UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

GEOLOGY OF THE GOLDEN ZONE MINE AREA, ALASKA

By

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Open-file report

1968

This report is preliminary
and has not been edited or
reviewed for conformity with
Geological Survey standards

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Abstract

The Golden Zone mine area, in the upper Chulitna district, is underlain mainly by siltstone and tuff, volcanic conglomerate and breccia, and limestone. These rocks were invaded, probably in the Tertiary, by dikes and a small stock of porphyry. The ore deposits of the area are the Golden Zone breccia pipe, a nearly vertical body about in the center of the porphyry stock, and steeply dipping veins. Most veins strike ~~[from]~~ north to northeast and are commonly only 1-5 feet thick, but locally are as much as 15 feet thick. Both pipe and vein deposits are gold deposits of low to moderate grade that are characterized by abundant arsenopyrite; some contain possibly economic amounts of copper, lead and zinc minerals. Of the deposits of the mine area, only the Golden Zone has been explored to any extent, and both it and some of the veins deserve further exploration to determine their potential.

Introduction

The Golden Zone area is in the upper Chulitna district on the south flank of the Alaska Range, not far from Broad Pass. Results of recent work in the district have been summarized in a Geological Survey Circular (Hawley and Clark, 1968); this brief report presents supplementary data on that part of the district near the Golden Zone mine (fig. 1). Other data on the district are in the reports by Capps (1919), Ross (1933) and Mulligan and others (1967).

Geology

Rocks

The Golden Zone mine area is mainly underlain by sedimentary and volcanoclastic rocks of late Paleozoic and early Mesozoic age which were invaded, probably in the Tertiary (Ross, 1933, p. 305), by a small stock and dikes of biotite quartz diorite porphyry. The porphyry stock is the host rock of the Golden Zone mineralized breccia pipe. Except in the canyon of Bryn Mawr Creek, at a few isolated outcrops and in artificial exposures, the rocks of the district are covered by a veneer of colluvium and glacial drift.

Most of the area is probably underlain by three rock units: (1) siltstone and tuff, (2) volcanic conglomerate and breccia, and (3) limestone (fig. 2). Subordinate rock types are the quartz diorite porphyry, basalt, and an argillite--here combined with the siltstone and tuff. At most places the siltstone and tuff is a jarositic[1/] clayey rock, pale greenish yellow on fresh surfaces. Locally it is limonitic[1/], and in places it contains veinlets of sulfides on interlacing fracture surfaces inches or less apart. The color, composition, and the local concentrations of sulfides show that, at most places, the siltstone and tuff is a hydrothermally altered rock. The unaltered equivalent is a red, hematitic siltstone with sparse tuffaceous layers, a rock type exposed only east of the north-striking fault in the lower course of Bryn Mawr Creek.

[1/] Jarositic is used to describe the yellow rock containing the hydrated K-Fe sulfate mineral jarosite; limonitic, to describe brown gossan characterized by hydrated iron oxides, including goethite.

The volcanic conglomerate and breccia unit varies from a pale red rock, through a green hornfelsed type into very pale gray to pale yellow hornfelsed and hydrothermally altered variety. The hydrothermally altered type is dominant in the mapped area (fig. 2). The least altered rock is exposed about 650 feet northwest of the Golden Zone breccia pipe and consists of dominant subangular to angular andesite(?) fragments and sparse red siltstone clasts in a porous aggregate. The green hornfelsed type is exposed northwest of the Golden Zone stock. Both it and the hydrothermally altered variety are tightly cemented and the breccia fabric is evident only on freshly broken slabs. The altered breccia is well exposed in the trenches at the Mayflower vein; here it has a silica-carbonate matrix with sparsely disseminated pyrite and arsenopyrite. The andesite(?) and siltstone fragments are bleached.

In Long Creek canyon (south of the Golden Zone, not shown on fig. 2) the volcanic conglomerate and breccia unit is mainly conglomerate, consisting of rounded pebbles, cobbles and boulders in a matrix which varies from a red chloritic siltstone to greenish crystal tuff.

Limestone with subordinate amounts of fine-grained clastic rocks probably underlies the northwest part of the area, but is only exposed at three places (fig. 2). Fossils in the limestone exposed at the hairpin turn on the mine access road have been dated as Lower Triassic (N. J. Silberling, written commun., 1967).

Biotite quartz diorite porphyry forms the Golden Zone stock and two small dikes, one exposed in Bryn Mawr Creek, the other near the Mayflower vein. The Golden Zone stock is a tadpole shaped body, in plan, with maximum dimensions of approximately 600 by 1000 feet. Holes drilled from the 200-foot level of the mine suggest that at least the west and north contacts of the stock are essentially vertical (Hawley and Clark, 1968). The contacts are sharp and well defined where exposed.

The porphyry is a pale gray rock with abundant phenocrysts of biotite less than 2 mm across and sparse hornblende needles 5 mm or less in length set in an aphanitic matrix. Thin sections show abundant plagioclase phenocrysts as much as 5 mm across which, however, are almost the same color as the matrix minerals of the rock and so not evident in hand specimen. Close to the Golden Zone breccia pipe the porphyry is bleached, and mafic minerals destroyed; in the pipe the porphyry has been changed to an almost white rock rich in sericite and quartz.

