68-101

DEPARTMENT OF INTERIOR

GEOLOGICAL SURVEY

GOLD GRADIENTS AND ANOMALIES
IN THE
PEDRO DOME - CLEARY SUMMIT AREA,
FAIRBANKS DISTRICT,
ALASKA

By

R. B. Forbes
H. D. Pilkington
Daniel B. Hawkins

August 30, 1968

CONTENTS

TABLE OF ILLUSTRATIONS

Plates

TABLES

GOLD GRADIENTS AND ANOMALIES IN THE PEDRO DOME-CLEARY SUMMIT AREA, FAIRBANKS DISTRICT, ALASKA

By

R. B. Forbes, H. D. Pilkington and Daniel B. Hawkins [1/]

Abstract

Anomalous gold values have been discovered in hydrothermally altered quartz diorite, quartz monzonite and quartz mica schist at the head of Fox Creek; and in similarly altered quartz diorite in the Granite Creek area. Channel samples across some of these altered zones have produced anomalous gold values over widths which merit further investigation as potential large tonnage low-grade gold deposits.

Trace gold gradients have also been detected in the wall rocks adjacent to mineralized veins and in hydrothermal alteration zones in the Pedro Dome-Cleary Summit area. Although most of the gradients may not materially increase the mineable width of the deposit under current economic conditions, such gradients can be used to locate auriferous quartz veins and altered zones by geochemical methods. Gold enrichment is accompanied by anomalous concentrations of arsenic and antimony, and gold bearing quartz veins and altered zones are frequently signalled by peripheral haloes of these metals before trace gold is detectable. Hydrothermally altered and/or sheared zones in both granitic and metamorphic rocks should be carefully prospected, along the trend of the Cleary Antiform.

INTRODUCTION

The Fairbanks district has produced over 7,500,000 ounces of gold since the discovery of placer gold on Pedro Creek in 1902; and at least 300,000 ounces of this production has been taken from auriferous lodes from 1902 to the present. Although gold production has declined in recent years, due to rising costs versus the previously fixed price of gold, the district contains unworked placer reserves, small high-grade lodes and low-grade lode systems which seem to merit a more thorough examination.

This report concerns the recognition of gold gradients in the wall rocks adjacent to gold bearing quartz veins; altered zones of considerable width, which carry low-grade gold values; and previously unreported gold anomalies in hydrothermally altered and/or silicified schists and granitic intrusives in the Pedro Dome-Cleary Summit area (Fig. 1).

This report excludes background information and similar geologic data from other areas within the Fairbanks gold belt.

Geologic setting

The Fairbanks district is chiefly underlain by metamorphic rocks which have been traditionally mapped as Precambrian Birch Creek Schist. Birch Creek Schist terrane, however, contains at least two sequences of metamorphic rocks which appear to be in thrust contact in the district. The older sequence is exposed as a possible window in a belt that extends southwest from Cleary Creek on the north side of Pedro Dome (Fig. 1). A K^{40}-Ar^{40} age of 470 ± 35 million years was determined for hornblende[1/]

[1/] K^{40}-Ar^{40} age determination performed by Geochron Laboratories.

taken from a garnet-pyroxene-hornblende rock collected from the lower sequence in a barrow pit near mile 6.1 on the Elliot Highway. Mica and whole rock K^{40}-Ar^{40} ages from crystalline schists in the upper sequence range from 86 ± 3 to 167 ± 31 million years (Kulp, Engel and Forbes, unpublished data). Rocks in the older basement complex are of higher metamorphic grade than those in the overlying sequence (amphibolite versus greenschist facies).

The crystalline schists have been intruded by small quartz diorite and quartz monzonite plutons in the Pedro Dome-Cleary Summit area. Biotite from the quartz monzonite pluton (Fig. 1) gave a K^{40}-Ar^{40} age of 93 ± 5 million years (Kulp, Engel and Forbes, unpublished data). Discordant granitic (quartz porphyry) dikes which appear to be restricted to the mineralized belt are probably related to the quartz monzonite plutons.

Structural controls

As first described by Prindle, Katz and Smith (1913), Hill (1933) and Mertie (1937), the more productive gold-bearing quartz veins in the district tend to occur in a northeast-trending belt which extends from the Fairbanks Creek area southwest to Pedro Dome and continues for about 10 miles farther southwest from Pedro Dome (Fig. 1). The Ester Dome gold-bearing lodes and adjacent placer deposits about 20 miles southwest of Pedro Dome define the southwest terminus of the mineralized belt, and the intervening area appears to be barren of mineralization. Both Hill (1933) and Mertie (1937) suggested that the northeastern part of the mineralized belt was coincident with an anticline. Later work by Forbes and Brown (1961) and Brown (1962) reinforced this theory and showed that the Ester Dome lodes appear to be localized on the southeast flank of a structural dome, which suggests that metalliferous veins are related to late arching and accompanying fracture and shear.

Our findings indicate that the anticlinal structure may be confined to rocks composing the upper plate of a thrust which overrides an older basement complex of higher-grade and more complexly deformed rocks. Mineralization appears to be rare to absent in the rocks of the older complex.

Types of mineralization

The metalliferous deposits occur in both intrusive and metamorphic host rocks. Hill (1933) and Sandvik (1967) recognized four distinct phases of mineralization in the Fairbanks District. Phase 1 is characterized by barren quartz veins and is common in the eastern part of the mineralized belt (Fig. 1). The second phase consists of quartz-arsenopyrite-pyrite-gold veins which cut both the quartz-mica schists and micaceous quartzites as well as the altered quartz monzonite intrusives. Most of the high-grade lodes belong to the Phase 3 mineralization and characteristically contain quartz-stibnite-gold $\pm$ arsonopyrite and sulfosalts. The host rocks are typically quartz-mica schist or micaceous quartzite. The fourth and final phase of mineralization consists of quartz and stibnite with little or no gold.

Preliminary investigations indicate that Phase 3 mineralization can be divided into three distinct assemblages. Most typical is the quartz-jamesonite-stibnite-gold assemblage as typified by the Kawalita Vein. Next in importance is the association quartz-jamesonite-freibergite-galena-stibnite, as it occurs in the Keystone locale. As mentioned later in this report, this assemblage also contains significant gold values. The third assemblage was more recently identified in fissure veins cut

by an adit in Pedro Dome quartz diorite, on the property of Busty Belle Mines, Inc., consisting of argentiferous galena-sphalerite-tetrahedrite-pyrite, with subordinate gold values. This assemblage appears to be restricted to veins that fill the fractures in the quartz diorite in the roof of this particular pluton.

Analytical techniques

Spectrographic analysis

With the exception of gold, the concentration of the various trace elements was determined spectrographically by the U. S. Geological Survey Field Services Section. The values reported are based upon a 6-step method of comparison in which the results are reported to the nearest number in the series 1, 0.7, 0.5, 0.3, 0.2, 0.15, 0.1, etc. For example, over the concentration range 1 to 10 ppm, the 6-step method would report values of 1, 1.5, 2.0, 3.0 . . . . . 10 ppm; and over the range 10 to 100 ppm, values of 10, 15, 20, 30 . . . . . 100 ppm would be reported. The precision of this method is about plus 100 per cent and minus 50 per cent of the value reported.

Gold analytical methods

The quantity of gold in the various samples was determined by three different methods:

1. Fire assay
2. The U.S.G.S. field method utilizing solvent extraction-atomic absorption spectrometry with an $HBr-Br_2$ digestion (Huffman, Mensik and Riley, 1967)
3. A solvent extraction-atomic absorption spectrometric method using an aqua-regia digestion (Tindall, 1965 and 1966)

In only a few instances were the same samples analyzed by all three methods. In general, all samples were analyzed by method 2 above, with extensive repeat analysis using method 3 and limited analyses using method 1.

Repeat analyses using the aqua-regia digestion were carried out when it was found that for some samples, method 2 gave gold values below those reported by fire assay. The agreement between the results obtained by fire assay and the aqua-regia digestion method is quite good. The agreement between the HBr-Br_2 field method and the aqua-regia method was generally satisfactory. The field method tended to give gold concentrations which were consistently lower than those obtained by the other two methods. Preliminary results indicate that the field method gives erroneously low gold values for those samples containing carbonate and/or sulfides as major constituents.

Acknowledgments

The investigations discussed in this report are based on cooperative research done by University of Alaska and U. S. Geological Survey personnel as part of the U. S. Geological Survey's Heavy Metals Program (Contract #13-08-001-10919). Analytical data shown in the following tables are from laboratory work done by the University of Alaska and various laboratories within the U. S. Geological Survey. Analysts and laboratories are acknowledged, where appropriate, within the report.

Many of the data contained in this report could not have been obtained without the consent of mine owners and claim holders in the district. We gratefully acknowledge their help and cooperation in this study.

WALL ROCK GOLD GRADIENTS

Serial grab and channel sampling of metalliferous lodes and adjacent wall rocks in the Cleary area has revealed the existence of gold values and gradients in both altered and apparently unaltered wallrock. The localities are numbered on Figure 1 in the order they are discussed below.

Kawalita Vein - Christina Claim, Cleary Summit Area (1)

The Kawalita Vein is a typical example of the bonanza association discussed by Sandvik (1967). Where sampled, the vein contains free gold and trace sulfosalts, and lenses of stibnite lie along the footwall contact. Gold assays of vein quartz shown in Table 1 range from 10.6 to 238 ppm, with a weighted average gold content of about 74 ppm for the full width of the vein. Figure 2 shows the gold values obtained from assays of vein material and the anomalous gold concentrations obtained from micaceous quartzites and quartz mica schists of the hanging and footwalls.

Table 1 also shows that anomalous arsenic, antimony, silver and lead concentrations accompany gold values, and that this association also persists in the wall rocks adjacent to the veins. A high gold assay was obtained near the footwall contact (75 ppm) from a zone which also contains stibnite lenses. The plots shown on Figure 2 indicate that gold enrichment extends at least five feet into the footwall where a 1.10 ppm gold assay may be related to another vein which is not exposed in the cut.

Grace E #2 Claim, Cleary Summit Area (2)

Analyses of grab and channel samples from auriferous quartz veins of the "bonanza type" and the adjacent schists reveal gold values >0.5 ppm

10 ft. into the footwall. Anomalous gold concentrations in the hanging wall range from 0.63 to over 2.50 ppm; however, the setting is complicated by multiple quartz veins (see Fig. 3 and Table 2).

Grace E #1 Claim, Cleary Summit Area (3)

The prospect opened up two small quartz veins typical of the Phase 2 veins as described by Sandvik (1967). The veins carry small amounts (2 to 3%) of sulfides including arsenopyrite, minor pyrite, and free milling gold. Gold gradients are not so well defined in the wallrock, but attention is directed to the 1.30 ppm assay obtained from unaltered schist 9 feet into the hanging wall (see Fig. 4 and Table 3).

Jamesonite Vein, Keystone Mines, Inc. Cleary Summit Area (4)

The Jamesonite Vein was being mined for silver, lead, and antimony at the time the samples were taken. At that time, unappreciated gold values were being neglected. Mineralogically the vein belongs to the "bonanza type", but its trace element content (Table 4) suggests that it belongs to a distinct sub-group characterized by anomalous silver, cadmium, lead and tin as well as anomalous arsenic and antimony. The gold profile across the vein and wall rocks emphasizes the loss in gold values sustained by the operators, and the gold gradients in both altered and unaltered schist (see Fig. 5 and Table 4).

Hydrothermal Alteration Zone, Cleary Summit Area (5)

Numerous weakly altered iron-stained zones occur in the Pedro Dome-Cleary Summit area. This particular zone, which is approximately 20 feet in width, is characterized by anomalous gold values up to 17.40 ppm; which

appear to correlate with the degree of alteration and a network of small quartz stringers (see Fig. 6 and Table 5).

Quartz Vein on Steese Highway, Cleary Summit Area (6)

A small quartz vein with no visible sulfides, which is strongly stained with arsenic and antimony oxides, crops out in the roadcut of the Steese Highway a short distance north of Cleary Summit. The trace element content (Table 6) indicates that the vein belongs to the same sub-group of the "bonanza type" as the Jamesonite Vein.

Fox Creek Area (7)

Recent trenching at the head of Fox Creek (Fig. 1) has exposed the roof zone (?) of a quartz monzonite pluton, roof pendants of silicified and altered schist, and auriferous quartz stringers and veins. A north-easterly trending alteration zone, about 30 ft. wide, cuts the quartz monzonite in the southeastern part of the trench, and quartz-mica schists and micaceous quartzites which were exposed by further trenching to the southwest. The quartz monzonite and crystalline schists are both sheared and silicified. The alteration zone in the schists is bounded by two quartz veins. The altered quartz monzonite has been invaded by a network of auriferous quartz stringers and veins. The relations are discussed under the section covering altered intrusive rocks.

