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Mineral Investigations in the Koyukuk Mining District, Northern Alaska

Volume I - Introductory text and summaries of mines, prospects, and mineral occurrences in the Bettles, Chandalar, Chandler Lake, and Hughes quadrangles

Joseph M. Kurtak, Robert F. Klieforth, John M. Clark, and Elizabeth A. Maclean

Mission Statement

The Bureau of Land Management sustains the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

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Cover

BLM geologist Elizabeth Maclean examines Devonian schistose rocks near Michigan Creek, in the Endicott Mountains.

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ABBREVIATIONS

%	percent
Btu/lb	British thermal unit per pound
cy	cubic yard(s)
°F	degrees Fahrenheit
lb(s)	pound(s)
lb(s)/cy	pound(s) per cubic yard
oz	ounce(s)
oz/cy	ounce(s) per cubic yard
oz/ton	ounce(s) per ton
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
tons	short tons

MINERAL INVESTIGATIONS OF THE KOYUKUK MINING DISTRICT, NORTHERN ALASKA

ABSTRACT

From 1997 to 2002, the Bureau of Land Management (BLM) conducted a mineral resource investigation of the Koyukuk Mining District in northern Alaska. The 11.6-million-acre study area comprises the upper portion of the Koyukuk River drainage basin. The objective of the investigation was to identify the nature and extent of mineral resources in the district. Field work consisted of mapping and sampling mines, prospects, and mineral occurrences and reconnaissance sampling in areas containing no documented sites. A total of 2,098 rock, soil, stream sediment, and concentrate samples were collected during the study. This investigation is part of the Bureau's ongoing statewide mining district assessment program.

The BLM identified a total of 269 mines, prospects, and mineral occurrences within or directly adjacent to the district. This includes 27 previously undocumented occurrences. Deposit types include gold and tin placers; antimony- and gold-bearing quartz veins; stratabound, carbonate-hosted, and volcanogenic massive sulfides; copper porphyries; copper, tungsten, and tin skarns; tin greisens; podiform chromite; and coal. Documented production totals 333,893 oz of placer gold. Resource estimates include a measured resource of 33,600 oz of placer gold in the Nolan-Hammond River area, an indicated resource of 2.3 million lbs of placer tin on the Kanuti Kilolitna River, an indicated resource of 1.1 million tons averaging 5.0% copper in skarn deposits near the Bettles River, and an indicated resource of 31,000 tons averaging 39.4 ppm gold in quartz veins on Sukakpak Mountain.

Other significant results from this investigation include the delineation of anomalous gold values within volcanic rocks on the upper Indian River; anomalous placer gold in bench gravels on the upper Hammond River; gold-bearing quartz veinlets on nearby Vermont and Smith Creeks; anomalous gold-bearing gravels on Black and Davis Creeks and Ironsides Bench; potential for significant amounts of placer gold in buried channels near Linda Creek; and gold anomalies associated with skarn and massive sulfide occurrences in the Chandalar copper belt north of Bettles River.

INTRODUCTION

In 1997 the Bureau of Land Management (BLM) initiated a 5-year assessment of the mineral resources of the Koyukuk Mining District. The ultimate objectives of this evaluation were (1) to identify the nature, extent, and development potential of mineral resources; (2) to perform mining feasibility studies, using hypothetical mine models on mineral deposits that have economic potential; and (3) to perform geophysical investigations in those areas possibly containing concealed mineral deposits. The geophysical investigations were done in cooperation with the Alaska Division of Geophysical and Geological Surveys (ADGGS). This study is part of the BLM's ongoing mining district evaluation program and is authorized under Section 1010 of the Alaska National Interest Lands Conservation Act (ANILCA).

The purpose of this two volume report is to present summaries of the 269 mines[1], prospects[2], and mineral occurrences[3] within the Koyukuk Mining District. Volume I contains introductory text and descriptions of sites in the Bettles, Chandalar, Chandler Lake and Hughes quadrangles. Volume II contains descriptions of the Melozitna, Survey Pass, Tanana, and Wiseman quadrangles. Mineral deposit types include gold and tin placers, antimony- and gold-bearing quartz veins, copper-zinc massive sulfides, copper porphyries, tungsten-copper skarns, tin greisens, podiform chromite, and coal. Samples were collected at all the documented[4] sites within the district and at over 100 additional reconnaissance sites. Industrial minerals usage in the district is confined to construction materials sites along the Dalton Highway. These sites have been evaluated by the State of Alaska (Cameron and others, 2002) and are not covered in this report.

Analytical results for all the samples collected during the study have been published in BLM Open File Report 84 (Klieforth and others, 2001). The results of the mining feasibility study have been published as BLM Technical Report 38 (Coldwell, 2002). The results of the geophysical investigations will be published as a separate BLM Technical Report.

ACKNOWLEDGMENTS

The authors are indebted to the many individuals whose expertise and enthusiasm helped carry the Koyukuk Mining District study to completion. Field assistants Darrel VandeWeg and Emily Davenport along with volunteers Mark Johnson, Fred Harnisch, Trisha Herminghaus, Karsten Eden, and Dan Kurtak provided valuable assistance while dealing with bugs, bears, and bad weather along the way. Resource Apprenticeship Program intern and high school student Johnnie Lyman was a welcome addition to the field crew and kept us focused by asking lots of questions. Cartographic technician Jerry Kouzes translated our field maps into the colorful finished products in the pages that follow.

Helicopter pilots Marty Stauber, Ed Bartoli, Len Warren, Herbert Marcher, and Tim Gaffney did their utmost to help us accomplish our mission without compromising safety. Mechanics Lowell Berentsen, Roger Lindeman, and Jerry Weaver kept the helicopter running smoothly and went out of their way to ensure that aircraft maintenance did not conflict with field work. The staffs of the Indian Mountain Long Range Radar Site, Bettles Lodge, and Silverado Gold Mines Ltd. provided comfortable accommodations for the field crew. A special thanks to Marie Mead for being our den mother at Nolan Creek and making sure that no one lost weight while tromping through the nearby hills.