Structure

The sedimentary and volcanoclastic rocks of the area generally strike to the northeast and dip very steeply; they are cut by faults, in places mineralized, of northeast to north strike and steep dip. Two main faults crop out in the area (fig. 2); one of these faults is exposed west of the Golden Zone stock and places highly altered siltstone and tuff against hornfelsed volcanic conglomerate and breccia. The second fault is exposed on the lower course of Bryn Mawr Creek; the fault strikes north, dips steeply to the east, and places altered and unaltered siltstone in juxtaposition. The rocks exposed west or upstream from the fault in Bryn Mawr Creek are locally brecciated, generally strongly fractured and are cut by local mineralized faults like the East vein. Locally, porphyry dikes follow northeasterly faults or fractures.

Ore deposits

The ore deposits of the district, that is, materials formerly mined or those strongly mineralized, are the Golden Zone breccia pipe and vein deposits. Many other bodies of rock in the area, principally in the siltstone and tuff and conglomerate, are weakly metallized or appear to have formerly been metallized and subsequently leached by hypogene or supergene solutions.

Mineralogy

The ore deposits are composed principally of arsenopyrite and pyrite; in some deposits or parts of deposits chalcopyrite, sphalerite, and galena are abundant. Consistent results from check assays of fresh ore indicate that most of the gold is finely disseminated with the sulfides or in their lattices, but gold was enriched at the surface and was partly particulate, as shown by relatively high assays and local ground sluicing of near surface ores. Except for the presence of tin in cassiterite identified by Walter Gnagy of the Bureau of Mines (written commun., 1967) the mode of occurrence of trace elements such as bismuth, cadmium, cobalt and nickel noted in analyses (tables 1 and 2) is unknown. Inspection of polished surfaces of ore from the Golden Zone indicates that arsenopyrite and one generation of pyrite were deposited early, chalcopyrite and sphalerite somewhat later, and colloform pyrite at a late stage engulfing other minerals and filling open spaces.

Alteration

Rocks in the Golden Zone map area were altered first by hydrothermal metalliferous fluids, then by supergene solutions charged with acid materials from oxidizing sulfides. Although the quartz diorite porphyry is strongly altered in and near the breccia pipe, generally the most strongly altered rocks are the siltstone and tuff and the volcanic conglomerate and breccia.

The study of alteration in the district, thus far, is based on the field relations, hand specimens and a few thin sections. Thin sections of quartz diorite porphyry show sparse sericitization of plagioclase away from the pipe, but pervasive sericitization, quartz flooding, and the formation of carbonate and sulfides--pyrite and arsenopyrite--near and in the pipe. The conglomeratic unit, besides being bleached, is strongly calcitized and contains disseminated sulfides. The siltstone-rich unit is commonly a clayey and jarositic rock. At places partial oxidation persists to some depth, as all the rock encountered in the U.S. Bureau of Mines drill hole No. 2 in Bryn Mawr Creek (fig. 2) is rich in clay but contains few sulfides above 300 feet or approximately 200 feet vertically below the creek. In contrast, probably equivalent rocks exposed northwest of the portal of the crosscut adit are limonitic and jarositic, but sulfides are locally found on the interlacing fracture surfaces.

Description of deposits and mineralized rock

The main deposit of the area, the Golden Zone breccia pipe, shown in plan and section (fig. 2), was described in Circular No. 564. Several other deposits, notably the Little, East, and Mayflower veins were only mentioned in that report, and brief descriptions of these and other deposits are given here.

Little vein.--The Little vein is a quartz-arsenopyrite-chalcopyrite vein which is exposed on the south side of Bryn Mawr Creek opposite the Golden Zone workings (fig. 2). The vein is very poorly exposed now, but it can be projected through old pits and a short caved adit for about 300 feet; it strikes north-northeast and dips steeply to the southeast. According to Ross (1933, p. 324) the vein was about 3 feet wide, but bounded by indefinite walls. One sample of scorodite-stained damp material taken (table 1, no. 6) assayed 25 ppm or approximately 0.7 oz/ton gold, a value consistent with fire assay results of 6 samples reported by Ross (1933, p. 323) and listed below:

Assays of samples from Little vein (Ross, 1933, p. 323)

Sample No.	Width	Gold (oz/ton)	Silver (oz/ton)	Arsenic (%)	Sampler
R	grab (Dump)	2.58	4.70	33.22	Harry Townsend
S	1.0 foot	0.48	2.40	23.61	"
g	grab (open cuts)	0.86	11.60	18.10	J. G. Shephard
6	3.0 feet	0.16	2.40	-----	C. P. Ross
7	0.6 foot	0.99	6.60	-----	"
8	4.0 feet	0.36	2.40	-----	"

East vein.--The East vein is exposed in Bryn Mawr Creek and was probably intersected in the crosscut adit level of the Golden Zone mine. The vein strikes about N. 25° E., dips 75° NW and ranges from slightly more than 1 foot to about 3 feet wide. As exposed in Bryn Mawr Creek sulfides make up at least 80 percent of 1-foot widths of the vein. In order of abundance the sulfides are pyrite, arsenopyrite, sphalerite, galena, and chalcopyrite. If the vein in the crosscut adit level is the East, then the vein is at least 900 feet long. The vein in the crosscut adit was reported to be as much as 8 feet wide and contained as much as 1.5 oz Au/ton with some silver and copper (Anchorage Weekly Times, July 20, 1939).

Two samples representing material rich in arsenopyrite and galena-sphalerite respectively (table 1, no. 14) were collected from the East vein in Bryn Mawr Creek. Both show considerable gold, more than 1 percent arsenic, and 1 percent or more lead and zinc. The results of 4 channel samples taken across about 1 1/2-foot widths by the U.S. Bureau of Mines (Mulligan and others, 1967) indicate from .01-.90 oz/ton Au, 1.2-8.5 oz/ton Ag and as much as 1.8 percent Pb and 1.7 percent Zn.

