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RESULTS OF 1984 BUREAU OF MINES SITE SPECIFIC FIELD STUDIES
WITHIN THE WILLOW CREEK MINING DISTRICT, ALASKA

by Joseph M. Kurtak

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by Joseph M. Kurtak^{1/}

ABSTRACT

The Bureau of Mines conducted mineral investigations of specific sites in the Hatcher Pass area, of the Willow Creek Mining District during 1984. The Hatcher Pass area has produced over 400,000 oz of gold, mainly from lode deposits and some minor placer production. Nine out of approximately 40 properties in the area were visited, including several active operations. Random samples were collected for analysis and mineral identification. Discussions with local miners identified several problem areas concerning metallurgy, recovery, and mining feasibility where Bureau work would be beneficial. Examinations of several mines, prospects, and mineral occurrences indicate that a need exists for the Bureau of Mines to conduct detailed investigations to determine mineral development potential in the area.

INTRODUCTION

During the summer of 1984, the Bureau of Mines (Bureau) undertook a preliminary investigation of specific sites in the Hatcher Pass area in the Willow Creek Mining District, Alaska (fig. 1). The area is located in the Talkeetna Mountains, 21 miles by road north of Palmer and 50 air miles northeast of Anchorage.

This report describes Bureau field work in the Hatcher Pass area of the Willow Creek Mining District and summarizes sample results obtained.

The Hatcher Pass area contains approximately 80 known mines, prospects, and mineral occurrences. Mineral resources in the area, in addition to precious metals, include sand and gravel, coal, limestone, and gypsum. The district is currently the largest producer of sand and gravel in Alaska and 10,000,000 tons of coal have been produced in the past.

PREVIOUS WORK

The U.S. Geological Survey (USGS) published the first reports on the Hatcher Pass area with the most complete being those by Capps (1)^{2/} and Ray (4). Bureau investigations in the area were done by Thorne and others (7) and Maloney (3). The most recent published work consists of summary reports on the area by Renshaw (5, 6).

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^{2/}Underlined numbers in parentheses refer to references listed at the end of this report.