[1] Confirmed production over a period of several years.
[2] Development work done, but no recorded production.
[3] Mineralization exists, but there is no sign of development.
[4] Noted in published literature.

The authors appreciate the cooperation and hospitality shown by the following miners and claim owners and apologize for any that may have been left out: Bud Anderson (Gold Creek), Bill and Lil Fickus (Crevice Creek), Mitch Fleming (Myrtle Creek), John and Ethel Hall (Linda Creek), Ralph and Dick Hamm (Porcupine Creek), Jack Jackson (Jennie Creek), Jack Jiles (Gold Bottom Gulch), Jim Lounsbury (Union Creek), Mick Manns (Birch Creek), Marie Mead (Sawyer Creek), Bill Nordeen (Emma Creek), Northern Lights Mining crew (Rye Creek), Jim Olmsted (Gold Creek), Mike Raible (Mascot Creek), Heinrich Schoenke (Lake Creek), Silverado Gold Mines Ltd. (Nolan Creek), Dennis Stacey (Vermont Creek), Garry Tainter (Prospect Creek), Larry Weisz (Hammond River), and Ted Wicken (Gold Creek).

Our thanks to Harry Noyes and Norman Phillips for providing access to geologic information on Doyon Ltd. lands within the Koyukuk Mining District.

GEOGRAPHY AND CLIMATE

The Koyukuk Mining District encompasses 11.6 million acres (18,125 square miles) and covers the upper portion of the Koyukuk River basin (figure 1, plate 1). The Kanuti-Koyukuk River confluence is the southern boundary; and the crest of the Brooks Range is the northern. The west side is bounded by the Noatak and Kobuk Rivers; and the east side, by the Chandalar River. The district has been divided into two subdistricts: the Alatna in the south and the Wiseman in the north (Ransome and Kerns, 1954, p. 82).

The Kanuti Flats make up the south-central portion of the district. These unglaciated low plains are 400 to 1,000 feet in elevation, dotted by lakes, and crossed by the forested meander belts of the Koyukuk and Kanuti Rivers. Bedrock exposures are uncommon in this part of the district. The Kanuti Flats merge with the Indian River upland on the west, which consists mostly of low, gentle ridges ranging from 1,500 to 2,000 feet in elevation. The ridges culminate in high points such as Indian Mountain (4,234 feet). To the east and south, the Kokrine-Hodzana Highlands consist of rounded ridges, 2,000 to 4,000 feet in elevation. The Highlands are surrounded by isolated areas of more rugged terrain. These include the Ray Mountains, with glaciated valleys and summits rising to 5,500 feet.

The northern part of the district is dominated by the rugged glaciated peaks of the Endicott Mountains, which make up the central Brooks Range (figures 2 and 3). Mt. Doonerak, at 7,457 feet, is one of the highest peaks in the range. A few cirque glaciers in the higher parts of the range are all that remain of the massive ice sheets that carved the present terrain. Broad glacial valleys, containing a few large lakes, alternate with steep ridges. In general the region south of the trunk of the Koyukuk River lies within the discontinuous permafrost zone, while that to the north lies within the continuous permafrost zone (Maddren, 1913, p. 28; Ferrians, 1965; Wahrhaftig, 1965).

The lowland river valleys are covered by forests of black and white spruce, poplar, and birch. Undergrowth consists mostly of alder, willow, and sphagnum moss. The low hills between stream drainages often contain a sparse growth of stunted black spruce and a sedge-tussock ground cover, which makes travel difficult. Forest growth extends up the river valleys to a tree line between 2,000 and 3,000 feet in elevation. Aspen can grow on well-drained south-facing slopes in the upland valleys. Lichen and moss are the prevailing vegetation at altitudes above 4,000 feet (Maddren, 1913, p. 28; Ferrians, 1965; Wahrhaftig, 1965).

The Koyukuk Mining District is dominated by the continental climate zone of Alaska, which is characterized by warm summers and extremely cold winters, low precipitation, and low humidity (Johnson and Hartman, 1969, p. 60). Low temperatures for weather stations within the district average

11°F, and highs average 30°F (table 1). The extremes are 93°F and -82°F; the latter is an unofficial North American record low temperature set at Coldfoot in 1989 (Mull and Adams, 1989, p. 79). Precipitation is usually lightest in April and heaviest in August, averaging 13.6 inches with an average snowfall of 85.5 inches (Leslie, 1986). Afternoon thunder and lightning storms with accompanying precipitation occur during summer months, and fresh snow can coat the high peaks during any month of the year.

Table 1. Climate summary for weather stations in the Koyukuk Mining District[5]

Location	Average high (°F)	Average low (°F)	Average total precipitation (inches)	Average total snowfall (inches)
Allakaket	30.9	5.7	12.3	61.4
Anaktuvuk	21.7	5.3	10.1	57.0
Bettles	30.6	13.5	13.7	84.4
Coldfoot	29.9	8.7	15.4	116.5
Indian Mountain	32.2	16.6	18.7	112.9
Wiseman	32.2	11.8	11.5	80.5
Average	29.6	10.3	13.6	85.5

[5] (Data from Leslie, 1986 and Western Regional Climate Center, 2001.)

Wildlife inhabiting the area include grizzly and black bear, caribou, moose, Dall sheep, wolf, coyote, lynx, fox, wolverine, beaver, snowshoe hare, ptarmigan, and grouse. Several species of raptors, including golden eagles and hawks, nest in the area. Grayling are abundant in streams, while lake trout, northern pike, arctic char, whitefish, and burbot inhabit the deeper lakes. Sheefish migrate up the Koyukuk and into the Alatna River. Chum and king salmon are known to migrate up the Koyukuk River as far as Wiseman.