Mayflower vein.--The Mayflower vein is actually a lode or a set of northeasterly trending veins that are now exposed in shallow trenches and open cuts. A shallow shaft near locality 21 (fig. 2) on the vein is caved.

The wall rock is calcitized and hornfelsed volcanic conglomerate with disseminated pyrite and arsenopyrite. A dike of fresh biotite quartz diorite porphyry is partly exposed in the trench system that explores the veins; like the veins, it strikes north-northeast and dips steeply.

The main vein of the lode system ranges from a few inches to about 15 feet in width and can be traced through prospect pits for about 600 feet. Arsenopyrite, chalcopyrite, and other sulfides are visible locally, but most vein material is oxidized and composed of limonite.

Results of sampling by the authors (fig. 2, table 1), U.S. Bureau of Mines, and the owner, W. H. Greene, indicate very low to moderate values in gold, silver, copper, lead, and zinc. A 5-foot channel sample by the Bureau at about the location of our sample no. 16 (a 15-foot chip sample) shows 0.14 oz/ton Au, 0.25 oz/ton Ag, and .10 percent copper with trace amounts of lead and zinc. Two samples collected by the owner from the now-caved shaft and analyzed by the State Division of Mines and Minerals showed about 10 percent combined base metals (Cu, Pb, and Zn) and about 3 oz/ton silver with a trace of gold (W. H. Greene, written commun., 1951).

The vein system possibly persists to the northeast below the surficial cover. Samples of mixed colluvium and glacial drift downslope from the vein--sample locations and values on the map (fig. 2)--show more copper than in other soil samples. Inasmuch as mercury is known to be slightly enriched in the Mayflower vein (to about 2.2 ppm, table 1), the slightly higher mercury contents of soils below and northeast of the exposed vein may also suggest that mineralized rock persists to the northeast along the strike of the vein.

Other veins and deposits.--A few samples were taken from other veins or small deposits of disseminated sulfides noted in the course of mapping. These sample localities are 5, 7, 8, 12, 13, 15, 23-25, and 26 on fig. 2; all the samples show evidence of mineralization, and are described briefly below:

Description of samples from small veins
and deposits (fig. 2, table 1)

5. Limonite-stained carbonate vein, separates unaltered argillite (not distinguished on map) from altered tuff and siltstone. Fault strikes N. 5° W., dips 45° NE. Grab sample representative of approximately 2 feet of vein material.

7. Vein material at caved prospect pit. Grab sample of limonitic breccia.

8. Chalcopyrite-arsenopyrite-quartz vein in brownish altered quartz diorite. Grab sample of 3-inch thick vein.

12. Sample ACF008. Limonite- and arsenic-stained tuff. Grab sample.
    ACF009. Limonite on fractures and in vuggy gossan. Grab sample.

13. Disseminated sulfides at contact of quartz diorite dike. Grab sample.

15. Jarosite-stained fragmental rock, sparse sulfides. Vein zone strikes N. 15° E., 78° SE. Composite grab sample over 5-foot width.

23. 0.5-foot thick vein with 0.1-foot sulfide-rich zone. Chip sample.

24. 3.5-foot thick quartz-pyrite vein. Chip sample.

25. Sulfidized siltstone. Limonite and sparse sulfides on irregular curving fracture surfaces. Dominant sulfides are pyrite and arsenopyrite; sparse galena, sphalerite, and chalcopyrite. 200-foot chip sample.

Altered rocks (fig. 2).--The metal contents of three composite chip samples of the jarositic siltstone and tuff indicate that this rock was ~~at least~~ locally affected by hypogene metallization. No one element characterizes the samples, but arsenic, copper, silver are anomalous in one or more of the samples (localities 9, 10, and 11). Sample 25 of strongly altered, sulfide-bearing rock described in the preceding section is appreciably more metalliferous than samples 9-11; it contains a trace of gold, and anomalous amounts of arsenic, silver, tin, lead, copper, and molybdenum. The altered siltstone at locality 25 is less oxidized than the rock exposed west of the Golden Zone and in Bryn Mawr Creek, and possibly its metal content is more representative of the altered rock before oxidation and surficial leaching.

Descriptions of samples 9, 10, and 11

9. Limonitic siltstone, strongly fractured with limonite concentrated in irregular patches and on fracture surfaces. Sample consists of random chips collected over a 20-foot width.

10. Same type of rock and length of sample.

11. Limonitic siltstone, slightly calcareous, strongly fractured. Composite grab sample.

Some data on the copper, silver, and gold content of the hydrothermally altered rocks of the district are provided by U.S. Bureau of Mines drill holes No. 2 and No. 3, drilled respectively in Bryn Mawr Creek and northeast of the Mayflower vein (fig. 2), and shown graphically by Mulligan and others (1967, figs. 10 and 11). Neither drill hole reached the intended vein targets, but both holes show that the altered rock contains as much as 500 to 900 ppm copper, a few tenths of an ounce/ton silver, and a trace of gold.

Veins south of the Golden Zone mine area (fig. 3).--The dominantly northeasterly vein set typical of the Golden Zone area persists to the south, as shown on a less detailed map (fig. 3); it probably also extends to the northeast under drift-covered country to at least the Riverside mine (Ross, 1933, p. 326-327).

Some veins south of the Golden Zone are very poorly exposed in pits and a shallow shaft excavated before 1920; others can be inferred from anomalous metal values found in residual materials collected from shallow trenches. The mapped structures probably include the Lindfors group of veins briefly described by Capps (1919, p. 226) and Ross (1933, p. 321), and the Golden Zone Extension noted by Capps (1917, p. 230).