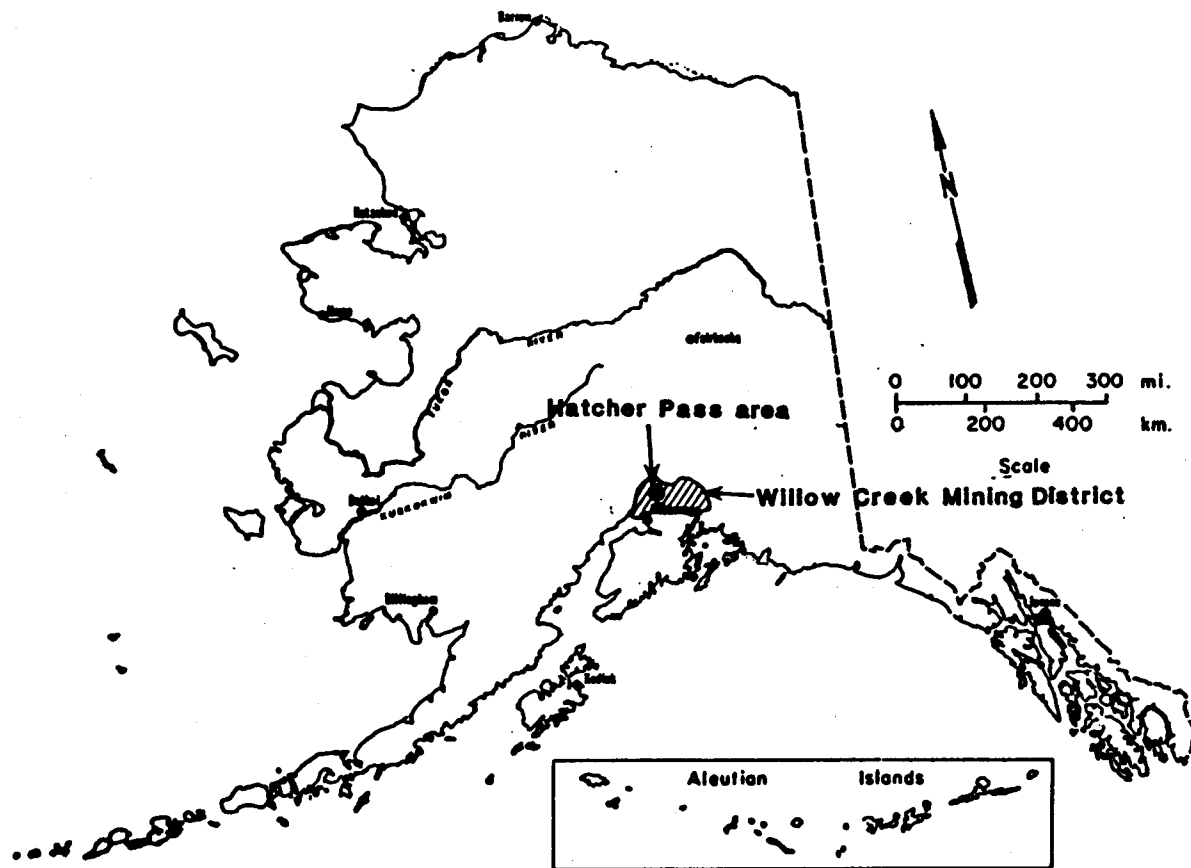


Figure 1 Location of the Willow Creek Mining District

LAND STATUS

The land in the Hatcher Pass area is under State jurisdiction. This land, excluding a state historic park in the Independence Mine area, is open to claim staking. Numerous unpatented and patented claims exist in the area.

ACKNOWLEDGMENTS

The writer wishes to acknowledge both individuals and mining companies operating in the Hatcher Pass area for allowing the Bureau to sample their surface and underground workings. These include Tony Dorff and Greg Visconty of Ensearch Exploration, Bill Mrak, Dan Renshaw, and Fritz Klamback. Enlightening discussions were also had with these individuals concerning the geology and ore deposits of the area.

MINING HISTORY

Placer gold was first discovered in the Hatcher Pass area in 1897 on Willow Creek (1) (fig. 2). Lode gold was discovered on Upper Fishhook Creek in 1906. Considerable prospecting activity followed and several properties came into production in the next few years. Lode gold production was at its peak between 1931 and 1942. In 1942, Public Law 208 effectively shut down all gold mining in Alaska due to the war effort. The Independence Mine was allowed to operate on a limited scale if it produced scheelite, an ore of tungsten critical to the war effort. After World War II production was small due to higher mining costs. The last major production was in 1950 (4).