The Koyukuk Mining District is sparsely populated. Permanent settlements include three Native villages: Anaktuvuk Pass (population 308), Allakaket (population 143), and Alatna (population 32). Bettles (population 48) is centrally located in the district and provides aircraft services and accommodations for travelers. This site is labeled Evansville on most maps. The original site of Bettles, located 6 miles down the Koyukuk River, has no permanent residents. Wiseman (population 19) was originally established as a supply point for mining operations in the Nolan Creek-Hammond River area. Coldfoot (population 17) was also established to support nearby placer mines and still provides services to travelers. The latter two settlements are accessible from the Dalton Highway which follows the Trans-Alaska Pipeline. This road provides year-round access to the eastern portion of the district. Several sites, including Bettles and mining operations on the Wild River, receive supplies via winter-only roads that connect to the Dalton Highway.

LAND STATUS

Approximately 72% of the 11.6 million acres within the Koyukuk Mining District is under Federal management (plate 1). BLM lands are concentrated in the eastern portion of the district along the Trans-Alaska Pipeline corridor. These lands are generally open to mineral entry except those lying directly adjacent to the pipeline. Other Federal lands include Gates of the Arctic National Park and the Kanuti Wildlife Refuge; both of which are closed to mineral entry. State lands make up 21% of the district and are generally open to mineral entry. The remaining 7% is held by Native Corporations; the majority of which is managed by Doyon Ltd.

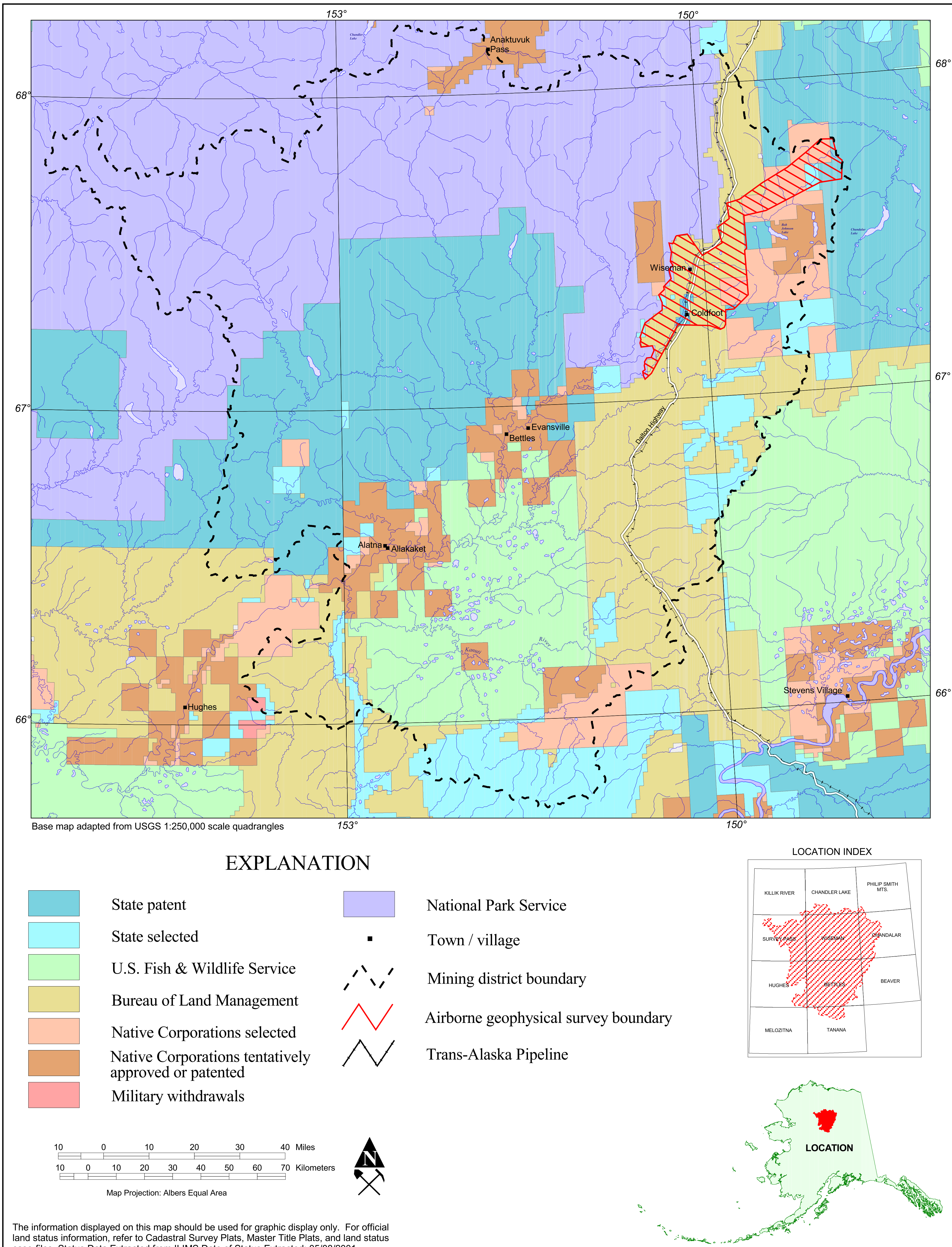


Figure 1. Location and land status map of the Koyukuk Mining District, Alaska.

Figure 2. Looking north across the Koyukuk River lowlands towards the Endicott Mountains.

Figure 3. Looking southeast at Sukakpak Mountain (map no. C42), near the Dalton Highway.