The known veins strike northeast, are very steeply dipping, and are in a set parallel to a biotite quartz diorite porphyry dike. Samples from the few vein exposures or, alternatively from, dump materials collected in shallow prospect pits along vein trends (letters A to F, fig. 3 and table 2) all contain gold in amounts ranging from about .2 ppm to 14 ppm. The samples also consistently contain lead and zinc; antimony is locally present in strongly anomalous amounts and trace amounts of bismuth, cadmium, and tin were detected in some samples.

The known vein system is exposed discontinuously in prospect pits for about 1000 feet on strike, and is at least 100 feet wide, although individual veins are small, probably measurable in inches or feet. Sampling in an old trench that was excavated into a soil horizon containing residual rock fragments shows that mineralized rock persists farther to the south. Twelve samples (6-17, fig. 3, table 2) were taken in the trench at 50-foot intervals, starting with sample 6 at the western end of the pit. Gold was detected in most samples, and anomalous amounts of antimony, arsenic, copper, lead, and zinc were detected in the same or in other samples. The analyses suggest that mineralized bedrock underlies nearly all of the 500-foot long trench; perhaps there is a gold-rich vein zone corresponding to samples 7 to 10, flanked on the east side by mineralized wall rocks characterized by antimony, arsenic, lead, and zinc in samples 13 to 15.

Other mineralized rock is indicated northwest of the exposed vein system in a series of ground sluiced trenches (samples 1 to 5). Gold was detected in all but one sample of the surficial materials collected at the toes of the excavated trenches.

Slightly mineralized material was also found in or adjacent to a major northeast-striking fault about 1500 feet southeast of the Golden Zone mine (samples G and H, fig. 3, table 2). Sample G of limonitic fault zone material shows detectable amounts of gold, silver, and the presence of arsenic. Sample H is of a minor carbonate-jasperoid vein. The sample contains a trace of gold; similar jasperoid-carbonate rocks have been noted with mafic volcanics (not shown) and the anomalous values of chromium and nickel probably reflect a volcanic affinity for the vein material.

Suggestions for prospecting

The deposit at the Golden Zone breccia pipe has been explored by diamond drilling and underground workings, but facets of its geology are still unknown as pointed out earlier (Hawley and Clark, 1968). The vein deposits of the district have been prospected only to a very limited extent, and there has been very little incentive to explore them for many years. Probably they would be mineable only if the Golden Zone or similar deposit was being exploited in the district. Some, however, like the Mayflower and veins of the Lindfors(?) group, are actually lodes and deserve more exploration. Surficial trenching would likely lead to extensions of the East and Mayflower veins and the veins south of the Golden Zone (fig. 3). Glacial drift of unknown thickness covers much of the mine area, and generally precludes simple soil sampling for tracing veins. Probably the drift is 5-10 feet thick in most places and meaningful samples near the interface of the glacial drift and the bedrock could be obtained with a hand auger. Analyses of samples of mixed drift and colluvium (fig. 2) possibly indicate an extension of the Mayflower vein to the northeast. Mercury is somewhat enriched (to .5 and .6 ppm) in two samples of drift and colluvium at the northern edge of the map (fig. 2) and slightly higher than normal concentrations of arsenic, lead, and silver were noted in the same or nearby samples. Although no evidence of mineralization was noted, except slightly limonitic limestone, the locations of samples suggest possible mineralization of limestone and the rocks near the contact between limestone and volcanic conglomerate and breccia.

The search for disseminated or pipelike deposits which could conceivably underlie some of the hydrothermally altered rocks of the district could best be started by electromagnetic or induced polarization geophysical surveys. Detailed fracture sampling of the altered rock of the district might also indicate leakage from a deeper deposit.

The area southwest of the Golden Zone mine was explored only by hand-dug or ground-sluiced workings. Here the bedrock is covered by residual soil or thin glacial drift and shallow trenching by backhoe or bulldozer appears feasible and desirable to trace the northeasterly striking vein system.

Although individual veins are small, the extent of mineralized rock indicated by sampling of residual materials indicates the area should be looked at again.

Some of the veins are exposed in or could be explored by drilling or drifting from the crosscut adit. The East vein was probably intersected and possibly was drifted on for a short distance in the adit. The vein represented by sample 24 also was apparently cut by the adit, and although the dip of the Mayflower is uncertain, it is steep and so the Mayflower vein should be within 400 feet of the face of the tunnel. Reopening and mapping of the workings should precede any extensive exploration in the area.

Inspection of the less detailed map (fig. 3) shows a zone of northeast to north-northeast veins discontinuously exposed over a distance of 4500 feet. The belt of mineralized rocks, as indicated by the hydrothermal and supergene alteration of the siltstone and tuff and conglomerate units, is approximately 2000 feet wide near the Golden Zone mine, and on the basis of existing information, this belt could contain other veins. The few analyses of surface samples of altered rock, the drill core and sludge from drill holes Nos. 2 and 3, and the residual materials from the area south of the Golden Zone suggests that a very large area contains rock with copper measured in hundreds of parts per million, silver measured from a few tenths to several parts per million, a trace of gold, and variable amounts of other elements including arsenic, zinc, and molybdenum. The extensively altered rocks of the district cannot be appraised realistically at present, but appear to be significant as a leakage halo related either to the known deposits or, possibly, deposits not yet exposed. The extensive jarosite-limonite rocks, which constitute a gossan, suggest strong leaching and the possibility that somewhat more metalliferous rocks would be found at and below the water table.