Figure 7 shows locations of channel and grab samples taken across the altered zone and from the quartz veins. Selected gold values exceeding 1.00 ppm are also shown. Table 7 lists gold, arsenic and antimony concentrations, as determined for these samples. As reported for other localities, gold anomalies can be correlated with trace arsenic and antimony content in both altered schists and vein quartz. Antimony anomalies are higher in the vein quartz while arsenic enrichment tends to be greater in the altered schists. In either case, arsenic and antimony concentrations exceeding 500 ppm are usually associated with gold values above 0.02 ppm.

Stibnite lenses along the hanging wall of the south vein contain significant gold values. Sample ECP 3-15-67, unaltered stibnite, assayed 0.80 ppm gold; and Sample ECP 3-43-67, an altered rind from a similar lens, contained 23.0 ppm in gold.

Table 1. Au, As, Ag & Pb content of [illegible]alita Vein and wallrock, Christina Claim.

Sample No.	Material	Sample Locations	Au in ppm; $HBr-Br_2$ field method	Au in ppm; Agua-Regia	Trace metals in ppm; 6 step spectroscopic analyses: As ppm	Sb ppm	Ag ppm	Pb ppm
ECV 7-1-67	Gouge	4" into footwall	0.28	0.37	1,500	3,000	3.0	500
7-2-67	Gouge	8" into footwall	0.14	n.d.	500	300	A	200
7-3-67	Quartzite	12" into footwall	0.10	n.d.	2,000	1,500	2.0	500
7-4-67	Quartzite	19" into footwall	0.36	n.d.	<200	<100	1.5	70
7-5-67	Quartzite	31" into footwall	0.11	n.d.	300	700	1.0	70
7-6-67	Quartzite	41" into footwall	0.16	n.d.	500	A	A	100
7-7-67	Quartzite	51" into footwall	0.20	n.d.	700	200	2.0	100
7-8-67	Quartzite	60" into footwall	1.10	n.d.	1,000	300	5.0	100
7-9-67	Quartzite	1" into footwall	15.50	75.00	2,000	>10,000	1.0	150
7-10-67	Qtz, no visible Au	1" into footwall of vein	5.20	11.00	A	1,500	3.0	30
7-11-67	Qtz/visible sulfide & Au	3" center of vein	287.00	238.00	700	2,000	150.0	1,000
7-12-67	Qtz, no visible Au	3" hanging wall of vein	1.20	10.6	A	700	1.0	100
7-13-67	Qtz-mica schist	0-6" channel, hanging wall	1.42	n.d.	7,000	7,000	2.0	150
7-14-67	Qtz-mica schist	14" into hanging wall	0.10	n.d.	A	150	A	15
7-15-67	Qtz-mica schist	24" into hanging wall	0.16	0.13	700	100	1.5	10
7-16-67	Qtz-mica schist	36" into hanging wall	0.10	n.d.	1,000	200	1.5	50
7-17-67	Qtz-mica schist	48" into hanging wall	0.04	n.d.	A	200	A	A
7-18-67	Qtz-mica schist	60" into hanging wall	0.02	n.d.	A	A	A	A
7-19-67	Qtz-mica schist	108" into hanging wall	0.02	<0.013	A	A	A	A

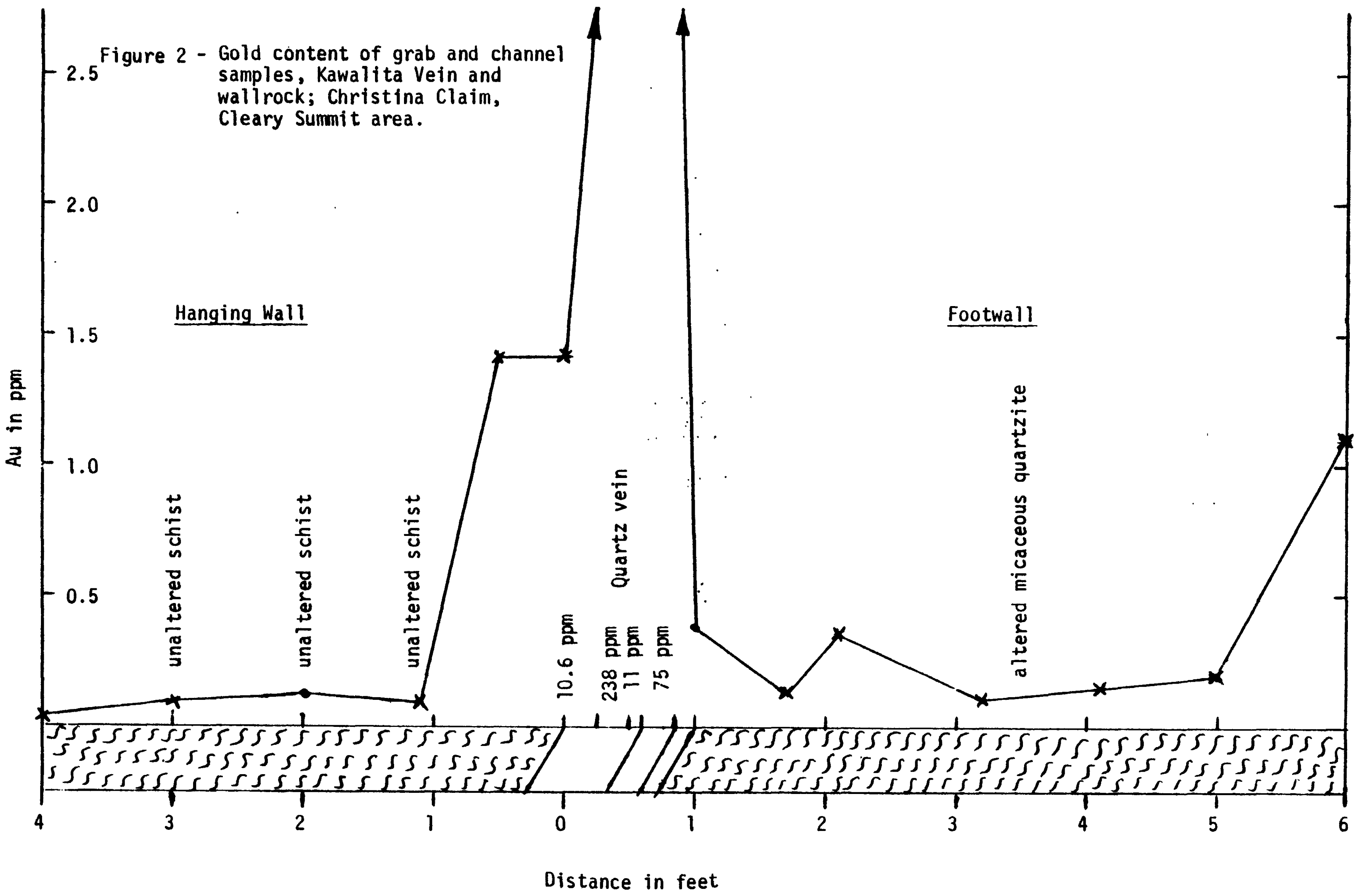


Figure 2 - Gold content of grab and channel samples, Kawalita Vein and wallrock; Christina Claim, Cleary Summit area.

Table 2. Au content - vein and wall rock - Grace E #2 Claim

Sample No.	Material	Location	Type	Au in ppm; HBr-Br2 field method	Au in ppm; Aqua-Regia
ECV 2-1-67	0.7 ft. vein quartz	Footwall of vein	Channel	9.00	8.20
2-3-67	0.2 ft vein quartz	Hanging wall of vein	Channel	1.68	4.10
2-4-67	Fe stained silicified schist	0-0.3 ft. into hanging wall	Channel	0.20	--
2-5-67	Fe stained silicified schist	0.8 ft. into hanging wall	Grab	2.64	2.60
2-6-67	Vein quartz	30 ft. into hanging wall	Grab	1.16	1.00
2-7-67	Silvery gray altered schist	30.2 ft. into hanging wall	Grab	0.76	0.75
2-8-67	Fe stained silicified schist	3.0 ft. into hanging wall	Grab	0.72	0.63
2-9-67	Fe stained silicified schist	3.5 ft. into hanging wall	Grab	0.40	0.63
2-10-67	Quartz mica schist	10 ft. into footwall	Grab	0.60	0.63
2-11-67	Segregation quartz	30 ft. into footwall	Grab	0.00	--

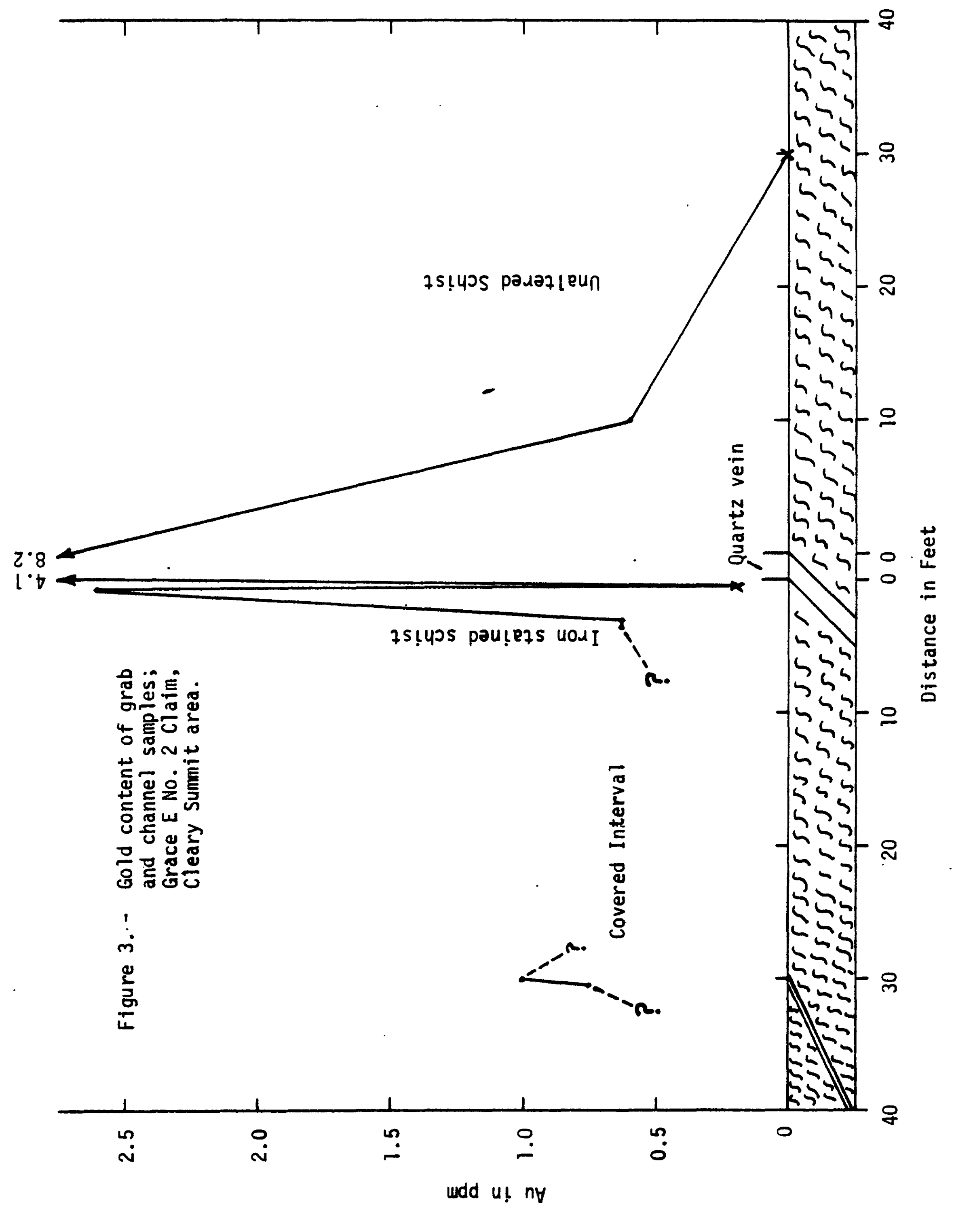


Figure 3.- Gold content of grab and channel samples; Grace E No. 2 Claim, Cleary Summit area.

Table 3. Au content - vein and wall rock - Grace E #1 Claim.