PREVIOUS STUDIES AND EXPLORATION

The first published account of exploration into the Koyukuk region of Alaska was made by Lieutenant H.T. Allen, who in the summer of 1885 made a remarkable 2,200-mile journey through Alaska. Allen and his party, under orders from the War Department, traveled up the Koyukuk River from the mouth of the Kanuti River and then up the John River to a point about 5 miles above its mouth. The party included topographers who produced the first accurate map of the area (Allen, 1887). Allen's party was followed by another commanded by Lieutenant G.M. Stoney of the U.S. Navy. During the winter of 1885-1886, Stoney and his group crossed from the headwaters of the Kobuk River to the Alatna River in the northwest corner of the Koyukuk Mining District. They ascended the Alatna River and then crossed the Brooks Range divide to Chandler Lake (Stoney, 1900).

Little documented exploration followed until the Klondike gold discovery in 1896. This brought a rush of prospectors to Alaska, including the Koyukuk country. News of subsequent gold discoveries prompted the Federal Government to send out U.S. Geological Survey (USGS) parties to conduct systematic scientific explorations in the area. The first of these was led by geologist F.C. Schrader in 1899. His party, which included topographers, ascended the Chandalar River and descended the Koyukuk via the Bettles and Dietrich Rivers. In 1901 a party led by W.J. Peters, and including Schrader, ascended the John River to the Brooks Range divide and descended the Colville River to the coast. Schrader was the first to describe the mineral resources of the area in some detail, documenting his work with the first published photographs of mining operations in the Koyukuk (figure 4) (Schrader, 1900, 1904).

In 1901 another USGS party led by W.C. Mendenhall descended the Kanuti River to the Koyukuk, then ascended 80 miles up the Alatna to Helpmejack Creek before crossing the divide and going down the Kobuk River (Mendenhall, 1902; Smith and Mertie, 1930; Marshall, 1933, p. 29-44). In 1909 A.G. Maddren made a brief visit to the district, gathering information on the gold placers and production. He is credited with making the first detailed descriptions of the placer gold deposits on the Koyukuk (Maddren, 1910, 1913). A party under the direction of Philip Smith ascended the Alatna River to its head in 1911 and descended the entire length of the Noatak, describing the geology along the way (Smith, 1913). In 1911 and 1912 Maddren revisited the principal mining areas in the district (Maddren, 1913). During the winter of 1924, a party led by Philip Smith ascended the Alatna River, but focused geologic work on rocks north of the Brooks Range divide outside of the study area (Smith and Mertie, 1930).

In the following years little documentation of activities in the district occurred until 1929 when Robert Marshall, a forester by profession, conducted a series of personal explorations into the headwaters of the Koyukuk. He visited many remote areas and contributed to the knowledge of the geography of the region by naming numerous features and publishing a sketch map of the area. He also described the cultural and socioeconomic aspects of life on the Koyukuk (Marshall, 1931, 1933, 1970). I.M. Reed, a mining engineer with the Territorial Department of Mines, visited the district briefly in 1929. In 1937 he revisited and made the most extensive examination of the district's placers on record (Reed, 1938).

The USGS returned to the area in the mid 1940s to study the geology of the National Petroleum Reserve - Alaska, which lies north of the crest of the Brooks Range and has a mutual boundary with the Koyukuk Mining District. During its investigation, the USGS produced geologic maps of the Chandalar (Brosge and Reiser, 1964), Hughes (Patton and Miller, 1966), Melozitna (Patton and others, 1978), and the Survey Pass quadrangles (Nelson and Grybeck, 1980). The Chandalar, Wiseman, and Survey Pass quadrangles were evaluated as part of the Alaska Mineral Resource Assessment Program (AMRAP), which included geochemical surveys by the USGS (Brosge and Reiser, 1972; Marsh and others, 1978a, 1978b).

After the completion of the Dalton Highway across the eastern portion of the district, the ADGGS in conjunction with the USGS began geologic studies of State-selected lands adjacent to the road. This resulted in a series of State and Federal publications: Mulligan, 1974; Dillon and others, 1980-1981, 1986-1989; Mosier and Lewis, 1986; Bliss and others, 1988; and Mull and Adams, 1989. The U.S. Bureau of Mines (BOM) did critical and strategic metal investigations in the southeastern portion of the district adjacent to the road (Foley and McDermott, 1983; Barker, 1991).

Results from USGS regional stream sediment sampling in the Chandalar quadrangle (Brosge and Reiser, 1964) initiated lode exploration of the area. In 1968, Bear Creek Mining Company discovered copper minerals associated with schist and calc-silicate rocks along a trend between Big Spruce and Robert Creeks. They designated this trend the Chandalar copper belt. Bear Creek's evaluation, which included geophysics and trenching, continued until 1973. The claims were then leased to the Midwest Oil Company, a subsidiary of AMOCO. Midwest drilled some of the properties before abandoning the claims in 1974. WGM Inc., which had managed projects for Midwest, subsequently staked claims and investigated some of these properties for several years. The Placid Oil Company held claims on this same mineralized trend, which extends into the adjacent Chandalar Mining District. Much of the land along this trend is currently owned by Doyon Ltd.

Alaska Ventures Corporation conducted base metals exploration in the Wiseman quadrangle in 1969. Claims were staked, but never evaluated due to the bankruptcy of King Resources which financed the project (WGM Inc., 1976-1983). Based on successes in the Ambler district, the Anaconda Company began exploring eastward, following the same package of massive sulfide-bearing felsic rocks into the Wiseman quadrangle. This led to discovery of copper, lead, and zinc mineralization on Roosevelt Creek in 1975. Drilling showed the mineralization to be limited in extent and the claims were later abandoned. Resource Associates of Alaska did some drilling along the same trend, but farther east near Jones Creek (Marrs, 1978, 1979).

In 1975, C.C. Hawley and Associates (acting for British Petroleum-Alaska), Resource Associates of Alaska, and Canavex Inc. (Falconbridge Ltd.) carried out exploration efforts in the Wiseman quadrangle. This led to the discovery of sulfide mineralization associated with carbonate and schist north and west of Mettenpherg Creek and along the Allen River. Subsequent geologic investigations proved the mineralization to be limited in extent. WGM Inc., acting for General Crude Oil and the New Jersey Zinc Company, conducted a regional exploration program in the south-central Brooks Range in 1974. This effort resulted in drilling at the Abo and Frog prospects west of Mettenpherg Creek. Neither of the prospects had mineralization extensive enough to warrant further investigations (WGM Inc., 1976, 1978).