References

Capps, S. R., 1919, Mineral resources of the upper Chulitna region: U.S. Geol. Survey Bull. 692, p. 207-232.

Hawley, C. C., and Clark, Allen L., 1968, Occurrences of gold and other metals in the upper Chulitna district, Alaska: U.S. Geol. Survey Circular 564.

Mulligan, J. J., Warfield, R. S., and Wells, R. R., 1967, Sampling a gold-copper deposit, Golden Zone mine, south-central Alaska: U.S. Bureau of Mines open-file report.

Ross, C. P., 1933, Mineral deposits near the West Fork of the Chulitna River, Alaska: U.S. Geol. Survey Bull. 849-E, p. 289-333.

Table 1.--Analyses of rock samples, Golden Zone mine area (fig. 2)

Analysts: Spectrographic analyses by Arnold Farley, Jr., and E. E. Martinez; gold, by atomic absorption, by W. L. Campbell, A. L. Meier, R. L. Miller, and T. A. Roemer; gold, fire assay, W. D. Goss, J. A. Thomas, and Claude Huffman, Jr.; platinum group metals, by L. B. Riley, W. D. Goss, and Joseph Haffty; mercury by H. D. King

Analyses, unless noted, are semiquantitative spectrographic and are reported in the series 0.1, 0.15, 0.2, 0.3, 0.5, 0.7, 1.0, 1.5, and so on, or by the following symbols: N = not detected; L = detected but below limit of determination; - = not looked for; > = greater than; < = less than

No. (Fig.2)	Lab. No.	Field No.	Ag	As	Au	Au 1/	Au 2/	B	Ba	Be	Bi	Cd	Co	Cr	Cr 3/	Cu	Hg 3/	La	Mo	Mn	Nb	Ni	Ni 3/	Pb	Pd 3/	Pt 3/	Rh 3/	Sb	Sc	Sn	Sr	Ta	Te	V	W	Y	Zn	Zr	Fe	Mg	Ca	Ti
			Parts per million																																				Percent			
1	ACF 117	67AHz 43	200	7000	N	4.2	1.9	150	700	1	30	200	<10	100	-	>5000	-	30	N	300	20	5	-	300	<.04	<.1	<.05	200	15	30	150	-	-	70	N	10	7000	150	10	.7	.15	.3
2	116	42	100	>10,000	L	15	14.8	150	700	N	50	50	<10	30	-	>5000	-	30	N	150	20	L	-	700	<.02	<.05	<.005	500	15	50	150	-	-	150	N	15	2000	150	15	.3	1	.3
3	119	46	20	>10,000	N	5.0	5.3	100	500	1	70	20	20	70	-	1500	-	20	N	300	<20	15	-	300	<.005	<.02	<.01	500	15	N	200	-	-	70	N	N	1000	100	15	.7	2	.3
4	ACE 627	46D	10	3,000	N	.4	-	200	300	1	N	30	10	50	-	500	-	<50	L	700	10	7	-	500	-	-	-	N	5	N	N	-	-	100	N	10	2000	70	5	1.5	3	.3
5	ACF 093	205	L	200	N	.09	-	50	1500	1	L	N	7	200	-	50	-	N	N	700	N	20	-	L	-	-	-	N	15	N	700	-	-	100	N	15	N	30	5	3	5	.2
6	118	45	30	>10,000	20	25	25.0	70	150	N	200	20	N	10	-	300	-	20	N	20	<20	N	-	5000	<.04	<.1	<.05	700	N	N	100	-	-	L	N	N	N	30	15	.3	L	.03
7	020	II-2	.5	500	N	.04	-	50	200	L	L	N	20	300	-	70	-	N	N	1000	N	150	-	30	-	-	-	N	30	N	N	-	-	100	N	15	N	50	5	.7	1	.3
8	021	III-5	30	>10,000	15	36	-	100	200	L	15	N	10	50	-	2000	-	N	N	500	N	15	-	500	-	-	-	500	5	15	300	-	-	50	N	15	L	70	3	1	.7	.1