Sample No.	Material	Location	Type	Au in ppm; HBr-Br_2 field method	Au in ppm; Aqua Regia
ECV 5-3-67	0.8 ft. vein quartz/visible sulfides	Vein	Channel	11.00	10.00
5-7-67	Unaltered schist	12 ft. into footwall	Grab	0.04	0.25
5-8-67	Unaltered schist	9 ft. into footwall	Grab	<0.04	<0.13
5-9-67	Unaltered schist	6 ft. into footwall	Grab	0.04	<0.13
5-10-67	Fe stained schist	3 ft. into footwall	Grab	0.16	--
5-11-67	Segregations quartz	15 ft. into footwall	Grab	0.16	0.13
5-12-67	Fe stained schist	3 ft. into hanging wall	Grab	0.20	<0.13
5-13-67	0.3 ft. vein quartz	6 ft. into hanging wall	Channel	16.00	34.40
5-14-67	Unaltered quartz mica schist	9 ft. into hanging wall	Grab	1.24	1.30

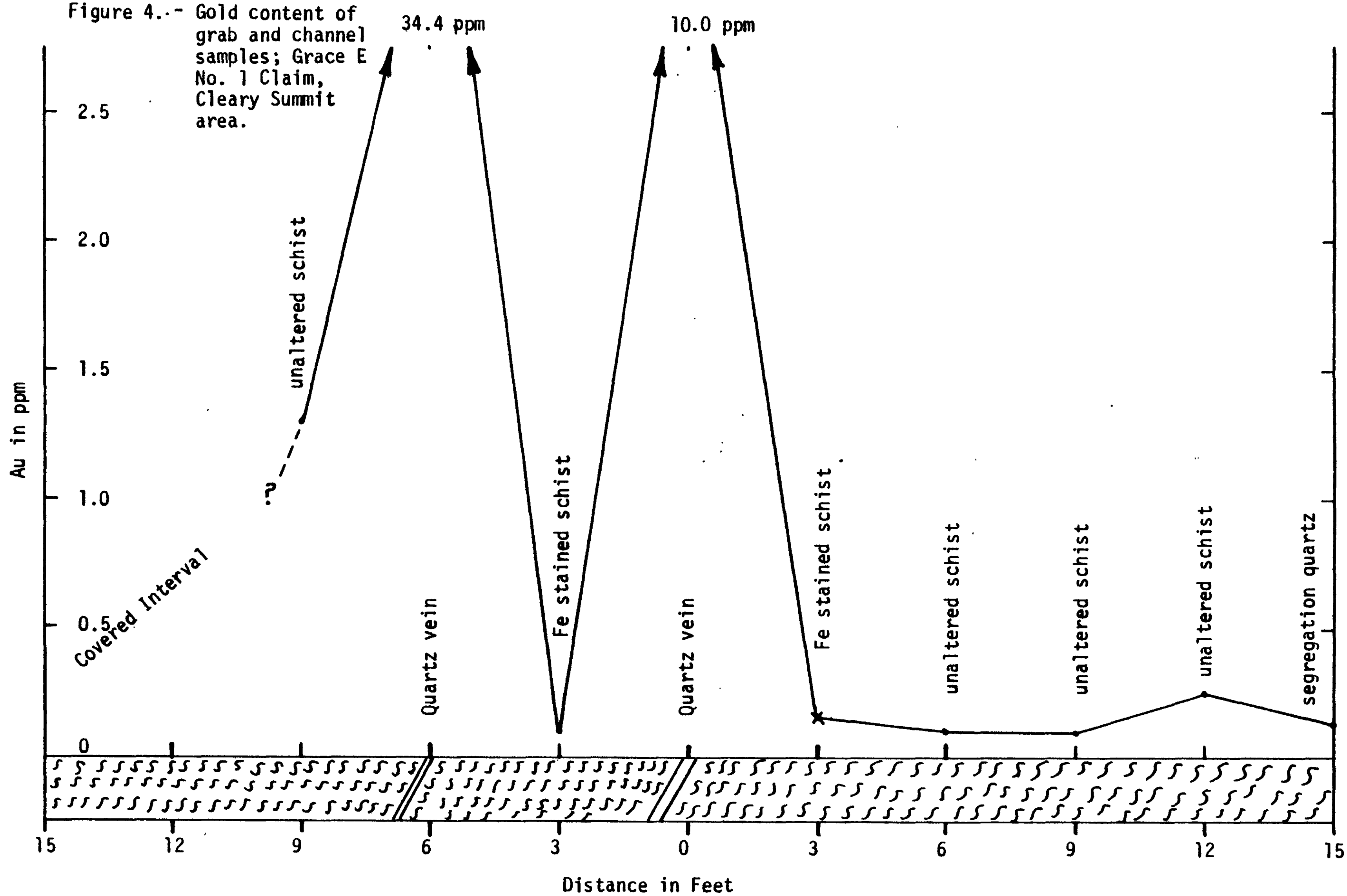


Figure 4.- Gold content of grab and channel samples; Grace E No. 1 Claim, Cleary Summit area.

Table 4. Au, As, Sb, Ag, Cd, Pb and Sn content Jamesonite vein and wallrock - Keystone Mines, Inc.

Sample No.	Material	Sample Location	Sample Type	Au in ppm; HBr-Br2 field method	Au in ppm; Aqua-Regia	Trace metals in ppm; 6 step spectroscopic analyses					
						As ppm	Sb ppm	Ag ppm	Cd ppm	Pb ppm	Sn ppm
ECV 8-1-67	0.3 ft. qtz, no visible sulfides	Footwall of vein	Channel	7.00	8.50	>10,000	>10,000	200.0	30	>20,000	>2,000
8-2-67	0.2 ft. qtz, no visible sulfides	Footwall of vein	Channel	3.00	5.60	>10,000	>10,000	1,500.0	100	>20,000	500
8-3-67	0.2 ft. qtz, no visible sulfides	Footwall of vein	Channel	1.52	3.00	>10,000	>10,000	300.0	70	>20,000	1,000
8-4-67	Silvery gray schist	Footwall of vein	Grab	2.48	--	>10,000	>10,000	100.0	N	>20,000	200
8-5-67	Silvery gray schist	1' into schist horse	Grab	0.03	--	3,000	1,000	10.0	N	2,000	100
8-6-67	Clayey shear	2' into schist horse	Grab	0.10	--	>10,000	1,500	3.0	N	7,000	N
8-7-67	Clayey shear	3' into schist horse	Grab	0.40	--	1,000	300	15.0	N	1,000	10
8-8-67	Thin qtz. stringers in schist	4' into schist horse	Grab	0.70	1.30	1,500	500	15.0	N	500	N
8-9-67	Sheared-leached schist	5' into schist horse	Grab	0.14	--	1,500	1,000	15.0	N	15,000	L
8-10-67	Dark gray schist	6' into schist horse	Grab	0.58	--	3,000	7,000	70.0	20	20,000	300
8-11-67	0.5 ft qtz, no visible sulfides	Hanging wall vein	Channel	3.84	5.30	>10,000	10,000	300.0	50	20,000	1,000
8-12-67	0.3 qtz/sulfide	Hanging wall vein	Channel	3.92	--	>10,000	>10,000	1,000.0	200	>20,000	>1,000
8-13-67	Qtz. and stibnite	Hanging wall vein	Grab	0.30	--	>10,000	>10,000	1,000.0	300	>20,000	>1,000
8-14-67	Qtz. and oxidation products	Hanging wall vein	Grab	1.64	--	>10,000	>10,000	2,000.0	300	>20,000	>1,000
8-15-57	Qtz. and gouge	Hanging wall vein	Grab	12.00	--	>10,000	>10,000	1,500.0	300	>20,000	700
8-16-67	Qtz. from shear	Hanging wall vein	Grab	1.20	--	5,000	5,000	50.0	N	20,000	20
8-17-67	Segregation (?) quartz	6" into hanging wall	Grab	2.00	2.70	2,000	2,000	70.0	N	1,000	15
8-18-67	Qtz-mica schist	1' into hanging wall	Grab	0.12	--	700	1,000	20.0	N	5,000	300
8-19-68	Qtz-mica schist	2' into hanging wall	Grab	0.05	0.13	200	300	15.0	N	300	70
8-20-67	Segregation Qtz.	0.9' into hanging wall	Grab	--	--	300	150	3.0	N	300	N
8-21-67	Footwall gouge	Footwall gouge	Grab	6.40	--	>10,000	>10,000	200.0	L	>20,000	200
8-22-67	Altered schist	1' into footwall	Grab	0.48	0.65	5,000	1,500	15.0	N	7,000	50
8-23-67	Silvery gray schist	2' into footwall	Grab	0.78	--	10,000	7,000	15.0	N	5,000	30
8-24-67	Altered qtz-mica schist	3' into footwall	Grab	0.10	--	7,000	1,500	15.0	N	15,000	15
8-25-67	Silvery gray schist	5' into footwall	Grab	0.46	0.52	7,000	1,500	10.0	N	3,000	30
8-26-67	Qtz-mica schist	6' into footwall	Grab	0.15	0.13	3,000	2,000	7.0	N	3,000	15
8-27-67	Qtz-mica schist	7' into footwall	Grab	0.02	--	700	700	1.5	N	1,500	N
8-28-67	Qtz-mica schist	8' into footwall	Grab	0.29	0.65	1,500	200	15.0	N	700	10
8-29-67	Qtz-mica schist	10' into foot-wall	Grab	0.04	--	300	150	3.0	N	500	N
8-30-67	Qtz-mica schist	12' into foot-wall	Grab	0.06	--	700	300	1.0	N	700	N
8-31-67	Qtz-mica schist	14' into foot-wall	Grab	<0.02	--	L	100	0.5	N	100	N

Figure 5.- Gold content of grab and channel samples; Jamesonite Vein - Keystone Mines, Inc. Cleary Summit area.

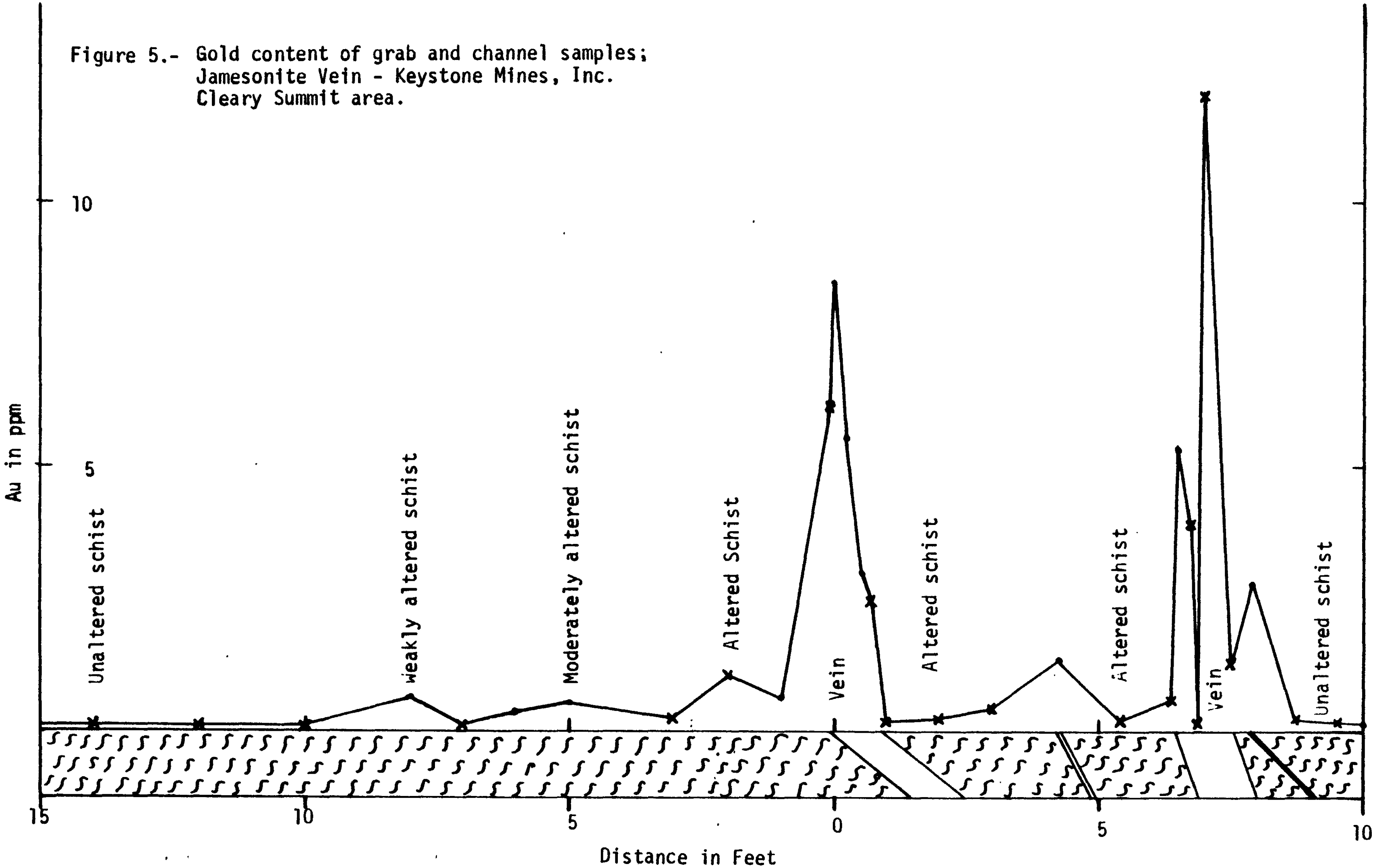


Table 5. Au content hydrothermal alteration zone - Cleary Summit.