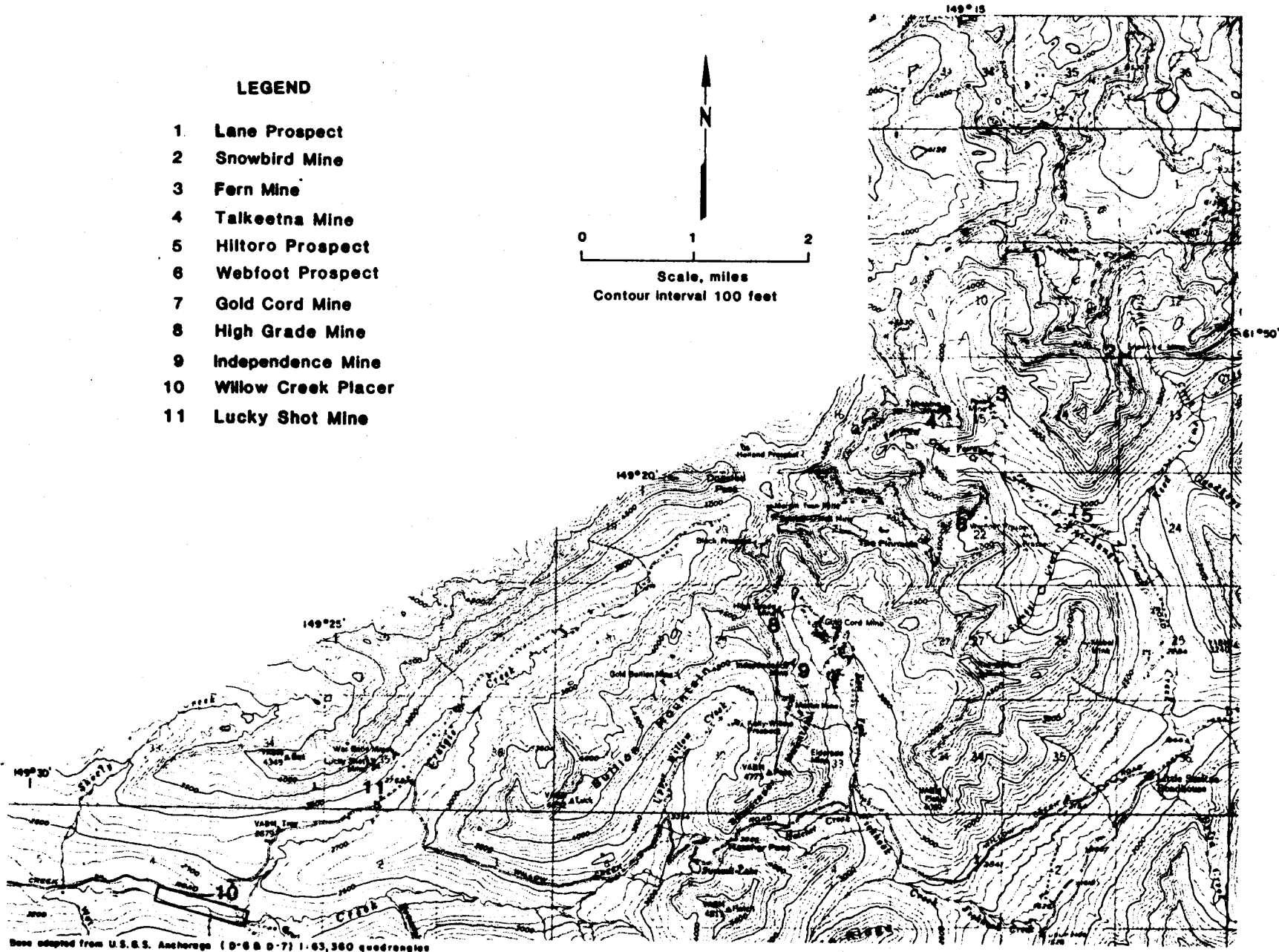
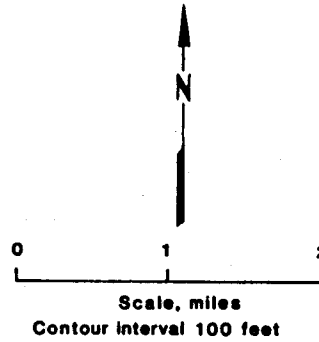
During the early 1980's, Ensearch Exploration rehabilitated the Independence Mine (fig. 2) and renewed production for a short time. The operation was shut down during the fall of 1984. During the summer of 1984, placer mining was active on Willow Creek and small groups of miners were doing development work at the Gold Cord and Fern lode mines (fig. 2).

GEOLOGY

The Willow Creek Mining District is underlain mainly by intrusive rocks composed predominantly of Tertiary quartz diorite with lesser gabbro and granite. Younger Tertiary metamorphic and sedimentary rocks flank the intrusive mass to the south. The metamorphic rocks are composed mostly of mica schist. Areas peripheral to the intrusive mass were particularly susceptible to fracture, and structural channelways developed in which gold quartz veins and associated lamprophyre, diabase, aplite, and pegmatite dikes were deposited. All veins and dikes were disrupted by major faulting that took place late in the tectonic history of the intrusive mass. Local placers are believed to have their source in the schist (4).

LEGEND

- 1 Lane Prospect
- 2 Snowbird Mine
- 3 Fern Mine
- 4 Talkeetna Mine
- 5 Hiltoro Prospect
- 6 Webfoot Prospect
- 7 Gold Cord Mine
- 8 High Grade Mine
- 9 Independence Mine
- 10 Willow Creek Placer
- 11 Lucky Shot Mine



**Figure 2: Hatcher Pass Area, Willow Creek Mining District, Alaska.
Mineral deposits investigated by the Bureau in 1984.**

BUREAU INVESTIGATIONS

Following a literature search, eight days were spent in the field during late July. Visits were made to several active operations in the area including the Willow Creek placer, Independence, Fern, and Gold Cord Mines to observe local mining techniques, collect samples and interview miners working in the area. A total of seven properties were visited and 13 samples collected. These operations are described below. Refer to figure 2 for locations.