9	174	27	N	300		N		50	1000	1	N	N	<10	150	-	30	-	30	N	700	<20	30	-	N	-	-	-	N	15	N	N	-	-	70	N	15	N	150	3	.2	.2	.5
10	128	28	1.5	N		N		70	500	N	N	N	70	300	-	150	-	N	N	1500	<20	150	-	N	-	-	-	N	30	N	500	-	-	100	N	20	N	70	7	1.5	15	.3
11	ACF 107	67AHz 32	N	N	N	.04	-	70	200	N	N	N	N	150	-	30	.5	30	N	1500	20	30	-	30	-	-	-	N	15	N	200	-	-	100	N	15	N	150	10	.7	3	.5
12	008	126A	30	>10,000	L	14		20	100	L	15	N	5	100	-	200	-	N	N	70	N	10	-	7000				1500	10	15	N	-	-	50	N	N	200	30	7	.15	.07	.15
12	009	126B	10	1500	N	.4		10	50	L	L	N	10	150	-	200	-	N	N	200	N	70	-	150				N	15	15	N	-	-	100	N	<5	300	20	7	.15	.05	.3
13	010	127	3	700	N	.1	-	20	100	N	10	N	7	300	-	200	-	N	N	150	N	70	-	30				N	7	10	N	-	-	70	N	<5	N	20	7	.15	.07	.5
14	011	128A	150	>10,000	10	9.4		15	N	L	30	300	15	L	-	1000	-	N	N	500	N	30	-	10,000				1500	L	N	N	-	-	10	N	N	10,000	N	10	.5	1	.03
14	012	128B	100	>10,000	L	4.2		50	200	L	L	500	10	100	-	500	-	N	N	500	N	50	-	15,000				1000	20	100	N	-	-	50	N	<5	>10,000	<10	10	.7	.3	.15
15	108	33	N	N	N	N	-	50	200	N	N	N	50	700	-	500	.7	20	N	1500	20	150	-	N				N	30	N	150	-	-	150	N	15	N	50	15	2	1.5	.5
16	109	34	N	N	N	.40	-	30	200	N	N	N	<10	100	-	50	.14	50	N	1000	<10	15	-	30				N	20	N	100	-	-	150	N	15	N	70	7	.2	.1	.5
17	110	35	7	N	N	.2	-	N	200	N	N	N	20	150	-	1000	2.2	N	N	1500	<20	15	-	N				N	30	N	N	-	-	150	N	15	200	50	20	1	3	.2
18	111	36	N	N	N	.4	-	N	300	N	N	N	<10	70	-	300	.09	30	N	1500	<20	15	-	N				N	20	N	N	-	-	100	N	20	L	150	15	.15	.07	.3
19	ACF 112	67AHz 37	1.5	N	N	.05	-	N	200	N	N	N	30	150	-	700	.08	50	N	1000	<20	10	-	N	-	-	-	N	20	20	150	-	-	150	N	15	N	70	15	1.5	7	.2
20	113	38	.5	N	N	.2	-	N	700	N	N	N	50	150	-	1000	.08	N	N	2000	<20	30	-	N				N	15	N	100	-	-	100	N	15	L	70	>20	.7	7	.2
21	114	40	10	>10,000	N	.7	-	30	700	N	N	N	100	150	-	1000	.65	30	N	1500	<20	20	-	30				N	20	30	N	-	-	150	N	15	N	70	15	.7	.15	.2
22	115	41	1	200	N	N	-	N	700	N	N	N	10	70	-	500	1.1	20	N	1000	20	20	-	N				N	20	N	N	-	-	100	N	20	N	100	15	1	1.5	.3
23	ACE 629	46V1	15	N	N	1	-	300	200	L	N	N	N	70	-	200	-	<50	5	150	20	15	-	5000				50 1/	20	N	N	-	-	300	N	30	300	100	10	.3	.1	.3
24	630	46V2	L	N	N	.06	-	300	150	L	N	N	N	10	-	50	-	<50	L	10	10	50	-	L				100 1/	N	N	N	-	-	50	N	7	N	70	7	.07	.05	.15
25	628	46W	3	L	N	.05	-	500	300	1	N	N	10	50	-	150	-	<50	5	50	10	15	-	100				60 1/	N	10	N	-	-	200	N	20	N	150	3	.5	.1	.3
26	ACF 108	21	N	N	N	N	-	70	700	1	N	N	20	200	-	100	.45	50	N	1500	N	150	-	20				N	30	N	N	-	-	100	N	15	N	150	7	.7	.3	.5
Limits of determination			.5	200	10	.02	.05	10	5	1	10	20	5	5	100	5	.01	20	5	10	10	5	10	10	.01	.004	.005	100	5	10	50	--	--	10	50	10	200	20	.05	.02	.05	.001