Sample No.	Material	Location	Type	Au in ppm; HBr-Br_2 field method	Au in ppm; Aqua Regia
ECC 1-4-67	Unaltered qtz-mica schist	3-2 ft. into wall rock	Channel	<0.02	<0.13
1-5-67	Unaltered qtz-mica schist	2-1 ft. into wall rock	Channel	0.60	0.66
1-6-67	Unaltered qutz-mica schist	1-0 ft. into wall rock	Channel	0.10	0.10
1-7-67	Altered Fe stained schist	0-1 ft. into altered zone	Channel	0.20	--
1-8-67	Altered Fe stained schist/qtz stringers	1-2 ft. into altered zone	Channel	17.40	--
1-9-67	Altered Fe stained schist/qtz stringers	2-3 ft. into altered zone	Channel	1.40	4.25
1-10-67	Altered Fe stained schist/qtz	3-4 ft. into altered zone	Channel	2.00	--
1-11-67	Altered Fe stained schist	4-5 ft. into altered zone	Channel	1.60	--
1-12-67	Altered Fe stained schist	5-6 ft. into altered zone	Channel	0.20	0.20
1-13-67	Altered Fe stained schist	6-8 ft. into altered zone	Channel	0.04	--
1-14-67	Strong Fe stain schist	8-10 ft. into altered zone	Channel	0.10	--
1-15-67	Strong Fe stain schist	10-12 ft. into altered zone	Channel	0.80	1.00
1-16-67	Strong Fe stain schist	12-14 ft. into altered zone	Channel	0.50	--
1-17-67	Moderate Fe stain	14-16 ft. into altered zone	Channel	0.10	--
1-18-67	Moderate Fe stain	16-17 ft. into altered zone	Channel	0.40	0.63
1-19-67	Moderate Fe stain	17-18 ft. into altered zone	Channel	0.06	--
1-20-67	Unaltered schist	18-19 ft into altered zone	Channel	<0.02	<0.13

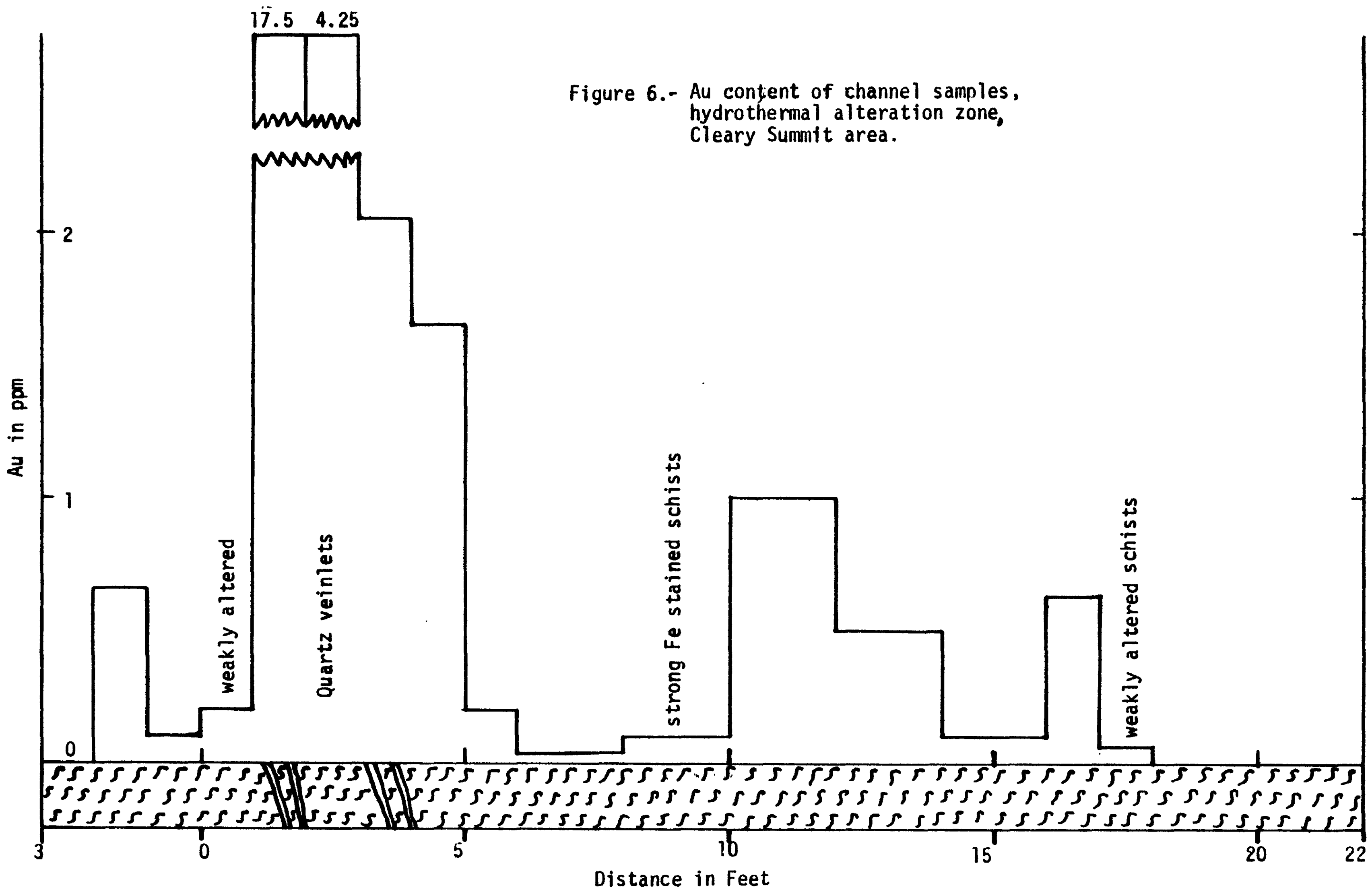


Figure 6.- Au content of channel samples, hydrothermal alteration zone, Cleary Summit area.

Table 6. Au, As, Sb, Ag, Cd, Pb, Sn and Zn content of channel samples, hydrothermal alteration zone, Steese Highway, Cleary Summit

Sample No.	Material	Sample Location	Sample Type	Au in ppm $HBr-Br_2$ field method	Trace metals in ppm; 6 step spectroscopic analyses: As ppm	Sb ppm	Ag ppm	Cd ppm	Pb ppm	Sn ppm	Zn ppm
ECC 1-33-67	Altered qtz-mica schist	2.0 - 3.0 ft. into footwall	Channel	0.02	L	L	L	N	10	N	N
1-34-67	Altered qtz-mica schist	1.0 - 2.0 ft. into footwall	Channel	0.04	1,500	700	30	L	3,000	15	15
1-35-67	Altered qtz-mica schist	0.0 - 1.0 ft. into footwall	Channel	0.10	7,000	3,000	30	70	15,000	300	3,000
1-36-67	Qtz. vein, strong As, Sb oxides	0.7 ft. vein	Channel	24.00	>10,000	>10,000	700	>500	>20,000	>1,000	700
1-37-67	Altered qtz. mica schist	0.0 - 1.0 ft. into hanging wall	Channel	0.10	3,000	300	7	50	500	20	3,000

Figure 7.- Sketch map of quartz veins and altered wallrock, showing sample locations and selected gold values in ppm; Fox Creek Lode, Busty Belle Mines.

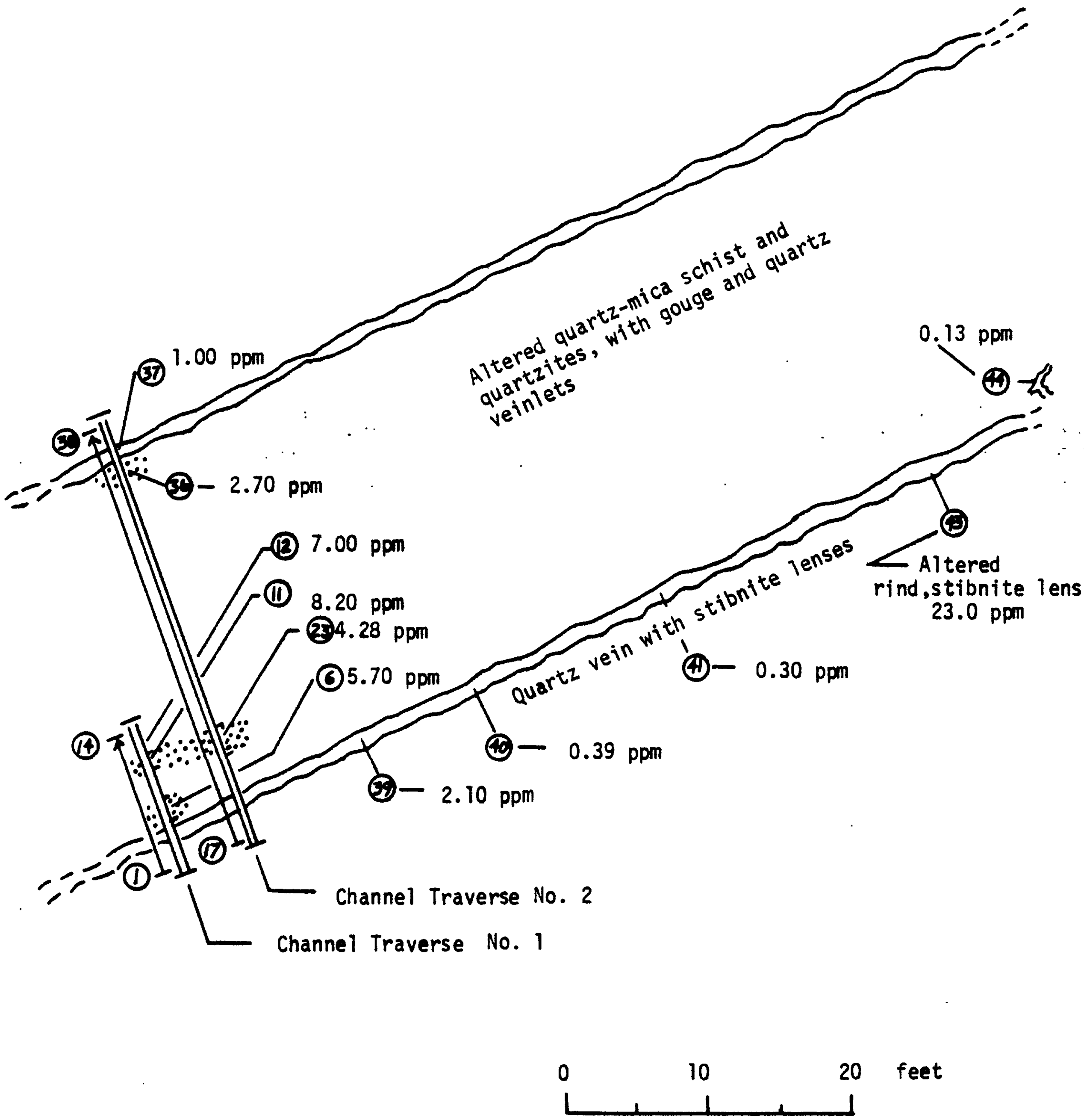


Table 7a. Au content in ppm of channel and grab samples taken from Traverse#1; NE-SW trench, Fox Creek Lode

Sample No.	Material	Channel Length	Au in ppm; HBr-Br2 field method	Au in ppm; Aqua-Regia method	As in ppm; 6 step spect.	Sb in ppm; 6 step spect.
	Channel Samples					
ECP 3-1-67	Altered quartz-mica schist	0 - 1'	nil	.13	1500	2000
3-2-67	Altered quartz-mica schist	1' - 2'	nil	n.d.	700	2000
3-3-67	Vein quartz	2' - 2'4"	nil	.76	700	700
3-4-67	Vein quartz	2'4"- 2'8"	0.17	.50	500	1000
3-5-67	Gourge	2'8" - 3'	0.06	.50	3000	7000
3-6-67	Green & brown stained quartzite	3' - 4'	1.66	5.70	1000	>10000
3-7-67	Altered schist	4' - 5'	1.44	.26	700	5000
3-8-67	Red-brown gouge	5' - 6'	0.42	.91	500	700
3-9-67	Red-brown gouge, w/quartz	6' - 7'	0.30	.50	L	700
3-10-67	Red-brown gouge, w/quartz	7' - 8'	0.30	n.d.	700	
3-11-67	Red-yellow gouge	8' - 9'	7.00	8.20	2000	1000
3-12-67	Red-yellow gouge	9' - 10'	0.24	7.00	1000	700
3-13-67	Altered schist & quartzite	10' - 11'	0.10	.13	300	300
3-14-67	Red-brown gouge	11' - 12'	0.10	n.d.	700	300
	Grab Samples					
ECP 3-15-67	Stibnite lens	2 ft. SE of samples 3 & 4 above.	0.80	n.d.	500	>10,000
3-16-67	Vein quartz near stibnite		2.70	n.d.	500	7,000

Table 7b. Au, As & Sb content in ppm of channel & grab samples taken from Traverse #2; NE-SW trench, Fox Creek Lode.