PLACER DEPOSITS

Willow Creek

Placer gold is currently being produced from Willow Creek west of Hatcher Pass (fig. 2). Production coming from this area may total approximately 10,000 ounces (5).

The only active operation is in upper Willow Creek just below the mouth of Grubstake Gulch. The claimant is currently in the process of patenting his claims. During a visit to the claims by the Bureau, the claimant stated that he was losing a considerable amount of fine gold during his recovery operations. A sample of placer tails was collected and submitted to the Bureau Reno Research Center for analysis. Only trace amounts of gold were found in the sample and what appeared to be fine gold is phlogopite mica. Gold recovery consisted of feeding gravel into a vibrating grizzly with a front end loader, and running the sized material over a set of riffle boxes. The gold-bearing concentrate is further cleaned by running it over a concentrating table. An analysis of the concentrate with most of the gold removed is shown on Table 2 (sample No. 6366).

LODE DEPOSITS

Lode deposit production from the Hatcher Pass area is approximately 400,000 ounces (5) mainly coming from the Independence Mine. No lode operations are currently producing gold but several are undergoing development and are listed below.

Independence Mine

Ensearch Exploration, Inc. has been conducting mineral exploration work and precious metals mining in the Hatcher Pass area for the past several years. At the time of the Bureau visit, the mine geologist was attempting to determine some of the ore mineralogy at the Independence Mine on Fishhook Creek. Gold tellurides had been reported in the ore. The Bureau submitted a sample to the Reno Research Center for scanning electron microscope (SEM) analysis. The initial results indicated a black opaque mineral associated with the gold to be nagyagite, a sulpho-telluride of lead and gold (4). Figure 3 shows mineral composition and figure 4, an (SEM) photograph of the polished section.