1/ Atomic absorption

2/ Fire assay or fire-assay-atomic absorption

3/ Specific instrumental or chemical method

TABLE 2 Open-file report

Table 2.--Analyses of rock and soil and colluvial samples (fig. 3)

Analysts: Spectrographic analyses by Arnold Farley, Jr., and E. E. Martinez; gold, by atomic absorption, A. L. Meier, R. L. Miller, and T. A. Roemer

Analyses, unless noted, are semiquantitative spectrographic and are reported in the series 0.1, 0.15, 0.2, 0.3, 0.5, 0.7, 1.0, 1.5, and so on, or by the following symbols: N = not detected; L = detected but below limit of determination; - = not looked for; > = greater than

No.	Lab. No.	Field No.	Ag	As	Au 1/	B	Ba	Be	Bi	Cd	Co	Cr	Cu	La	Mo	Mn	Nb	Ni	Pb	Sb	Sc	Sn	Sr	V	W	Y	Zn	Zr	Fe	Mg	Ca	Ti
			Parts per million																										Percent			
Rock samples																																
A	ACF017	Hr160-3	100	>10,000	14	20	150	L	15	50	20	30	300	N	N	70	N	10	>10,000	10,000	15	10	N	50	N	N	700	20	10	.15	L	.1
B	016	160-2	3	1500	.2	10	50	1	10	N	20	700	500	N	N	700	N	150	50	N	20	L	100	100	N	20	L	30	10	1.5	1	.2
C	015	160-1	15	1000	4.5	100	200	1	N	N	N	100	50	30	N	100	10	7	2000	500	15	20	N	70	N	L	300	100	3	.5	.1	.3
D	004	111	150	>10,000	4	50	50	1	10	300	5	20	500	N	N	300	N	50	15,000	>10,000	L	N	N	15	N	N	10,000	N	10	.15	.15	.02
E	018	160-4	150	>10,000	3.3	15	N	1	N	70	N	30	300	N	N	70	N	5	15,000	10,000	15	30	N	15	N	N	2000	N	10	.03	L	.05
F	019	160-7	15	>10,000	5.4	50	150	L	20	N	200	150	500	N	N	1000	N	100	500	300	20	N	N	100	N	20	300	20	10	.3	.5	.2
G	023	Cx 21	.5	L	.02	50	300	L	L	N	5	70	50	N	N	100	N	15	L	N	10	N	N	100	N	15	N	100	5	1.5	.15	.2
H	022	19	L	N	.06	N	N	N	N	N	30	2000	30	N	N	2000	N	700	30	N	15	N	300	100	N	5	N	N	3	1.5	7	.03
Soil and colluvial samples																																
1	ACF 036	Hr160-S-1	L	N	N	20	300	L	N	N	15	70	50	N	N	2000	N	30	20	N	20	N	N	100	N	30	N	70	7	.5	.2	.2
2	037	2	L	N	.06	30	500	1			15	150	70	N		700		50	30		15		50	100		15		150	3	1	.5	.3
3	038	3	N	N	.06	30	300	L			10	100	50	N		700		30	15		15		L	70		15		100	3	.5	.1	.3
4	039	4	N	N	.03	70	500	L			10	100	50	N		700		30	20		15		L	100		15		150	2	.7	.15	.5
5	040	5	N	300	.06	30	300	L			15	200	50	L		700		30	50		15		L	100		15		100	5	1.5	.1	.5
6	041	6-1	N	N	.06	50	1000	1			20	200	50	20		1000		30	15		20		50	150		20		150	7	1	.2	.7
7	042	2	.7	500	.2	70	500	L			15	100	150	L		700		50	50		15		L	100		15		100	3	.7	.1	.5
8	043	3	N	N	.1	30	300	L			7	70	30	L		700		30	20		10		L	70		15		100	2	.5	.15	.3
9	044	4	L	200	.05	50	500	L			15	150	70	N		1000		50	30		15		L	100		15		150	5	1	.2	.5
10	045	5	L	300	.1	50	300	L			10	100	70	N		700		30	15		10		L	100		15		100	3	.5	.3	.5
11	046	6	N	L	.04	50	200	L			5	70	50	N	N	700		30	20	N	10		L	70		15	N	100	2	.3	.1	.3
12	047	7	N	N	.06	50	200	L			5	70	30	N	N	300		30	15	N	7		L	70		10	N	70	1.5	.5	.1	.3
13	048	8	2	300	.04	70	300	L			15	150	150	N	N	1500		70	300	N	15		N	100		15	300	70	7	.7	.15	.5
14	049	9	2	N	.02	70	500	1			10	70	70	30	L	700		50	70	100	15		N	100		15	200	150	3	.5	.15	.3
15	050	10	2	200	N	50	300	L			15	70	50	N	N	700		50	300	150	10		N	100		15	200	150	2	.3	.15	.3
16	053	11	L	N	N	70	300	L			15	150	70	N	N	700		70	50	N	15		N	150		15	N	150	3	.7	.07	.6
17	054	12	L	N	.02	30	200	L			10	70	50	N	N	700		30	20	N	10		N	70		15	N	100	2	.5	.1	.3
Limits of determination			.5	200	.02	10	5	1	10	20	5	5	5	20	5	10	10	2	10	100	5	10	50	10	50	10	200	20	.05	.02	.05	.001