Channel Samples

Sample No.	Material	Channel Length	Au in ppm; HBr-Br_2 field method	Au in ppm; Aqua-Regia method	As in ppm; 6 step spect.	Sb in ppm; 6 step spect
ECP 3-17-67	Altered quartz-mica schist	0' - 1'5"	nil	0.26	2,000	7,000
3-18-67	Green stained vein quartz	1'5" - 2'6"	nil	n.d.	200	>10,000
3-19-67	Vein quartz & gouge	2'6" - 3'	nil	0.26	300	2,000
3-20-67	Red-brown quartz	3' - 5'	nil	n.d.	700	1,500
3-23-67	Red-brown quartz & gouge	5' - 7'	4.10	4.28	1,500	5,000
3-24-67	Red-brown quartz & gouge	7' - 9'	0.05	n.d.	700	500
3-25-67	Red-brown quartz & gouge	9' - 11'	0.01	n.d.	500	500
3-26-67	Red-brown quartz & gouge	11' - 13'	0.04	0.13	700	200
3-27-67	Brown quartzite	13' - 14'	0.05	n.d.	700	200
3-28-67	Brown quartzite	14' - 15'	0.06	n.d.	700	200
3-29-67	Brown quartz	15' - 17'	0.04	<0.13	500	150
3-20-67	Ochre gouge	17' - 19'	0.40	n.d.	1,000	200
3-31-67	Ochre & cream gouge	19' - 21'	0.20	n.d.	1,500	700
3-32-67	Cream gouge & vein quartz	21' - 22'4"	0.20	n.d.	N	150
3-33-67	Red-brown quartz	22'4" - 24'	0.20	n.d.	500	500
3-34-67	Brown quartz	24' - 24'6"	0.30	0.38	300	500
3-35-68	Brown quartz	24'6"- 25'	0.30	n.d.	1,000	700
3-36-67	Brown quartz	25' - 27'	2.00	2.70	1,500	2,000
3-37-67	Green stained vein quartz	27' - 27'6"	0.78	1.00	700	>10,000
3-38-67	Brown quartz & gouge	27'6" - 30'	0.40	0.26	L	7,000
		Grab Sample				
ECP 3-21-67	Green stained vein quartz	5' NE of ECP 3-20-67	n.d.	3.78	500	>10,000

Table 7c. Au, As and Sb content in ppm of grab samples taken from stibnite bearing quartz vein; Fox Creek Lode.

Sample No.	Grab Samples	Au in ppm; $HBr-Br_2$ field method	Au in ppm; Aqua-Regia method	As in ppm; 6 step spect.	Sb in ppm, 6 step spect.
ECP 3-39-67	Green stained vein quartz	1.80	2.10	1,000	>10,000
3-40-67	Green stained vein quartz	0.30	0.39	500	>10,000
3-41-67	Green stained vein quartz	0.30	n.d.	500	>10,000
3-42-67	Green stained vein quartz	0.06	0.52	700	>10,000
3-43-67	Altered rind of stibnite lens	20.00	23.00	2,000	>10,000
3-44-67	Quartz veinlet cut by green quartz vein	0.02	0.13	L	500

GOLD CONTENT OF THE INTRUSIVE ROCKS

The role played by the intrusive rocks in the mineralization of the Pedro Dome-Cleary Summit area has remained obscure. We are attempting to classify these relations by examining the gold content of the intrusives and their mineral phases. The following summarizes our preliminary work on this problem.

Fox Creek Area (7)

Coarse-grained quartz monzonite has been exposed by trenches at the head of Fox Creek (SE 1/4 Sec. 8, T2N, R1E of the Livengood A-2 Quadrangle). Numerous roof pendants of schist are enclosed by the pluton, and both the quartz monzonite and hornfelsed wall rock are cut by a network of quartz veins.

Microscopically, the rock is a coarse-grained hypautomorphic granular quartz monzonite. The rock appears to be relatively free of hydrothermal alteration except along the mineralized shear zones. Minor deuteric alteration of the feldspars was noted including sericitization and albitization of the plagioclase and incipient development of exsolution perthite in the orthoclase. The rocks are strongly weathered, which tends to obscure their earlier history.

Within the altered zone, which is approximately 30 feet wide, the quartz monzonite appears to have been sheared and converted into clay minerals and strongly stained by limonite and/or hematite. The intensity of the alteration and iron staining increased to the southeast, across the zone. The quartz monzonite within the altered zone is cut by numerous quartz veins

which parallel the shear direction and dip steeply to the southeast. Gold values up to 2.77 ppm were found in the altered quartz monzonite, whereas the quartz monzonite outside the altered zone gave only background values (see Fig. 8 and Table 8).

This zone continued downslope to the southwest, where it contains auriferous quartz veins and altered schist - without quartz monzonite.

Cleary Summit Area (8)

An unaltered quartz monzonite dike is exposed in the road cut at Cleary Summit (NW 1/4, Sec. 6, T2N, R2E Livengood A-1 Quadrangle) on the Steese Highway. The rock is a porphyry with quartz and biotite phenocrysts in a very fine grained groundmass containing visible sulfides, which are thought to be primary. The south margin of the dike exhibits weak hydrothermal alteration for about 2 feet below the hanging wall contact. The dike appears to have been emplaced along a shear zone; and shear appears to have continued after emplacement, as shown by the gouge zone on the south margin of the dike. Secondary mineralization was at least contemporaneous with late shearing, or perhaps younger.

Figure 9, a sketch map, shows the field relations and sample localities discussed above. Table 9 shows the gold, arsenic, and antimony content of the dike and wall rock.

Mile 17.5 Steese Highway (9)

A small pluton of quartz diorite is exposed in road cuts along the Steese Highway south of Granite Creek (Sw 1/4, Sec. 11, T2N, R1E of the Livengood A-1 Quadrangle). The south border of the quartz diorite mass is strongly sheared, altered, and iron stained. Vein quartz, 0.5 feet thick, occurs in the gouge zone which trends N.87°W. and dips steeply to the south. Gold values up to 2.70 ppm occur in the altered quartz diorite adjacent to the quartz vein, but decrease progressively away from the vein (see Fig. 10 and Table 10).

Reticulated Quartz Veins in Altered Quartz Diorite (10)

A recently opened prospect trench (Locality 10, Fig. 1) near the head of the Fox Creek (SE 1/4, SE 1/4, Sec. 18, T2N, R1E of the Livengood A-2 Quadrangle) exposed a reticulated vein system in quartz diorite. The veins contain quartz-argentiferous galena-stibnite and gold. The quartz diorite is strongly altered and intensely iron stained. Three series of channel samples were taken (Fig. 11) across the vein system. Traverse No. 1 was sampled from north to south. Samples collected from south to north in Traverse No. 2 (Fig. 11) cross a 10-foot zone of mineralization which averages 11.57 ppm in gold (Table 11, Samples ECP 5-14-68 through ECP 5-23-68). Samples 5-31-68 through ECP 5-38-68 cut from north to south along Traverse No. 3 (see Fig. 11 and Table 11) average 9.61 ppm gold, and samples ECP 5-46-68 through ECP 5-51-68 average 15.45 ppm gold.

Contact Zone Between Quartz Diorite and Quartz Monzonite (11)

Approximately 300 ft. northwest of the above prospect, another recently cut trench has exposed a contact between altered quartz monzonite and quartz diorite. Both intrusives are iron stained and highly altered near the contact. The quartz monzonite has been sheared and silicified, and invaded by quartz veinlets. Gold assays for channel and grab samples from both units are shown in Table 12. Channel samples from the quartz diorite contain no detectable gold, but trace gold concentrations up to 0.72 ppm were found in the altered monzonite. Although these values may not be of direct economic import, they do suggest that gold enrichment may be genetically related to emplacement of the quartz monzonite rather than the quartz diorite.

Vein quartz and altered quartz diorite, listed as samples ECP 7-1 and 2-68 in Table 12, also contain anomalous gold values. These samples come from another prospect trench, about 150 feet southeast of the above contact.

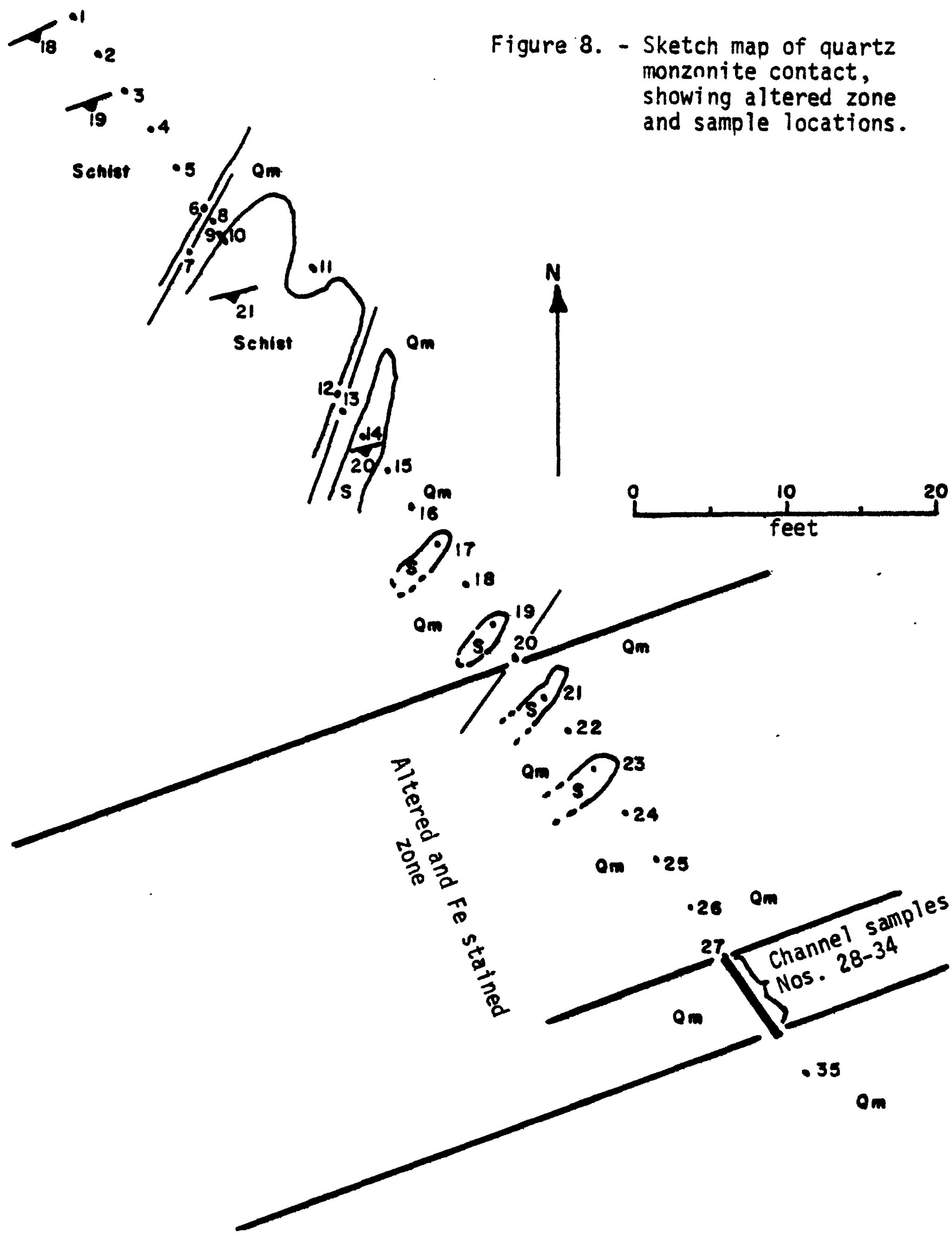


Figure 8. - Sketch map of quartz monzonite contact, showing altered zone and sample locations.