Doyon Ltd., a Native Corporation, has encouraged mineral exploration on its holdings in the Koyukuk District. From 1975 to 1979, Doyon Ltd. and a consortium of other companies, participated in a mineral exploration effort on Doyon's lands. The project was managed by WGM Inc. Numerous occurrences were located and detailed geologic investigations were made at some, including the Luna, Bluecloud Mountain, and Bonanza prospects. In addition tin placers along the Kanuti Kilolitna River were evaluated (Bright, 1988; WGM Inc., 1976a-1983). Doyon Ltd. has since contracted with other exploration groups, including Arctic Resources, ASA Inc., Central Alaska Gold Company, Ventures Resources, and most recently North Star Exploration, to conduct mineral investigations on its lands (Bright, 1995).

Graduate theses and dissertations on the geology and mineralogy of specific deposits within the district include the following areas: Anaktuvuk Pass (Porter, 1962), Chandalar lode mines (Ashworth, 1983), Arrigetch Peaks (Adams, 1983a, 1983b), upper Bonanza Creek skarns (Clautice, 1987), Endicott Mountains (Gottschalk, 1987; Handschy, 1989), Sukakpak Mountain (Huber, 1988), Chandalar copper belt (Nicholson, 1990), and the Nolan-Hammond River area (Eden, 2000).

MINING HISTORY AND PRODUCTION

Although reports of placer gold in gravel bars of the Koyukuk River date back to the period between 1885 and 1890 (when minor discoveries were made at Tramway, Florence, and Hughes Bars), the area did not receive major attention by prospectors until the Klondike gold rush era. Beginning in 1899, stampeders disenchanted with the Klondike rush in Canada worked their way down the Yukon River and prospected its tributaries, including the Koyukuk. This led to the first major discovery in the district when members of the Dorothy party from Boston, Massachusetts, found gold near the confluence of Slate and Myrtle Creeks in 1899 (figure 4). Knute Elingson and his partners mined Myrtle Creek the same year, making the first “real money” on the Koyukuk (Schrader, 1900, 1904; Marshall, 1933).

In 1900 Myrtle Creek produced 1,900 oz of gold. News of this find and others on nearby Emma and Slate Creeks sparked a rush of about 1,000 fortune seekers up the Koyukuk River and its tributaries. The settlement of Coldfoot (figure 1) was established along the river as a supply point for mining operations in the area. The site got its name when some gold seekers reportedly got “cold feet” and turned around at that point (Maddren, 1913; Marshall, 1933).

Gold was discovered on the Hammond River in 1900 and on Nolan Creek in 1901 (see back cover). A shifting of activity to these areas led to the establishment of Wiseman about 11 miles north of Coldfoot and resulted in the eventual abandonment of the latter site. Other strikes occurred on Mascot, Gold, Linda, and Porcupine Creeks. Mascot Creek, which produced about 4,300 oz of gold during 1903, was said to be one of the most profitable in the Koyukuk. The Mascot gold rested directly on bedrock with only a thin gravel cover, which made it extremely easy to recover. However, when compared to other Alaskan placer districts, the Koyukuk proved to be extremely remote and one of the most costly in which to operate. At the time it was noted for being one of the northernmost mining districts in the world (Maddren, 1910, 1913).

Initial production from creeks in the Wiseman area came from shallow placers. These were soon worked out, and by 1904 production began to drop (figure 6). Rumors of bonanzas on the John River in 1905 sent 400 prospectors in that direction, and the Chandalar discoveries in 1906 funneled more gold seekers away from the Nolan area. However, in 1907 interest was renewed with the discovery of rich, buried channels more than 100 feet beneath the surface at Nolan Creek. It is reported that, in a little over 3 months, about 5,000 oz of gold were recovered, and the following year it was estimated that nearly 250 people were working on the creek (Hill, 1909). The district’s highest annual production came in 1908 with the recovery of nearly 54,500 oz of gold. Hydraulic mining was first used in the district the next year on Myrtle Creek. The Nolan Creek drainage proved to be some of the richest ground, yielding at least 175,000 oz of gold through 2000. A similarly rich, deep channel was struck beneath the Hammond River in 1912, and during the following 4 years, over 48,000 oz gold were produced, including a 138.8-oz nugget (third largest in Alaska) (Pringel, 1921; T.K. Bundtzen, written communication, 1999). The Nolan-Hammond area continues to be the center of mining activity in the district.

Figure 4. Placer mining on Myrtle Creek in 1899; the site of the first major gold discovery in the Koyukuk Mining District. Photo by F.C. Schrader, U.S. Geological Survey.

Figure 5. Placer operation on Nolan Creek by Silverado Gold Mines Ltd. In 1994 Silverado recovered a 41.35 oz nugget (unofficially the tenth largest in Alaska) from bench gravels on the east side of the creek (map no. W96).