1/ Atomic absorption

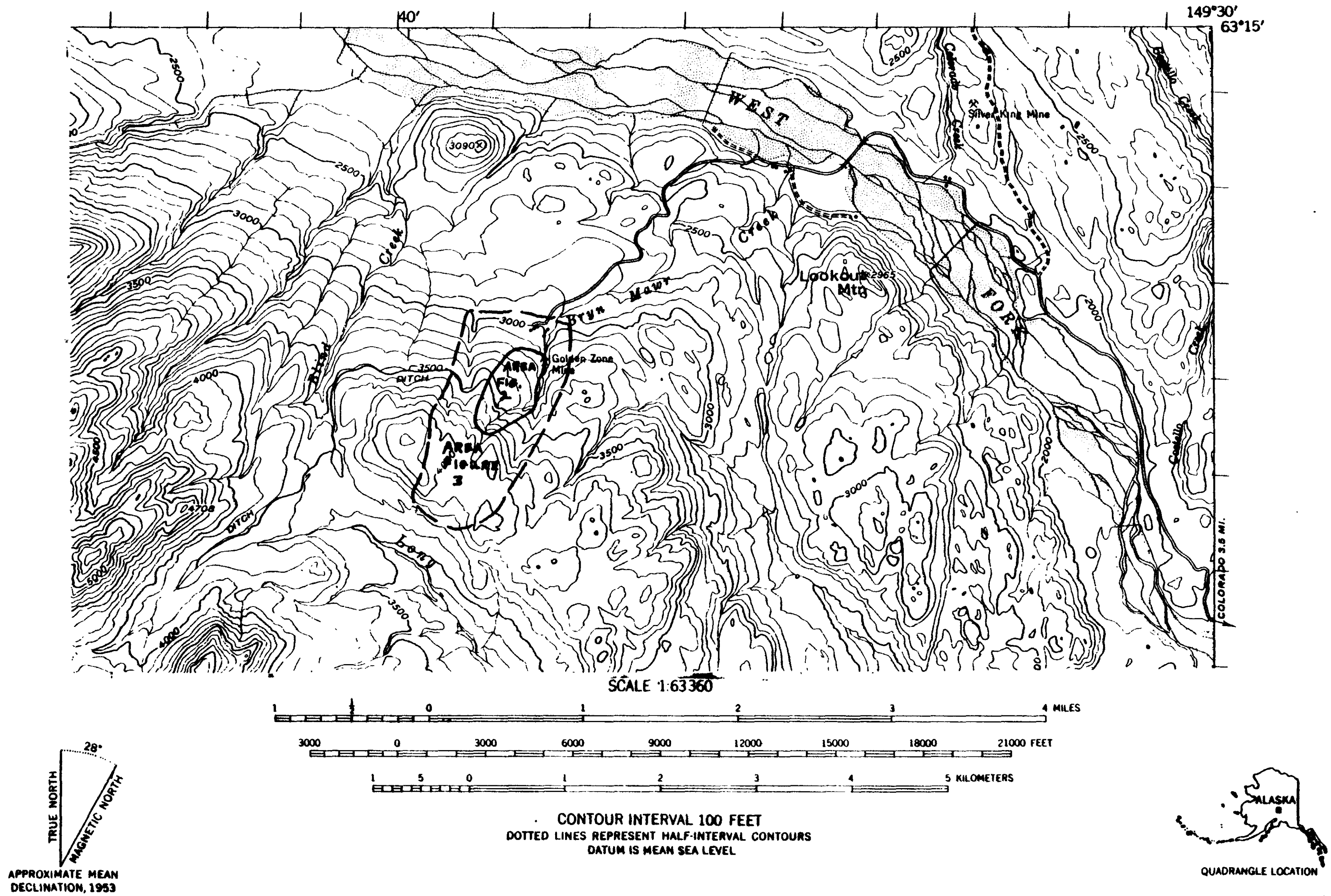
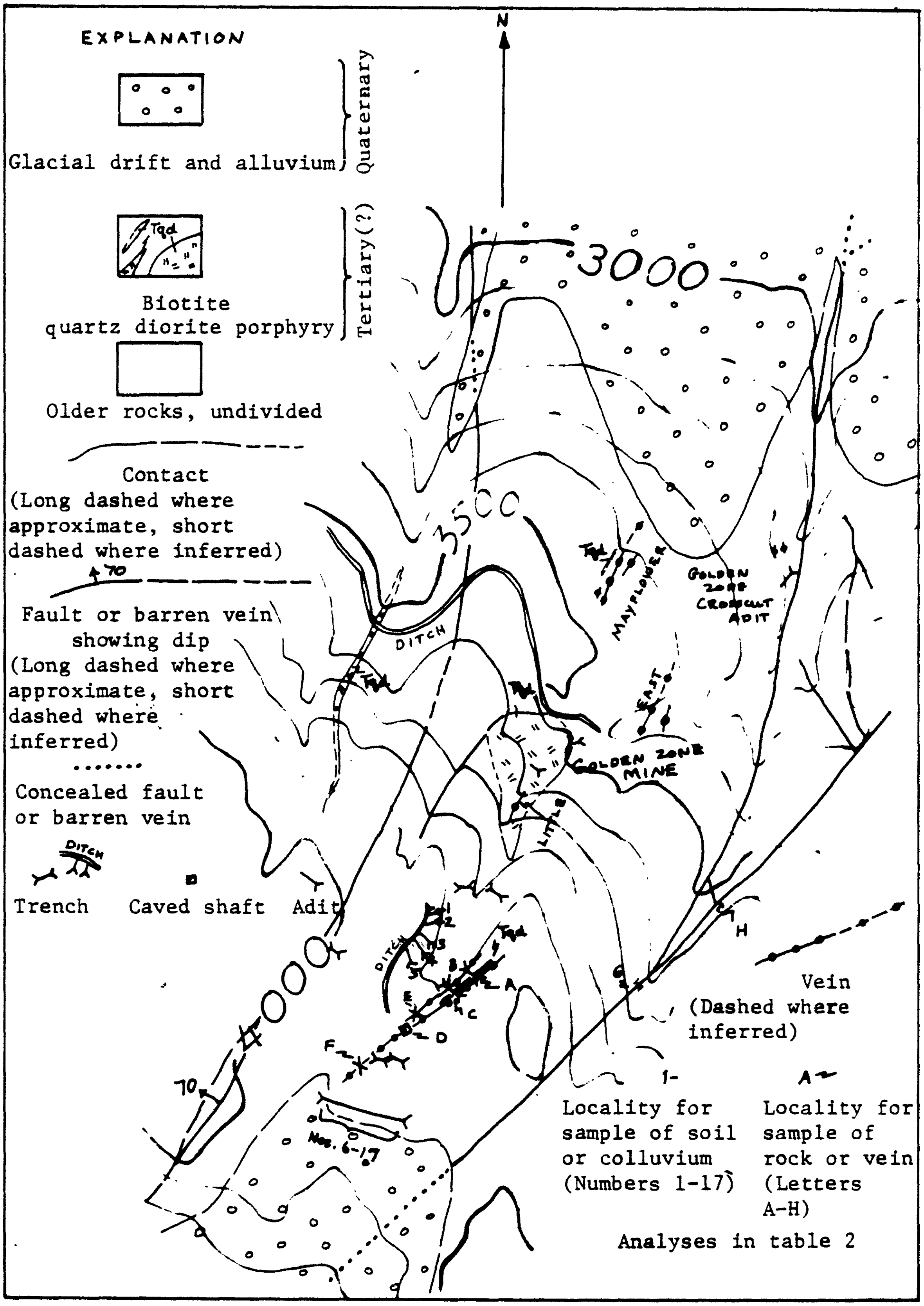


Figure 1. Index map showing location of the Golden Zone mine area.



Base enlarged from Healy A-6 U.S. Geol. Survey 1:63,360 Quadrangle

Figure 3. Generalized geologic map of the Golden Zone mine area and surrounding region

1000 0 1000 2000 Feet