Table 8. Au, As & Sb in ppm of grab and channel samples; NW-SE cross-cut; Fox Creek Lode

Sample No.	Material		Au in ppm; HBr-Br2 field method	Au in ppm; Aqua-Regia method	As in ppm; 6 step spect.	Sb in ppm; 6 step spect.
	Grab Samples					
ECP 4-1-67	Quartz-mica schist		0.04	0.13	n.d.	n.d.
4-2-67	Quartz-mica schist		nil	n.d.	N	N
4-3-67	Quartz-mica schist		nil	n.d.	n.d.	n.d.
4-4-67	Quartz-mica schist		0.02	0.13	n.d.	n.d.
4-5-67	Quartz-mica schist		nil	n.d.	L	N
4-6-67	Quartz-mica schist		0.02	n.d.	n.d.	n.d.
4-7-67	quartz vein in quartz monzonite		nil	n.d.	L	N
4-8-67	Quartz monzonite		nil	n.d.	n.d.	n.d.
4-9-67	Quartz monzonite		0.03	n.d.	n.d.	n.d.
4-10-67	Fe stained quartz-mica schist		nil	<0.12	L	N
4-11-67	Quartz monzonite w/quartz veins		nil	n.d.	N	N
4-12-67	Fe stained quartz-mica schist		nil	n.d.	n.d.	n.d.
4-13-67	Quartz vein from schist - Qm contact		0.04	<0.12	L	N
4-14-67	Fe stained quartz-mica schist		nil	n.d.	n.d.	n.d.
4-15-67	Quartz monzonite		nil	n.d.	n.d.	n.d.
4-16-67	Quartz monzonite		nil	<0.12	n.d.	n.d.
4-17-67	Fe stained quartz-mica schist		0.04	n.d.	N	N
4-18-67	Slightly altered quartz monzonite		0.04	n.d.	L	N
4-19-67	Quartz-mica schist		nil	<0.12	n.d.	n.d.
4-20-67	Quartz vein in quartz monzonite		nil	n.d.	N	N
4-21-67	Fe stained quartz-mica schist		0.06	n.d.	n.d.	n.d.
4-22-67	Fe stained quartz monzonite		nil	<0.12	n.d.	n.d.
4-23-67	Fe stained & silicified quartz-mica schist		0.02	n.d.	L	L
4-24-67	Fe stained quartz monzonite		0.06	0.76	n.d.	n.d.
4-25-67	Fe stained quartz monzonite		0.02	n.d.	n.d.	n.d.
4-26-67	Fe stained quartz monzonite		0.70	0.63	700	2,000
4-27-67	Green & red brown stained vein quartz		1.20	1.13	3,000	10,000
	Channel & Grab Samples					
ECP 4-28-67	Altered & sheared quartz monzonite	0' - 1'	1.40	1.51	1,500	>10,000
4-29-67	Fe stained vein quartz	1' - 2'	0.20	n.d.	3,000	3,000
4-30-67	Fe stained vein quartz in quartz monzonite	2' - 3'	2.40	2.77	7,000	>10,000
4-31-67	Fe stained vein quartz in quartz monzonite	3' - 4'	1.40	n.d.	3,000	3,000
4-32-67	Fe stained vein quartz in quartz monzonite	4' - 5'	2.00	2.14	5,000	>10,000
4-33-67	Fe stained vein quartz in quartz monzonite	5' - 6'	0.60	n.d.	3,000	2,000
4-34-67	Fe stained vein quartz in quartz monzonite	6' - 7'	1.50	1.51	2,000	1,500
4-35-67	Fe stained & altered quartz monzonites	Grab	0.03	<0.12	700	700

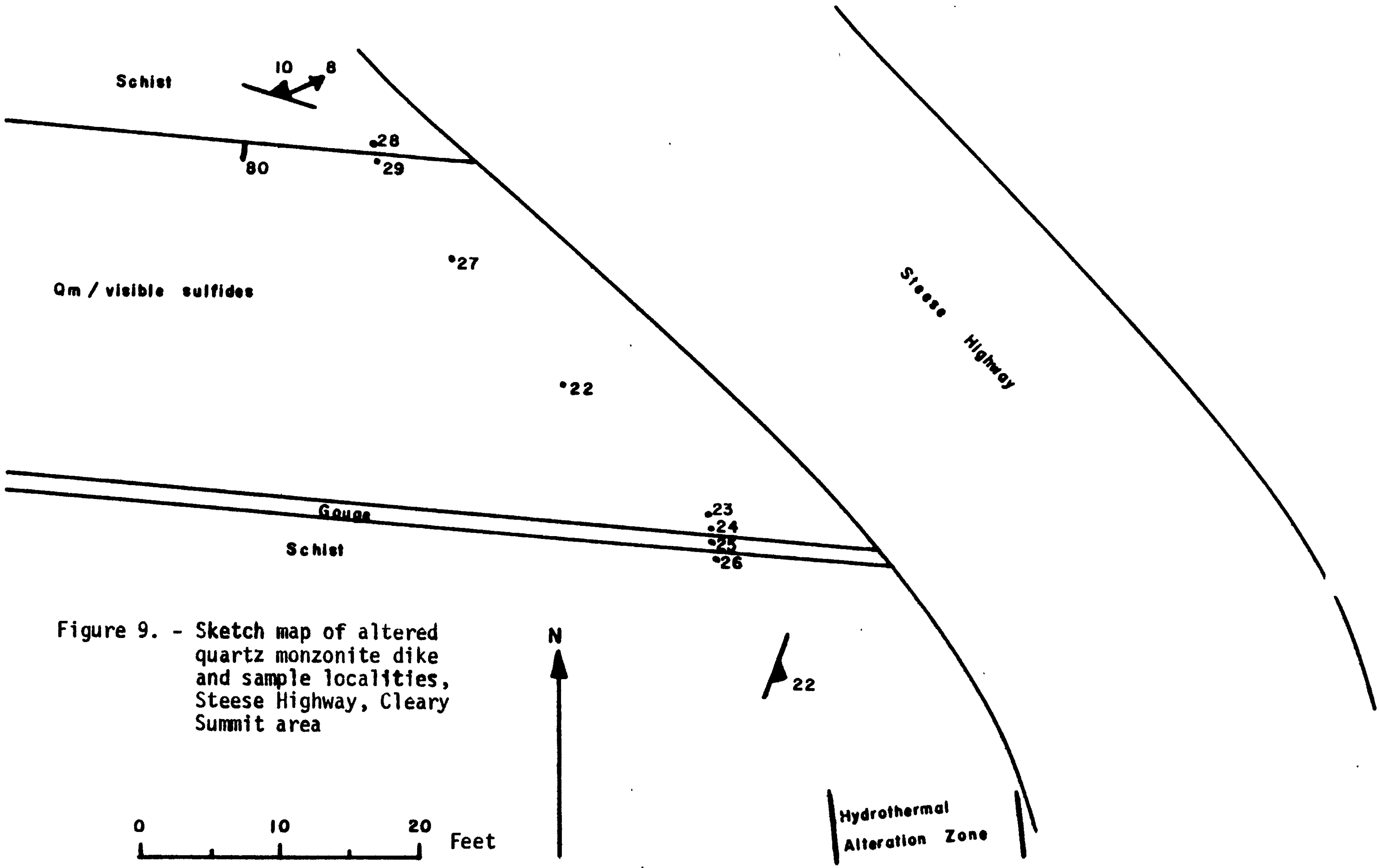


Figure 9. - Sketch map of altered quartz monzonite dike and sample localities, Steese Highway, Cleary Summit area

Table 9. Au, As & Sb in ppm of channel & grab samples from altered quartz monzonite dike and wall rock, Cleary Summit Area

Sample No.	Material	Sample Type	Au in ppm, HBr-Br_2 field method	Au in ppm; Aqua-Regia method	As in ppm; 6 step spect.	Sb in ppm; 6 step spect.
Ecc 1-22-67	Quartz monzonite	Grab	0.08	0.13	L	N
1-23-67	Quartz monzonite (slightly altered)	Grab	<0.02	<0.13	700	N
1-24-67	Altered quartz monzonite (Fe stained)	1 ft. channel	0.20	0.13	3,000	L
1-25-67	Gouge	1 ft. channel	1.80	2.80	>10,000	L
1-26-67	Quartz-mica schist	1 ft. channel	0.04	<0.13	1,500	L
1-27-68	Quartz monzonite	Grab	<0.02	<0.13	N	N
1-28-68	Quartz-mica schist	1 ft. channel	<0.02	<0.13	N	N
1-29-67	Quartz monzonite	Grab	<0.02	<0.13	N	N

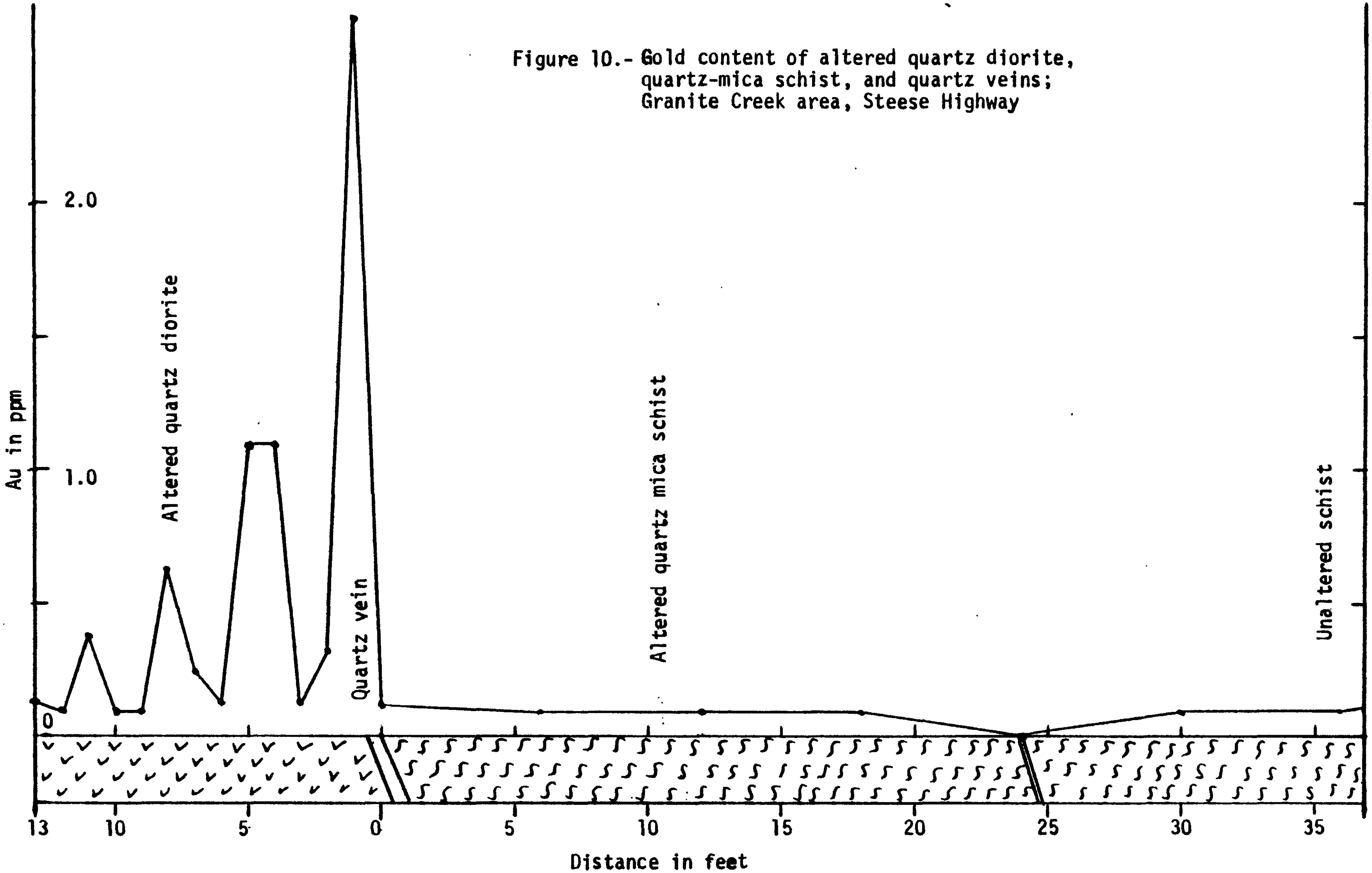


Figure 10.- Gold content of altered quartz diorite, quartz-mica schist, and quartz veins; Granite Creek area, Steese Highway

Table 10. Au content altered zone along quartz diorite-quartz-mica schist contact, Steese Highway.