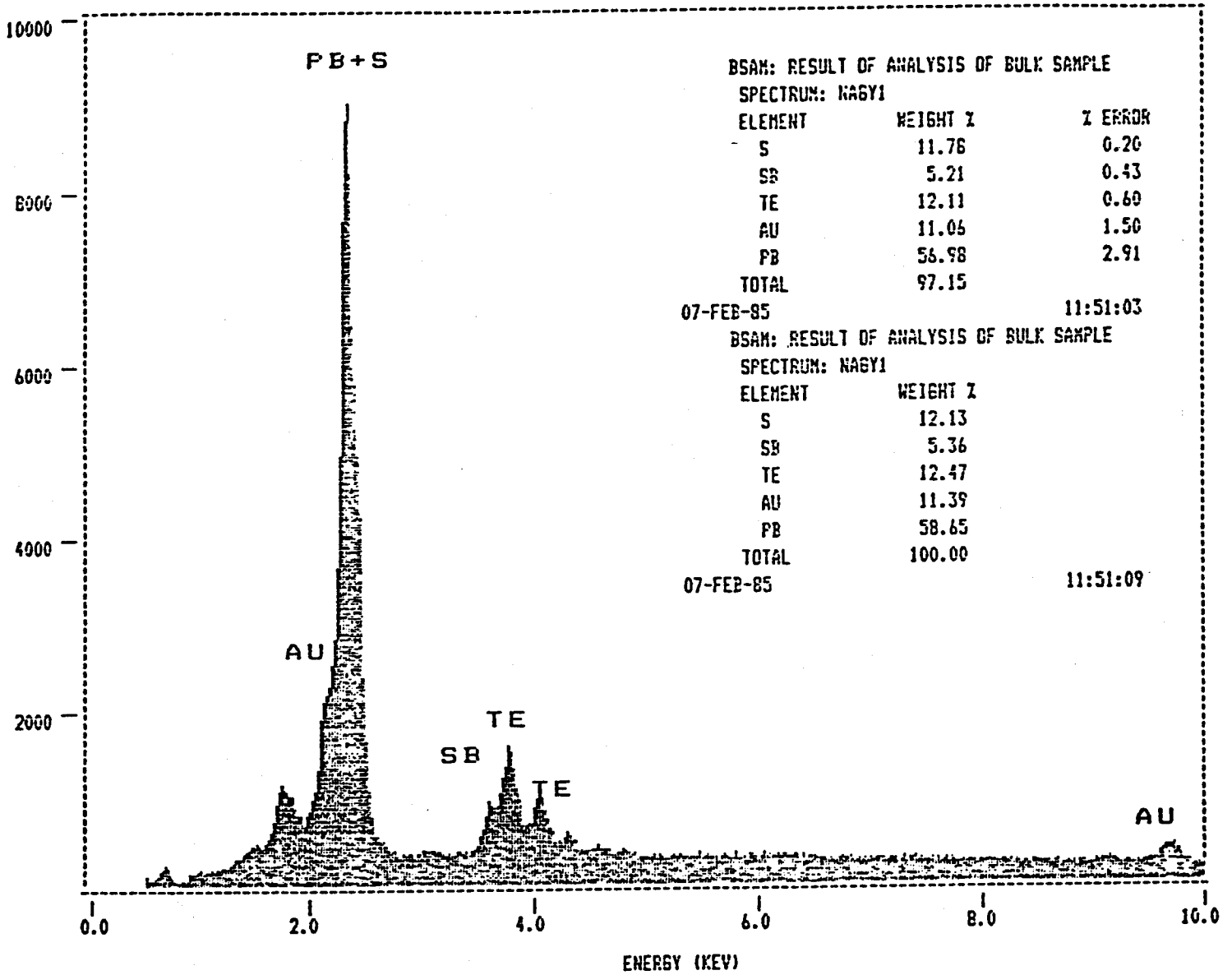
INDEPENDENCE MINE

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NAGYAGITE

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Figure 3 Composition of Independence Mine gold ore

