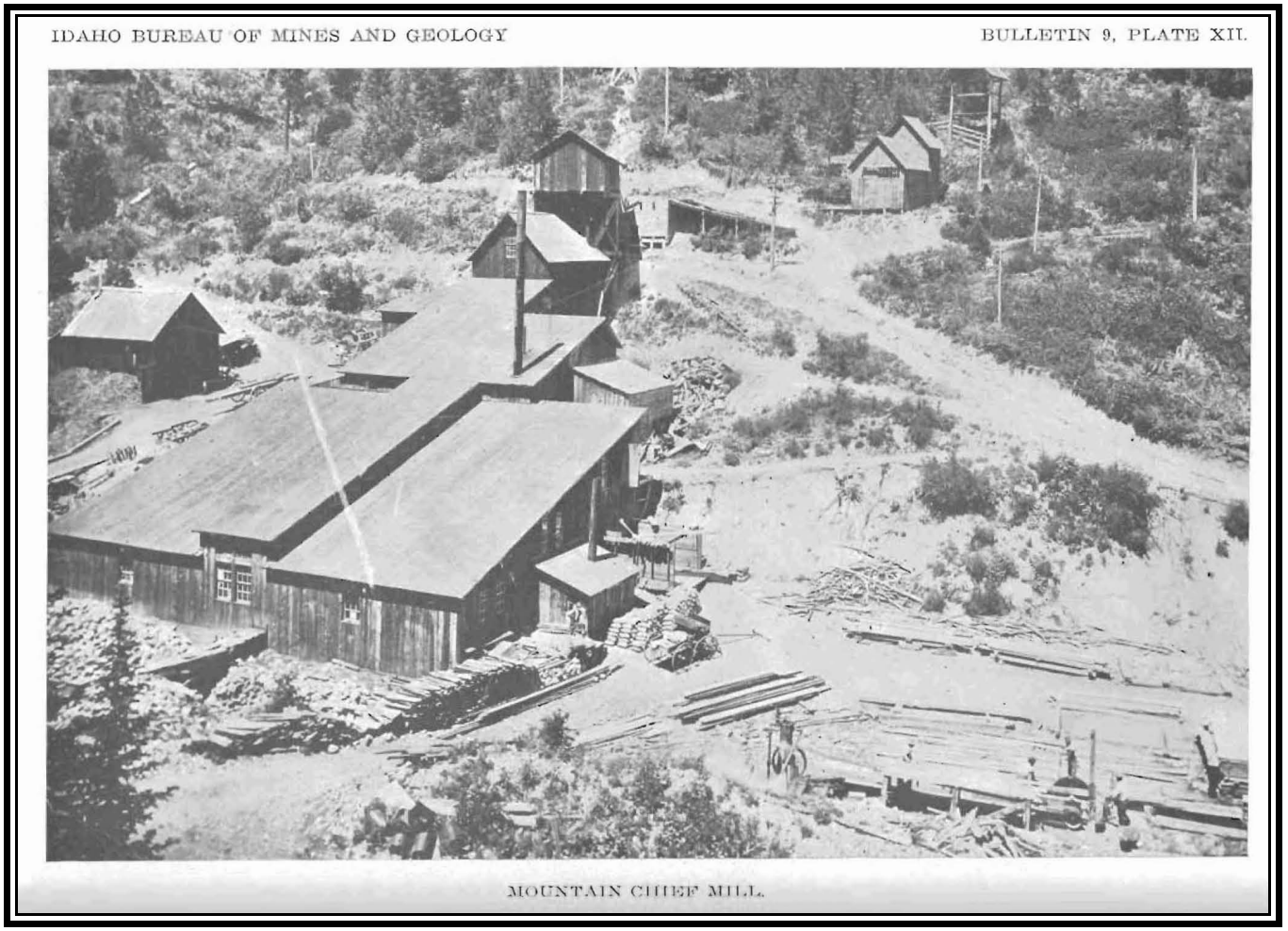

Figure 25. Close-up of the Mountain Chief mill (Plate XII from Ballard, 1924). Note the tram station in the background.