Sample No.	Material	Location	Type	Au in ppm; Aqua-Regia AA det.
ECC 2-6-67	Vein quartz	0.5 ft. vein qtz	Channel	0.08
2-7-67	Gouge	0-0.5 ft. into footwall	Channel	0.13
2-8-67	Altered qtz diorite	0-1 ft. into footwall	Channel	2.70
2-9-67	Altered qtz diorite	1-2 ft. into footwall	Channel	0.27
2-10-67	Altered qtz diorite	2-3 ft. into footwall	Channel	0.13
2-11-67	Altered qtz diorite	3-4 ft. into footwall	Channel	1.10
2-12-67	Altered qtz diorite	4-5 ft. into footwall	Channel	1.10
2-13-67	Altered qtz diorite	5-6 ft. into footwall	Channel	0.13
2-14-67	Altered qtz diorite	6-7 ft. into footwall	Channel	0.25
2-15-67	Altered qtz diorite	7-8 ft. into footwall	Channel	0.63
2-16-67	Altered qtz diorite	8-9 ft. into footwall	Channel	<0.13
2-17-67	Altered qtz diorite	9-10 ft. into footwall	Channel	<0.13
2-18-67	Altered qtz diorite	10-11 ft. into footwall	Channel	0.38
2-19-67	Altered qtz diorite	11-12 ft. into footwall	Channel	<0.13
2-20-67	Altered qtz diorite	12-13 ft. into footwall	Channel	0.13
2-22-67	Altered qtz mica schist	6 ft. into hanging wall	Grab	<0.13
2-23-67	Altered qtz mica schist	12 ft. into hanging wall	Grab	<0.13
2-24-67	Altered qtz mica schist	18 ft. into hanging wall	Grab	<0.13
2-25-67	Altered qtz mica schist/qtz vein	24 ft. into hanging wall	Grab	0.00
2-26-67	Altered qtz mica schist	30 ft. into hanging wall	Grab	<0.13
2-27-67	Altered qtz mica schist	36 ft. into hanging wall	Grab	<0.13
2-28-67	Unaltered qtz mica schist	42 ft. into hanging wall	Grab	0.13

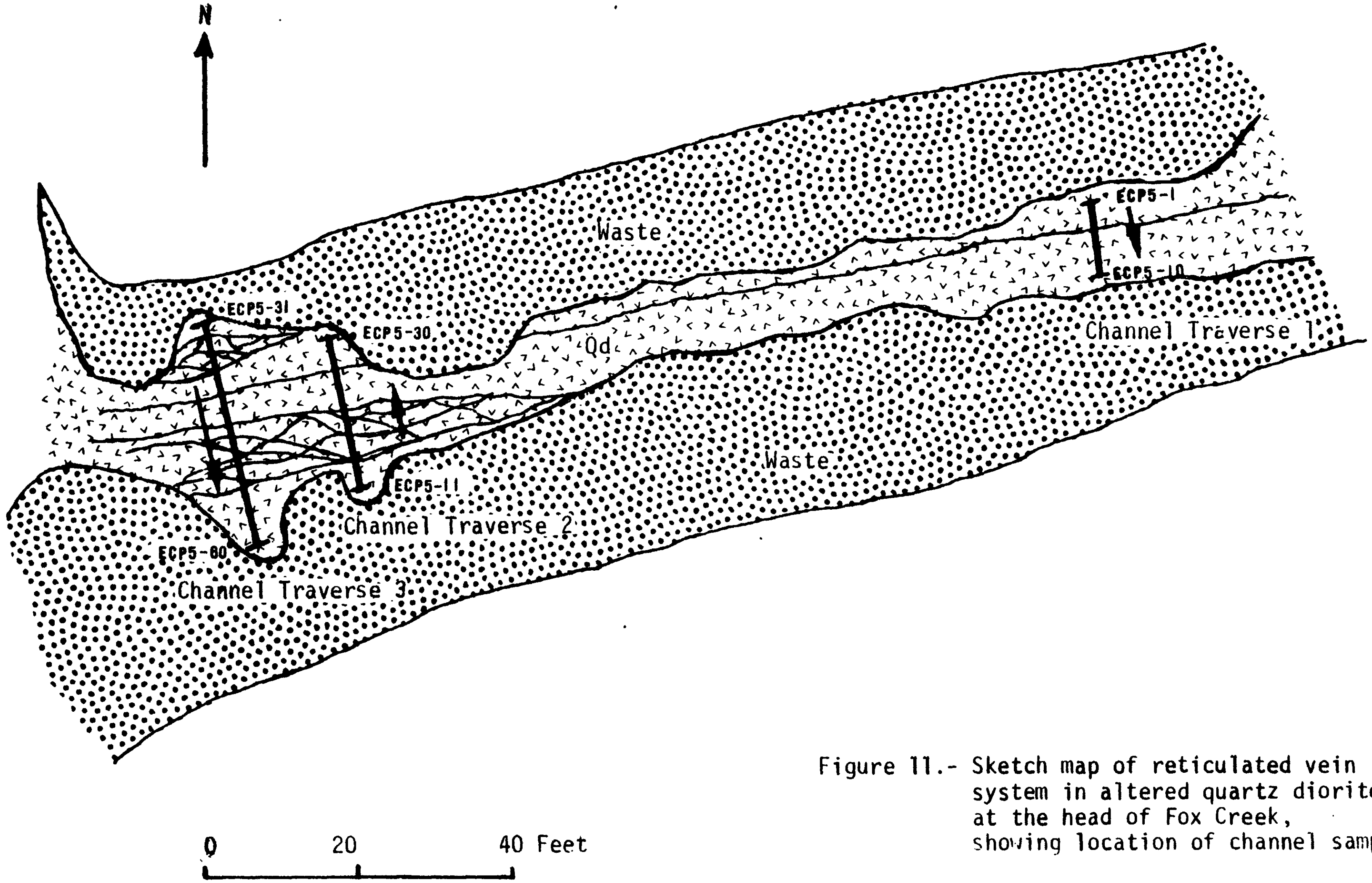


Figure 11.- Sketch map of reticulated vein system in altered quartz diorite, at the head of Fox Creek, showing location of channel samples

Table 11. Gold content of a reticulated vein system in altered quartz diorite, Fox Creek area.

	Sample No.	Description	Location	Type	Au in ppm, aqua-regia method (1)	Au in ppm, aqua-regia method *(2)
Channel 1	ECP 5-1-68	Weathered, altered qtz diorite	0-1 ft.	Channel	<0.03	
	5-2-68	Weathered, altered qtz diorite	1-2 ft.	Channel	0.05	
	5-3-68	Iron stained qtz diorite/qtz veins	2-3 ft.	Channel	<0.03	
	5-4-68	Iron stained, altered qtz diorite	3-4 ft.	Channel	0.06	
	5-5-68	Oxidized vein material	4-5 ft.	Channel	0.34	
	5-6-68	Oxidized vein and altered qtz diorite	5-6 ft.	Channel	1.54	
	5-7-68	Weakly iron stained qtz diorite	6-7 ft.	Channel	0.02	
	5-8-68	Slightly iron stained qtz diorite	7-8 ft.	Channel	<0.02	
	5-9-68	Unaltered quartz diorite	8-9 ft.	Channel	<0.02	
	5-10-68	Unaltered quartz diorite	9-10 ft.	Channel	<0.02	
Channel 2	5-11-68	Unaltered quartz diorite	0-1 ft.	Channel	<0.02	
	5-12-68	Weakly iron stained qtz diorite/veins	1-2 ft.	Channel	<0.02	
	5-13-68	Iron stained, altered qtz diorite	2-3 ft.	Channel	<0.02	
	5-14-68	Altered qtz diorite/quartz veins	3-4 ft.	Channel	6.00	4.00
	5-15-68	Altered qtz diorite/quartz veins	4-5 ft.	Channel	0.24	
	5-16-68	Altered qtz diorite/quartz veins	5-6 ft.	Channel	20.00	
	5-17-68	Altered qtz diorite/quartz veins	6-7 ft.	Channel	27.00	
	5-18-68	Altered qtz diorite/quartz veins	7-8 ft.	Channel	>>27.00	
	5-19-68	Altered qtz diorite/quartz veins	8-9 ft.	Channel	19.60	11.00
	5-20-68	Altered qtz diorite/quartz veins	9-10 ft.	Channel	2.65	6.40
	5-21-68	Weakly altered quartz diorite/veins	10-11 ft.	Channel	7.30	19.00
	5-22-68	Weakly altered quartz diorite/veins	11-12 ft.	Channel	5.75	10.20
	5-23-68	Iron stained quartz diorite	12-13 ft.	Channel	0.19	
	5-24-68	Moderately iron stained quartz diorite	13-14 ft.	Channel	0.05	
	5-25-68	Weakly iron stained quartz diorite	14-15 ft.	Channel	0.05	
	5-26-68	Weakly iron stained quartz diorite	15-16 ft.	Channel	0.09	
	5-27-68	Weakly iron stained quartz diorite	16-17 ft.	Channel	0.03	
	5-28-68	Strong iron stained quartz diorite/vein	17-18 ft.	Channel	0.10	
	5-29-68	Weakly iron stained quartz diorite	18-19 ft.	Channel	<0.02	
	5-30-68	Weakly iron stained quartz diorite	19-20 ft.	Channel	<0.02	

Table 11. (Continued)

Sample No.	Description	Location	Type	Au in ppm aqua-regia method (1)	*(2)
ECP 5-31-68	Slightly iron stained qtz diorite	0-1 ft.	Channel	0.44	
5-32-68	Iron stained, altered qtz diorite	1-2 ft.	Channel	0.46	
5-33-68	Altered quartz diorite/qtz veins	2-3 ft.	Channel	3.40	2.50
5-34-68	Altered quartz diorite/qtz veins	3-4 ft.	Channel	33.00	52.00
5-35-68	Altered quartz diorite/qtz veins	4-5 ft.	Channel	23.00	20.00
5-36-67	Altered quartz diorite/qtz veins	5-6 ft.	Channel	0.58	
5-37-68	Altered quartz diorite/qtz veins	6-7 ft.	Channel	15.80	15.00
5-38-68	Iron stained quartz diorite	7-8 ft.	Channel	0.24	
5-39-68	Iron stained quartz diorite	8-9 ft.	Channel	0.18	
5-40-68	Iron stained quartz diorite	9-10 ft.	Channel	0.08	
5-41-68	Unaltered quartz diorite	10-11 ft.	Channel	<0.02	
5-42-68	Unaltered quartz diorite	11-12 ft.	Channel	<0.02	
Channel 3 5-43-68	Unaltered quartz diorite	12-13 ft.	Channel	<0.02	
5-44-68	Weakly iron stained quartz diorite	13-14 ft.	Channel	<0.02	
5-45-68	Weakly iron stained quartz diorite	14-15 ft.	Channel	<0.02	
5-46-68	Weakly iron stained quartz diorite	15-16 ft.	Channel	0.34	
5-47-68	Altered quartz diorite/qtz veins	16-17 ft.	Channel	11.50	10.00
5-48-68	Altered quartz diorite/qtz veins	17-18 ft.	Channel	20.00	20.00
5-49-68	Altered quartz diorite/qtz veins	18-19 ft.	Channel	40.00	40.00
5-50-68	Altered quartz diorite/qtz veins	19-20 ft.	Channel	17.50	18.80
5-51-68	Iron stained quartz diorite	20-21 ft.	Channel	0.34	
5-52-68	Iron stained quartz diorite	21-22 ft.	Channel	0.03	
5-53-68	Iron stained quartz diorite	22-23 ft.	Channel	0.04	
5-54-68	Iron stained quartz diorite	23-24 ft.	Channel	0.10	
5-55-68	Sheared quartz diorite	24-25 ft.	Channel	0.13	
5-56-68	Altered quartz diorite/qtz veins	25-26 ft.	Channel	1.00	
5-57-68	Altered quartz diorite/qtz veins	26-27 ft.	Channel	1.78	
5-58-68	Iron stained quartz diorite/qtz vein	27-28 ft.	Channel	0.12	
5-59-68	Iron stained quartz diorite	28-29 ft.	Channel	0.08	
5-60-68	Iron stained quartz diorite/qtz vein	29-30 ft.	Channel	0.82	

* repeat analyses

Table 12. Gold content of altered quartz diorite and quartz monzonite, Fox Creek Lode.