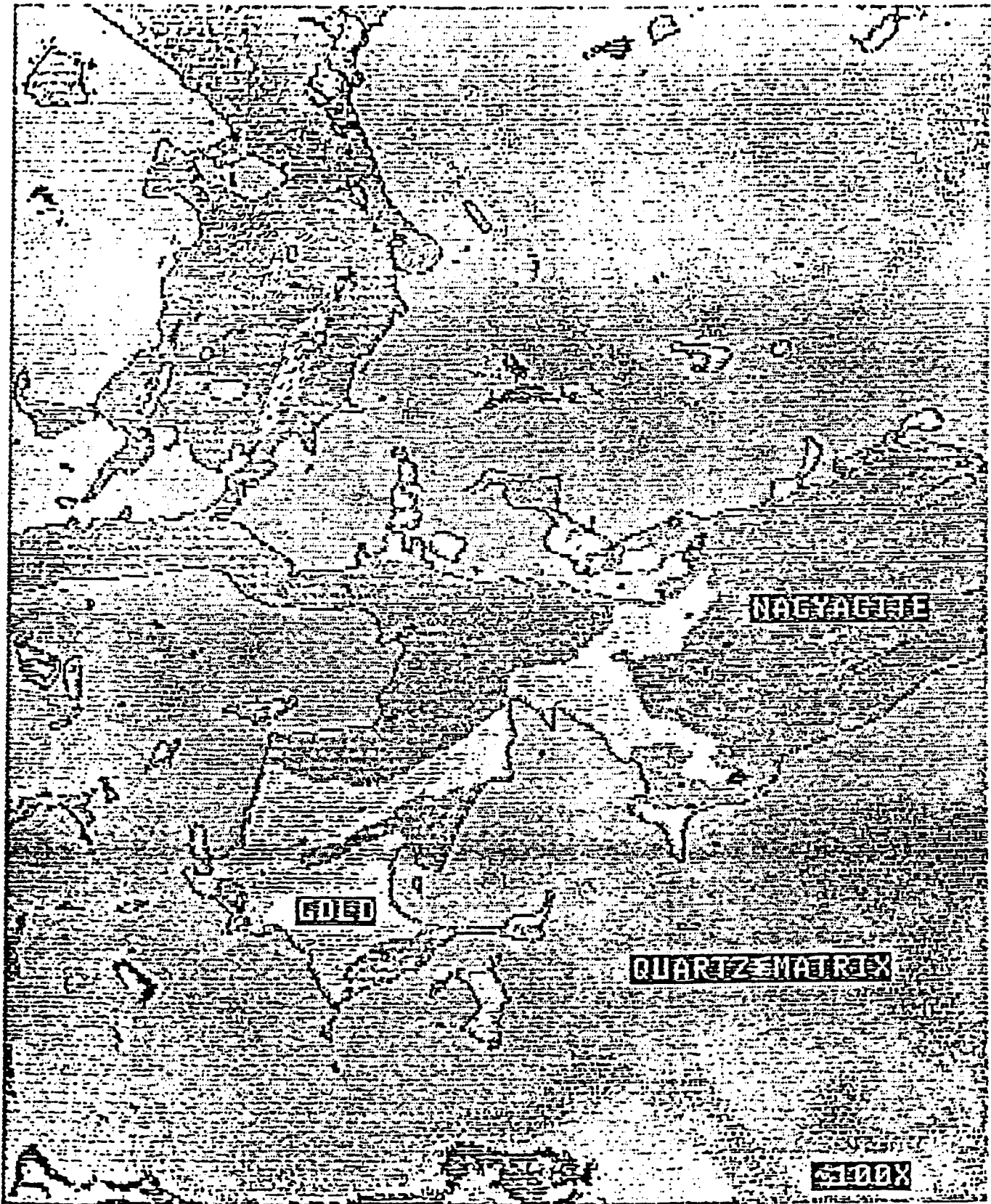


Figure 4 Scanning electron microscope image of Independence Mine gold ore.

Magnification 100X

Ensearch core drilled underground in the vicinity of the Lucky Shot Mine during the summer of 1984, but have since closed their entire operation.

Fern Mine

Underground work was in progress at the Fern Mine on Archangel Creek during the Bureau visit. Four miners were reopening a caved area to access old stopes which reportedly still contain ore (9).

The Bureau collected samples from some of the underground veins and a 100 lb bulk sample from a surface ore dump. The bulk sample was sent to the Reno Research Center to test gold recovery by heap leaching.

The +1/2 inch fraction contained 0.013 oz gold/ton and 0.02 oz silver/ton as determined by fire assay. The -1/2 inch fraction contained 0.03 oz gold/ton and .003 oz silver/ton. The +1/2 inch fraction was ground to -100 mesh and leached for 12 hours in 4 lb/ton sodium cyanide solution with pH adjusted to 10.5 with sodium hydroxide.

Solution analysis indicates that 91% of the gold was solubilized. Fire assay on the tails was 0.01 oz/ton. Cyanide consumption was between 0.5 and 1.0 lb/ton of ore treated (8). A spectrographic analysis of the sample is shown in Table 3.

Gold Cord Mine

Two miners were working in the Gold Cord Mine area. An adit was being driven to gain access to caved underground workings and core drilling was being done to test projected vein extensions. None of the work had exposed mineralized quartz veins at the time of the Bureau visit, so no samples were collected.

Other Mines and Prospects

Several of the more significant inactive mines and prospects in the area were also visited to determine accessibility to underground workings and what Bureau work would be required to evaluate them. Random samples were collected as a check on gold content of the veins. These properties are summarized in Table 1 and sample analyses are shown on Table 2.

RADIOACTIVITY

Radioactive minerals have been reported in some of the pegmatites in the Hatcher Pass area (4). A random grab sample of pegmatite was collected by the Bureau from Ensearch Exploration, Inc. drill core. The sample contained only trace amounts of uranium and thorium (sample No. 6396), but is not representative of pegmatites in the entire area.

CONCLUSIONS

Preliminary mine and prospect examinations by the Bureau, described in the body of this report, indicate potential for future lode and placer gold production in the Hatcher Pass area. Further investigations by the Bureau are warranted to completely delineate the mineral production potential of the entire area. The resulting data would be of immediate use to large companies, small groups of miners, and land managers. Proximity to nearby roads and communities provides infrastructure making mine development economically more feasible than in many of the more remote districts in Alaska.

Recommended Bureau work consists of: 1) completing a thorough search of all available literature and records concerning the area; 2) locating, mapping, and sampling all known mines, prospects, and occurrences; 3) performing reconnaissance work to locate previously overlooked resources by following up known geochemical anomalies identified by the State of Alaska and USGS; 4) estimating reserves and mineral development potential; 5) evaluating metallurgy and extraction methods to determine the district's resource significance relative to national and worldwide use and demand; and 6) developing preliminary mine feasibility studies for deposit types identified in the Willow Creek District.