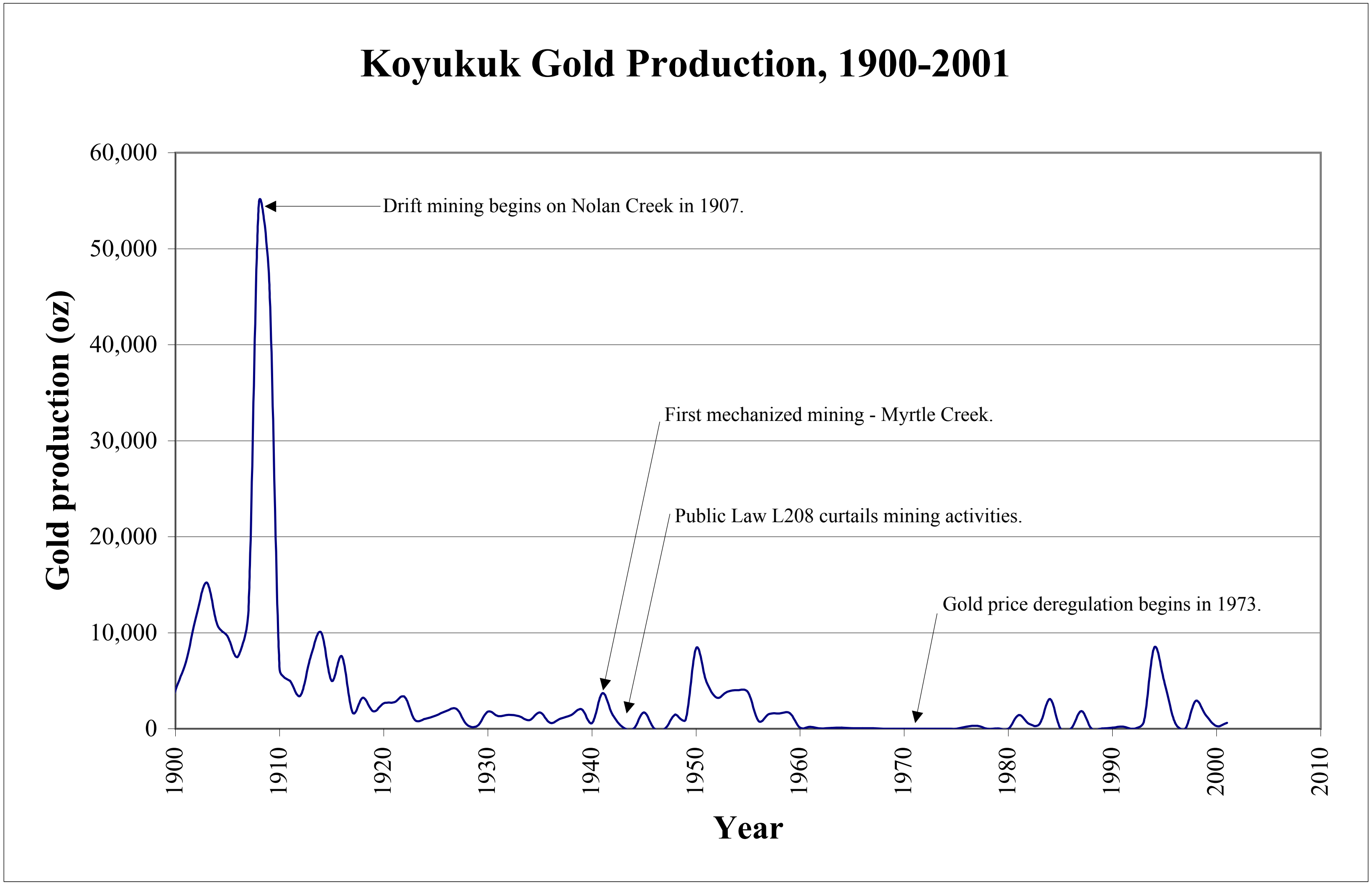


Figure 6. Historic gold production in the Koyukuk Mining District.

Gold was first mined in the central part of the district in 1904, following discoveries near Wild Lake and in Crevice Creek on the John River drainage. Interest in the area took a major jump in 1915 when 572 oz of gold were recovered from Jay Creek (Pringel, 1921). Sporadic mining continues to the present day, concentrated on Crevice, Lake, Jay, and Birch Creeks.

The report by a native of a gold discovery on the Indian River in the southwest corner of the district prompted J.C. Felix to visit the area in 1910. He found workable placer deposits and began mining the following year. In 1913 approximately 1,550 oz gold were produced. Discoveries followed on nearby Black and Utopia Creeks. A dragline mined nearly the entire length of Utopia Creek from about 1939 to 1950, and the same dragline operated on the upper Indian River and Black Creek until the early 1960s (Eakin, 1916, p. 83-84).

Mechanized mining came to the northern part of the district in 1940 when a dragline-dozer operation began working Myrtle Creek, causing a major jump in district production. Production dropped to a minimum in 1942 due to the enactment of Public Law L208. This law curtailed all mining in the United States that was not related to the production of strategic metals. The only recorded lode production in the district occurred the same year when about 5 tons of antimony ore were recovered on Smith Creek as a by-product of gold mining. However, the antimony ore was reportedly never shipped due to a major drop in price (Maddren, 1913; Marshall, 1933; Joesting, 1943; Saunders, 1954; Cobb, 1973). Gold production picked up again after the war, reaching a high of 11,817 oz in 1964 with Nolan Creek being the largest producer. Completion of the Dalton Highway in 1975 allowed for road access to many of the placer mines along the Middle Fork Koyukuk River. As a result, the use of mechanized mining methods increased dramatically.

In 1994 Silverado Gold Mines Ltd. was the largest producer, recovering 8,024 oz of gold from both surface and underground operations on Nolan Creek (figure 5). In addition this operation recovered a 41.35-oz nugget from Nolan Creek, which is unofficially the 10th largest in Alaska (T.K. Bundtzen, written communication, 1999) (see back cover). In 1997 gold prices began a dramatic plunge, dropping over $100/oz by 1999. This has greatly affected the economics of mining in the district. In addition, high runoff during the spring of 1998 resulted in the destruction of many mine access roads, which operators then spent most of the summer reconstructing. That year, 13 active operations in the district produced a minimum of 829 oz of gold. By 2000 only five mines were active, and district production had dropped to a minimum of 480 oz. District production is summarized in figure 6 and listed by property in Appendix J.