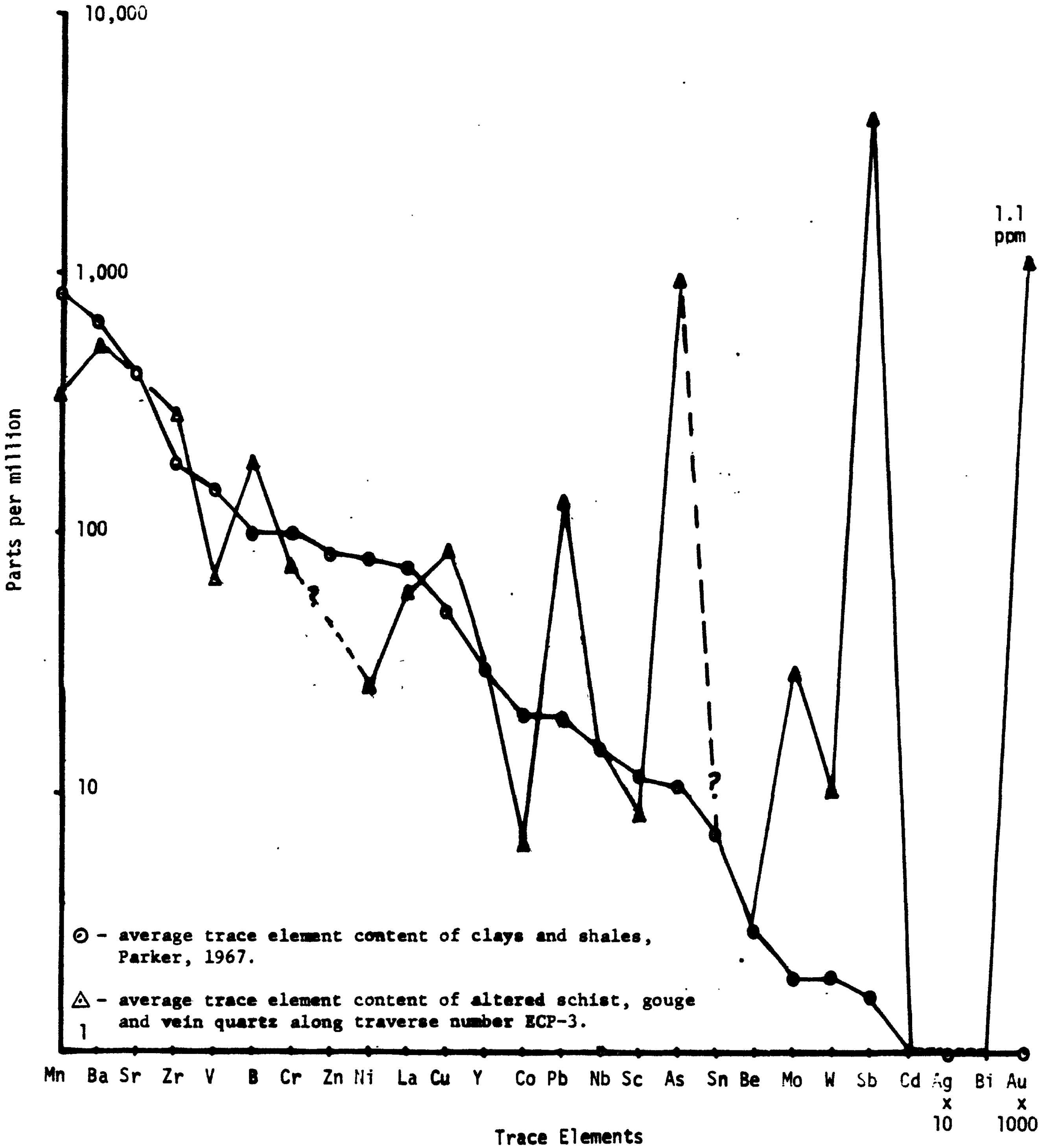
Sample No.	Material	Sample width	Type	Au in ppm aqua-regia method
		Pit No. ECP6		
ECP 6-1-68	Altered quartz diorite	0 - 1'	Channel	n.d.
6-2a-68	Altered quartz diorite	1' - 2'	Channel	n.d.
6-2b-68	Vein quartz (in qd)		Grab	
6-3-68	Altered quartz diorite	2' - 3'	Channel	n.d.
6-4-68	Altered quartz diorite	3' - 4'	Channel	n.d.
6-5-68	Altered quartz diorite	4' - 5'	Channel	n.d.
6-6-68	Altered quartz diorite	5' - 6'	Channel	n.d.
6-7-68	Altered quartz diorite	6' - 7'	Channel	n.d.
	Quartz monzonite - quartz diorite contact			
6-8-68	Altered quartz monzonite	7' - 8'	Channel	0.19
6-9-68	Altered quartz monzonite w/diorite incl.	8' - 9'	Channel	0.06
6-10-68	Altered quartz monzonite	9' - 10'	Channel	0.02
6-11-68	Altered quartz monzonite	10' - 11'	Channel	n.d.
6-12-68	Altered quartz monzonite	11' - 11'6"	Channel	0.06
6-13-68	Silicified schist	11'6" - 13'	Channel	0.02
6-14-68	Brown, sheared schist	13' - 14'	Channel	0.17
6-15-68	Sheared quartz monzonite w/quartz veinlets	14' - 15'	Channel	0.72
6-16-68	Quartz monzonite with quartz veins and veinlets	15' - 16'	Channel	0.06
6-17-68	Quartz monzonite with quartz veins and veinlets	16' - 17'	Channel	n.d.
6-18-68	Quartz monzonite with quartz veins and veinlets	17' - 18'	Channel	n.d.
		Trench No. ECP7		
ECP 7-1-68	Vein quartz, in altered quartz diorite		Grab	0.48
7-2-68	Altered quartz diorite (arsenic and/or antimony stain)		Grab	2.90

TRACE ELEMENTS ASSOCIATED WITH GOLD MINERALIZATION

In Figure 12, the average concentration of various trace elements in clays and shales is arranged in order of decreasing concentration (Parker, 1967). It is assumed that these materials most closely approach the altered schist, gouge, and vein quartz encountered in this work.

As shown in Figure 12, anomalously high concentrations of antimony, tungsten, molybdenum, arsenic, and lead accompany the gold mineralization. Anomalously low concentrations of vanadium, nickel and cobalt may be a consequence of this mineralization

Figure 12. - Comparative trace element content of gold bearing quartz and altered wall rocks, versus clays and shales.



SUMMARY

Studies of gold content of wall rock associated with mineralized veins and hydrothermal alteration zones in the Pedro Dome-Cleary Summit area have revealed the presence of anomalous gold concentrations and gradients over considerable widths. In general, gold gradients adjacent to most of the gold-bearing veins are too steep to increase the mineable width. However, gold concentrations in the hydrothermally altered quartz diorite at Mile 17.5 on the Steese Highway and at the head of Fox Creek, the altered quartz mica schist and quartz monzonite of the Fox Creek area, and the hydrothermally altered quartz mica schists of the Cleary Summit area deserve further investigation as possible low grade gold deposits.

REFERENCES

Brown, J. M., 1962, Bedrock geology and ore deposits of the Pedro Dome Area, Fairbanks Mining District, Alaska: Unpublished M.S. Thesis, University of Alaska.

Forbes, R. B. and J. M. Brown, 1961, Preliminary geologic map of the Fairbanks Mining District, Alaska: State of Alaska Division of Mines and Minerals Rept. 1-194.

Hill, J. M., 1933, Lode deposits of the Fairbanks District: U. S. Geological Survey Bull. 849.

Huffman, Claude, Jr., J. D. Mensik and L. B. Riley, 1967, Determination of gold in geologic materials by solvent extraction and atomic absorption spectrometry: U. S. Geological Survey Circ. 544.

Mertie, J. B., 1937, The Yukon Tanana Region, Alaska: U. S. Geological Survey Bull. 872.

Parker, Raymond L., 1967, Composition of the Earth's Crust: U. S. Geological Survey Prof. Paper 440-D.

Prindle, L. M., F. J. Katz and P. S. Smith, 1913, A geologic reconnaissance of the Fairbanks Quadrangle, Alaska: U. S. Geological Survey Bull. 525.

Sandvik, Peter O., 1967, Mineralogy and distribution of metallic minerals in the Fairbanks District, Alaska: Unpublished paper presented at the Alaska Centennial Minerals Conference, AIME.

Tindall, Frank M., 1965, Silver and gold assay by atomic absorption spectrophotometry: Atomic Absorption Newsletter, 4 (9).

_______________, 1966, Notes on silver and gold assay by atomic absorption: Atomic Newsletter, 5 (6).

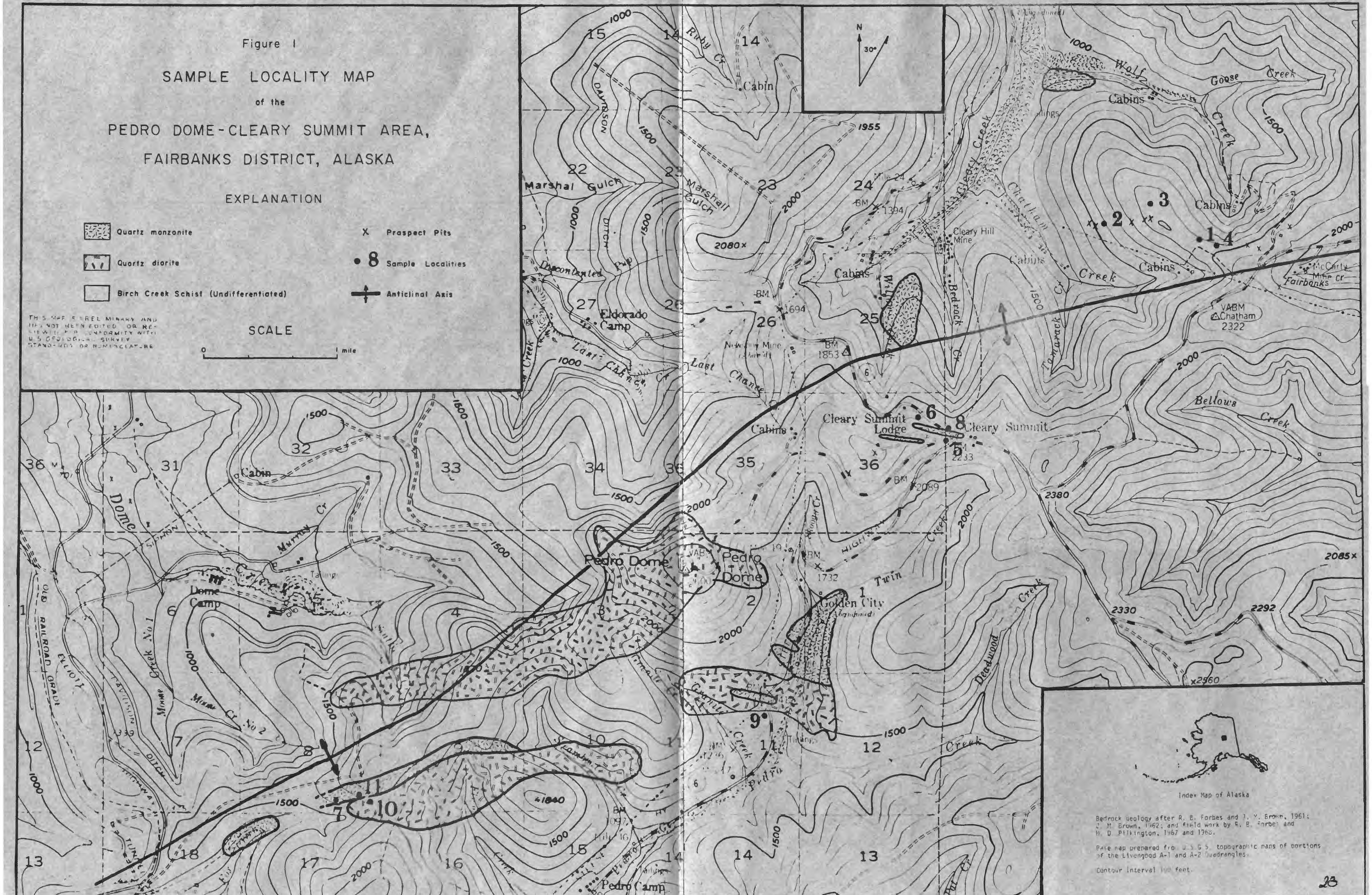


Figure I
SAMPLE LOCALITY MAP
of the
PEDRO DOME-CLEARY SUMMIT AREA,
FAIRBANKS DISTRICT, ALASKA
EXPLANATION
Quartz monzonite
Quartz diorite
Birch Creek Schist (Undifferentiated)
x Prospect Pits
• 8 Sample Localities
Anticlinal Axis
SCALE
0
1 mile
N
30°
Index Map of Alaska
Bedrock geology after R. B. Forbes and
Base map prepared from
of the Livengood A-1 and A-2
Contour interval
Pedro Dome
Cleary Summit
Cleary Summit Lodge
Golden City
Eldorado Camp
Dome Camp
Pedro Camp
Cleary Hill Mine
VABM Chatham 2322
Marshal Gulch
Marshall Gulch
Cleary Creek
Chatham Creek
Wolf Creek
Goose Creek
Bellows Creek
Deadwood Creek
Twin Creek
Last Chance Cr
Bedrock Cr
Tamarack Cr
Ruby Cr
Murray Cr
Dome Creek
Minnie Creek No 1
Minnie Cr No 2
Cabins
Cabin
DAVIDSON DITCH
OLD RAILROAD GRADE
ELLIOTT
Fairbanks
1
2
3
4
5
6
7
8
9
10
11