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TABLE 1. - Property Summaries - Hatcher Pass Area

Name Commodity Location	Summary of mineralization	Workings	Sample data ^{2/} and Recommendations
Webfoot Gold Archangel Creek <u>1/</u>	N-S trending quartz vein up to 5-ft-wide dipping 30°W. Sericitic alteration on vein margins. Developed along strike for approximately 150 ft.	Adit at 3,800 ft follows vein for approximately 150 ft along strike to partially caved stoped area. Workings extend approximately 50 ft into bad ground of stope. A series of cuts follow the vein along the surface and the stope appears to break through to the surface. An air compressor is located near the adit portal. Several collapsed buildings lie below the mine and a tramway once ran to the valley below.	A 2.5-ft-wide chip sample across a quartz vein on the edge of a stope contained 0.44 ppm ^{3/} gold (6368). A sample from a surface exposure contained 0.21 ppm gold (6369). The stope was not sampled. Underground and surface workings need to be mapped and sampled.

See footnotes at end of table.

TABLE 1. - Property Summaries - Hatcher Pass Area - Continued

Name Commodity Location	Summary of mineralization	Workings	Sample data and Recommendations
Hilltoro Gold Archangel Creek	Vuggy quartz float near adit contained arsenopyrite, limonite, and trace pyrite. No vein was exposed at the surface.	Adit trending N20°E. Appears accessible.	Grab sample of quartz float (6394) contained .06 ppm gold. Underground workings need to be mapped and sampled.
Snowbird Gold Reed Creek	Caved underground workings prevented access to veins. Quartz float lies on the dump.	The main adit at 4,300 ft extends approximately 600 ft N45°W to a caved area where it crosses a fault. Several collapsed buildings and a mill lie at 3,760 ft below the mine workings. The equipment has been removed from the mill.	No samples were collected due to inaccessibility to the veins. Main underground workings have been mapped but cannot be sampled due to cave-in. Minor surface workings need mapping and sampling.

See footnotes at end of table.

TABLE 1. - Property Summaries - Hatcher Pass Area - Continued

Name Commodity Location	Summary of mineralization	Workings	Sample data and Recommendations
Lane (Glacier) Gold Archangel Creek	N25°W trending quartz vein dipping 35°W is exposed underground for 25 ft. Vein averaged 0.8-ft-wide underground and is intermittently exposed along the base of a cliff for approximately 150 ft to the east.	A 25 ft adit at 5,160 ft follows the vein. Some minor stoping has been done. A lightweight cable tram at one time led to buildings below the adit. 0.5 miles southwest of the workings.	Visible gold occurs in quartz float on the adit dump. A grab of dump float (6376) contained 9.4 ppm gold. A grab of vein quartz (6375) contained 2.5 ppm gold. The high grade ore previously reported here appears to have been mined out (2). Underground and surface workings need to be mapped and sampled.
Talkeetna Gold Fairangel Creek	A N75°E trending poorly exposed quartz vein has been mined out for approximately 75 ft along strike. Altered vein margins are exposed along pit walls.	A sloughed-in 75-ft-long open cut follows vein. Nearby an adit is open for 50 ft to a caved area. A tramway once led from the adit portal to a camp and mill below.	A surface grab sample of the vein walls (6367) contained 0.57 ppm gold. The vein was not sampled underground. Underground and surface workings need to be mapped and sampled.

See footnotes at end of table.

TABLE 1. - Property Summaries - Hatcher Pass Area

Name Commodity Location	Summary of mineralization	Workings	Sample data and Recommendations
High Grade Gold East Fork Fishhook Creek	A N10°W shear zone is developed for approximately 550 ft along strike of a series of shear zones containing a few intermittent quartz veins.	At the 4,020 ft level nearly 1,000 ft of workings have been driven on ore level (2). Some stoping was done along one of the drifts. Several small buildings, enclosing a shop and compressor are located on the surface.	No samples were taken from the inaccessible area. Underground workings have been mapped but need sampling.
Gold Cord Gold East Fork Fishhook Creek	Altered zone in quartz diorite trending N65°W and dipping 40°N. Sericite, kaolinite, disseminated pyrite and minor quartz stringers. Gouge on margins.	Only the workings at the 4,900 ft level are accessible. A tunnel follows the vein through a ridge and is open on both ends. During the summer two miners were drilling some short core holes and attempting to reopen some of the caved underground workings.	At the 4,900 ft adit a 1.8-ft-wide chip sample (6374) across a quartz vein in a stope contained 13 ppm gold. The accessible 4,900 ft level workings need to be mapped and sampled.