During the Koyukuk assessment, surface placer mines operated on the Hammond River, Emma, Nolan, Gold, Porcupine, Slate, Smith, and Mascot Creeks in the Wiseman area. In the central portion of the district, mining took place on Lake, Jay, Birch (a tourist-oriented mine), and Prospect Creeks. Underground drift mines operated on Nolan and Linda Creeks.

BUREAU INVESTIGATIONS

A brief examination of the Koyukuk Mining District was made in 1994 when the Alaska mining district studies were administered by the U.S. Bureau of Mines. After closure of that agency in 1996, this function was transferred to the BLM and work resumed on the project. Prior to beginning field work, an extensive bibliography on the geology and mineral resources of the district was assembled. Letters were sent to 181 claimants requesting permission to visit their properties and to obtain any input they might have in regard to specific sites. A total of 210 days were spent working in the field during the summers of 1997 to 2001. The Dalton Highway is the only road access to the district and from it some sites could be visited by vehicle. All other fieldwork was done using a helicopter. Bases of operation included Bettles, Indian Mountain long range radar site, and the Silverado Mines Ltd. camp at Nolan Creek.

Field investigations focused on documented mines, prospects, and mineral occurrences. The initial investigations were followed by the prospecting of areas with anomalous geochemistry or with geology similar to that of documented sites. BLM personnel collected rock samples and mapped the geology in an effort to determine the grade and extent of mineralization at lode sites. Placer deposits were investigated by collecting stream sediment, pan concentrate, and/or placer samples. Any preexisting information was combined with that obtained by the BLM to make resource estimates as well as a determination of mineral resource potential. The results from the first two years of the study were published in BLM Open File Report 74 (Kurtak and others, 1999). Those data are combined with the last three years of the study in this report.

As a cooperative effort in 1997, the ADGGS and BLM made an airborne geophysical survey of a 533-square-mile area in the northeast portion of the district. The BLM provided the funding and selected the area to be covered, and the ADGGS administered the project. Sial Geosciences Inc. conducted the survey, and On-Line Exploration Services was the field representative. The geophysical survey results were published as a series of ADGGS Public Data Files and Reports of Investigation (Sial Geosciences Inc., 1998a-1998d). The BLM also funded publication by the ADGGS of the Chandalar C-5 geologic map (Dillon and others, 1996), the area of which lies within the airborne survey.

In 1998 the BLM conducted ground magnetic and electromagnetic conductivity surveys at five sites as a follow-up to the airborne geophysical work (figure 7). These surveys delineated several anomalies. The Bureau conducted additional geophysical studies in the form of ground penetrating radar (GPR) profiles, completed at three known placer deposits identified channel locations and depth to bedrock. A portion of these studies are described in BLM Open File Report 74 (Kurtak and others, 1999). The complete results will be published as a separate BLM Technical Report (Williams, in progress).

In a partnership with Silverado Gold Mines Ltd., the BLM sponsored a geology graduate student (Karsten Eden) from the Technical University of Clausthal in Germany, who mapped the geology and assessed lode mineralization in the Nolan-Hammond River area. This project fulfilled the requirements of a master's degree in geology, and the results were published as BLM Open File Report 78 (Eden, 2000).

SAMPLING METHODS

The BLM collected a total of 2,098 samples during the Koyukuk study. Sample types included rock, pan concentrate, stream sediment, placer concentrate, sluice concentrate, and soil samples (figure 8). Sample site locations were recorded using hand-held global positioning system (GPS) instruments.

Figure 7. Ground magnetic and VLF survey, near the Ginger prospect (map no. C17), Big Spruce Creek.

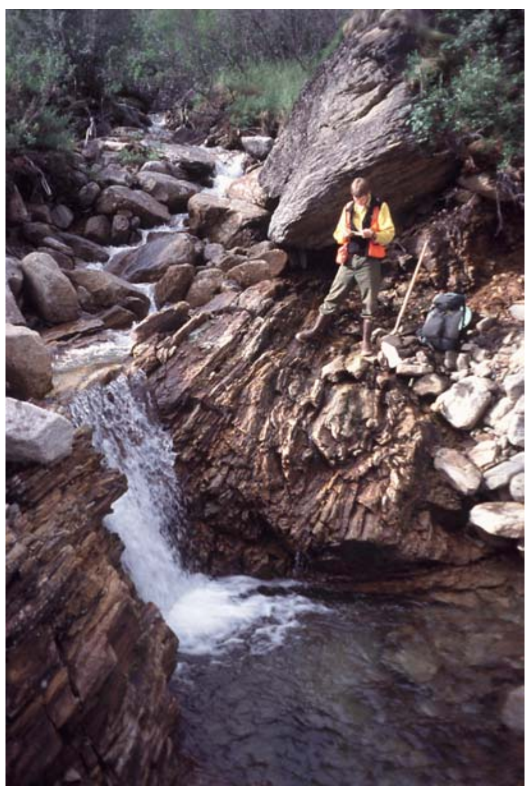


Figure 8. Sampling sulfide-bearing muscovite schist on Willow Creek near Bettles River (map no. C27).

Rock samples weighed between 3 to 4 lbs each, and consisted of fresh, altered, or mineralized rock pieces. The samples were collected from the following sites: (1) outcrop - rock that is in place; (2) rubblecrop - rock fragments overlying bedrock that is not visible, but implied; and (3) float - loose rock fragments or cobbles not necessarily found near or overlying bedrock of the same composition.

Rock samples are of six types: (1) continuous chip - small rock fragments broken in a continuous line for a measured distance across an exposure; (2) spaced chip - collected in a continuous line at designated intervals across an exposure; (3) representative chip - sample volume collected in proportion to volumes of different rock types observed at a specific locality; (4) random chip - collected at random points from an apparently homogenous mineralized exposure; (5) grab sample - collected more or less at random from float or outcrop; and (6) select sample - collected from the highest grade portion of a mineralized zone.