> Several careful examinations have been made of the mine workings. In addition to surveys of the mineral resources, close estimates have been made as to equipment requirements, such as track, cars, steel, tools, explosives, and mine timbers, ventilating pipe, etc. In this connection I may say that our two main workings, adit tunnel No. 4, and crosscut tunnel No. 5, aggregate over 3,000 feet. The face of No. 4 is approximately 1,300 feet from the portal, with no crosscuts. No. 5 is 2,200 feet from the end of the waste dump, or 2,000 feet from the portal. This tunnel cuts the "Ebenezer" vein, which is drifted on both east and west, the big porphyry dike, and continues east on the "Mountain Chief" vein.
>
> The face of No. 4 is now showing the first ore of what we consider "Ore Shoot No. 3", a new body of ore never before mined in our ground, but which in all probability is (or will lead into) the one Mr. Ballard is now taking out the phenomenally rich ore you have been advised about. From No. 4 to the surface, we will have over 400 feet high of virgin ground, and from 150 to 300 feet in length in our various upper levels. Ore Shoots Nos. 1 and 2 above No. 4 accounted for the past production of this mine, No. 1 producing fully as rich ore as that now being taken from the "Belshazzar".
>
> Tunnel No. 5, crosscuts all of the veins and dikes 300 feet below No. 4. The drift on the "Mountain Chief" is now under "Ore Shoot No. 1" with 300 feet of virgin ground above. When extended it will have the same distance on "Ore Shoot No. 2" but will have nearly 700 feet (to the surface) on "Ore Shoot No. 3".
>
> The amount and value of the ore in "Shoots Nos. 1 and 2" are well known, being a matter of record. There can be no "guesswork" or uncertainty as to what we will have there. The body of ore in the "Ebenezer" is also a known quantity, buth as to amount immediately available, and value. In addition to these absolutely known situations, (from past operations and present measurements), we will have a very large tonnage of good milling ore which will be rapidly developed while operating on the bodies first mentioned. There isn't a particle of doubt regarding present ore supply or its value. Furthermore, it is a certainty that after a few months of development, when we double the capacity of the mill (which is a part of the plan), that we will have more ore than we can handle.
>
> My conclusions, after a most careful examination of mine conditions (made jointly with Mr. Seaver and Mr. McCormick, our Mine Foreman), are that I made one error in my original representations to you: I was entirely too conservative as to the possibilities, at least, of the "Mountain Chief" group of ore bodies.
>
> The actual work of mining, that is, the extraction of ore for the mill, will naturally not begin until the mill is ready to run.

Plans called for continued expansion at the mine for the rest of the year and into the following year.

The Mountain Chief mill was completed in 1929. It was operated part of the year, and several hundred tons of ore was treated by a combination of amalgamation and concentration. The bullion was taken to Boise, and several carloads of concentrates containing gold and silver were shipped to Midvale, Utah. In late summer, the company ran into financial and legal difficulties, and operations were suspended. In 1930, the Mountain Chief shipped a small lot of siliceous gold ore that had been treated by amalgamation. Federated Mines forfeited its corporate charter on December 1, 1930.

Ideal Mining Company leased the Mountain Chief in 1931. The company cleaned up the old workings, rehabilitated two of the main tunnels, and produced 1,100 tons of ore. The mill operated intermittently, but produced gold bullion and concentrates valued at $3,843. Operations were interrupted when power was cut off by the Boise Basin forest fire of 1931. Ideal Mining forfeited its corporate charter in 1932.

National Mining and Development did small amount of development work during the summer of 1932. Some ore was produced, and a small amount of bullion and concentrate was marketed. In 1933, the company got the mine ready for deep development and upgraded the mill, which treated 2,200 tons of ore by amalgamation and

flotation during the year. Lessees operated the Mountain Chief Mine in 1934 and produced gold bullion and concentrates valued at $18,000. The mine and mill operated from April to December. In 1935, A. C. Gallupe had a crew of 16 men working at the Mountain Chief. The following year, John Murnan and Fred Brassey leased the mine.

In 1938, Mellor and Proffer installed a small ball mill on a dump at the Mountain Chief and handled small amounts of custom ore. In 1940, Delbert McFarland and Fred Proffer of Centerville leased the Mountain Chief Mine from the National Mining and Milling Company. The lessees built a small pilot mill with amalgamation and flotation. A larger mill was planned for the spring. In October 1942, all gold mines closed by order of the War Production Board Limitation Order L-208. No further records of activity at the mine were located.

The site was visited by an IGS field crew in 2002 and inventoried in detail (Leppert and others, 2007). At that time, all but one of the adits had collapsed, but parts of the mill were still standing (Figure 26), including the old stamp mill (Figure 27) and the cyanide vats (Figure 28). The mill has since been burned

Total production from the Mountain Chief Mine from 1901 to 1941 was 19,816 tons of ore. This material yielded 14,126.84 ounces of gold, 26, 016 ounces of silver, 3,269 ounces of copper, and 3,342 pounds of lead. An unknown amount of ore was produced before 1901.

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Figure 26. Small building at the base of the millsite at the Mountain Chief Mine houses what apparently is fine grinding equipment (Photograph P7260025 from Leppert and others, 2007). Two wooden vats are off to the left of the building, and a very fine tailings pile is to the left, out of view. Canyon Creek is in the brush behind the building.

Figure 27. Stamp mill battery containing five stamps at the Mountain Chief millsite (Photograph P7260021 from Leppert and others, 2007).

Figure 28. Remains of one of the cyanide vats at the Mountain Chief millsite (Photograph P7260030 from Leppert and others, 2007).

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