1/See figure 2 for location.

2/Complete analytical results shown on Table 2.

3/ppm (parts per million) 34.28 ppm equals 1 oz/ton.

TABLE 2. - ANALYTICAL RESULTS^{1/} - Hatcher Pass Area

Sample	Material type	Sample type	Width (feet)	Elements, ppm (unless otherwise indicated)													Descriptions
				Au	Ag	Cu	Pb	Zn	As	Th	Mo	U	Sb	Te	W	Zr	
6366	Alluvium	Grab	NA	0.50	0.4	105	30	55	50	ND	<2	ND	<2	0.2	15	165	Placer concentrate. Willow Creek.
6367	Altered quartz diorite	Grab	NA	0.57	0.6	135	60	65	40	ND	<2	ND	28	0.33	12	ND	Talkeetna Mine
6368	Quartz diorite	Cont Chip	2.5	0.44	0.40	30	60	5	35	ND	4	ND	16	3.0	3.0	ND	Webfoot Prospect.
6369	Quartz	Cont Chip	4.5	0.21	1.0	50	60	5	35	ND	7	ND	12	2.7	24	ND	Webfoot Prospect
6370			1.5	1.5	0.6	55	20	10	15	ND	2	ND	8	0.67	9	ND	
6371	Quartz	Cont Chip	NA	1.1	0.2	25	20	15	35	ND	2	ND	3	0.33	10	ND	Fern Mine.
6372	do.	Grab	NA	1.5	<0.2	20	10	5	15	ND	32	ND	<2	0.33	28000	ND	do.
6373	do.	Cont Chip	0.8	<0.02	<0.2	105	45	35	10	ND	2	ND	<2	0.01	60	ND	do.
6374	Altered diorite	do.	1.8	13	0.8	155	35	45	160	ND	2	ND	35	1.0	55	ND	Gold Cord Mine
6375	Quartz	Grab	0.8	2.5	0.2	75	50	5	40	ND	2	ND	22	0.33	6	ND	Lane Prospect.
6376	Quartz	Grab	NA	9.4	0.4	50	25	5	30	ND	3	ND	16	1.3	3	ND	do.

See footnotes at end of table.

TABLE 2. - ANALYTICAL RESULTS - Hatcher Pass Area

Sample	Material type	Sample type	Width (feet)	Elements, ppm (unless otherwise indicated)													Descriptions
				Au	Ag	Cu	Pb	Zn	As	Th	Mo	U	Sb	Te	W	Zr	
6394	Quartz	Grab	NA	.06	0.4	20	35	20	10	ND	2	ND	30	0.33	20	ND	Hilltoro Mine.
6396	Pegmatite	Grab	NA	<0.2	0.2	50	15	35	<10	<20	2	5	2	<20	10	ND	Independence Mine.

1/ All analyses by atomic absorption methods. Analysis by Rainbow Resource Labs, Anchorage, Alaska

NA - Not available

ND - Not determined

TABLE 3. - Spectrographic Analysis of Fern Mine Bulk Sample^{1/}

Element	+1/2 inch fraction (%)	-1/2 inch fraction (%)
Ag		
Al	major	major
As	---	---
Au	---	---
B	---	---
Ba	---	---
Be	---	---
Bi	---	---
Ca	^{2/} G 4.0	2.0
Cd	---	---
Co	^{3/} .006	---
Cr	^{3/} L .002	L .002
Cu	.008	.008
Fe	2.0	2.0
Ga	.004	.004
Hf	---	---
In	---	---
Mg	1.0	1.0
Mn	0.2	0.2
Mo	---	---
Na	2.0	2.0
Nb	---	---
Ni	.004	.004
P	---	---
Pb	---	---
Pt	---	---
Re	---	---
Sb	---	---
Si	major	major
Sn	---	---
Sr	---	---
Ta	---	---
Te	---	---
Ti	0.2	0.2
Tl	---	---
V	0.01	0.01
W	---	---
Zn	0.09	0.09
Zr	---	---

^{1/}Analysis by U.S. Bureau of Mines Reno Research Center

^{2/}Greater than

^{3/}Less than