Coal samples were collected from channels cut a minimum of 1 foot into outcrops. Approximately 4 lbs of coal were collected for each sample. The coal was stored in airtight bags to retain its original moisture content during shipment.

Pan concentrate samples were collected at sites where heavy minerals might accumulate, such as stream gradient changes from steep to moderate, the downstream side of boulders, and on bedrock. A 14-inch gold pan heaped with coarse gravel and sand was panned down to approximately 0.75 oz of fine concentrate, which was then stored in sealed plastic bags prior to chemical analysis. The presence of heavy minerals such as gold, sulfides, magnetite, and garnet in the concentrate was noted in the field.

Stream sediment samples were collected from the active portion of the stream bed and consisted of composites of silt and clay. Approximately 8 oz of material were collected with a plastic trowel and stored in paper geochemical envelopes.

Placer concentrate samples consisted of 0.1 cy of stream or bank material processed through a 10- by 48-inch sluice box. The sluice product was then panned to produce approximately 2.5 oz of concentrate. Visible gold was separated from the sample and weighed. Remaining concentrates were examined with a microscope and ultraviolet lamp in order to determine mineralogy, then forwarded to the laboratory for geochemical analysis. Occasionally, selected sites required testing of larger volumes of gravel. In these situations a hydraulic concentrator, with grizzly and spray bar, was used.

Sluice concentrate samples were collected mostly from active placer mines. They consisted of 1 to 2 lbs of black sands and other heavy minerals remaining after the placer gold was removed by the miners. The amount of gravel washed to produce the concentrate was often unknown. These samples were collected in order to find potentially anomalous values of accessary minerals such as arsenic, antimony, bismuth, or tungsten. They were processed like placer samples; the visible gold was separated and weighed, metal contaminants (battery pieces, lead shot, and miscellaneous metal) were removed, and the concentrate was examined with a microscope and ultraviolet lamp in order to determine mineralogy.

Soil samples were collected from the thin C horizon, characteristic of Arctic soils, with a stainless steel hand auger. The C horizon is the subsoil closest to bedrock and can contain small pieces of eroded bedrock. The samples were stored in paper geochemical envelopes. Soil samples were collected in areas of poor outcrop exposure.

All pieces of sampling equipment (shovels, plastic trowels, plastic gold pans, soil augers, rock hammers, and chisels) were rinsed with water regularly to limit the potential of cross-contamination.

REGIONAL GEOLOGY

The Koyukuk Mining District is underlain by three main geologic terranes (figure 10). The oldest is the Ruby terrane, which underlies the southeastern margin of the district and makes up a portion of the Ruby Geanticline, a linear uplift of pre-Cretaceous rocks that diagonally crosses central Alaska. The geanticline is composed of autochthonous Proterozoic(?) through late Paleozoic metasedimentary rocks consisting of miogeoclinal pelitic schist, quartzite, greenstone, carbonate rocks, and quartzo-feldspathic gneiss. These rocks were metamorphosed in the Early Cretaceous to greenschist facies with areas of local almandine-amphibolite facies and glaucophane-bearing blueschist mineral assemblages. The Ruby terrane is extensively intruded by mid-Cretaceous granitic plutons. It may have been contiguous with the Arctic Alaska terrane to the north and possibly a portion of the southern Brooks Range that was rotated or displaced in Mesozoic time (Patton, 1989, p. 27).

The continentally derived Arctic Alaska terrane makes up the northern half of the district and underlies the central and eastern portions of the Brooks Range Province. It is composed dominantly of Proterozoic(?) and lower Paleozoic sedimentary, metasedimentary, and volcanic rocks. This includes an extensive carbonate sequence, which is confined mostly to the northern portion of the terrane. Unmetamorphosed upper Paleozoic and Triassic rocks occur locally. The carbonate sequence and associated volcanic rocks were intruded by Early to Middle Devonian premetamorphic granitic and mixed felsic-mafic intrusive complexes. These rocks host tin skarns in the Arrigetch Peaks and copper porphyries and skarns north of Bettles River (Patton, 1989, p. 28).

The oceanic upper Paleozoic-Mesozoic Angayucham terrane makes up the central portion of the district and contains the youngest and least metamorphosed rocks. The base of the terrane is composed of a Permian-Jurassic sequence of mafic and ultramafic volcanic and intrusive rocks consisting of pillow basalt, diabase, gabbro, peridotite, pyroxenite, and dunite with subordinate chert, limestone, and serpentinite. The igneous rocks, which are considered to be part of a dismembered ophiolite, locally contain small podiform chromite occurrences. These rocks are likely to be the erosional remnants or klippen of allochthonous rocks that were thrust over those of the Arctic Alaska terrane in the late Mesozoic. This complex is unconformably overlain by an Early and Late Cretaceous graywacke and igneous- and quartz-pebble conglomerate that filled the lower Koyukuk basin and left the igneous rocks exposed only on the basin margins (Mull, 1989, p. 33). The Late Cretaceous sediments contain some coal beds.

During the Jurassic through Cretaceous Brooks Range orogeny, obduction of the younger Angayucham terrane onto the Arctic Alaska terrane resulted in imbricate thrusting, northward-verging folding, and tectonic-burial metamorphism within the lower plate. This terrane boundary is marked by a series of thrust faults that compose the Angayucham fault zone. Metamorphism was most intense adjacent to the fault zone, resulting in formation of a belt of schistose rocks along the south flank of the Brooks Range. There is a broad-scale equivalence between this schist and the schist belt that hosts volcanogenic massive sulfide deposits in the Ambler district, 90 miles to the west (Dillon, 1989, p. 161; Nicholson, 1990, p. 75). These lower Paleozoic schistose rocks also comprise the bedrock that underlies some of the major placer gold producing drainages in the district, including Mascot, Nolan, and Myrtle Creeks. In addition, thrusting resulted in crustal shortening and uplift. This deformed the central Brooks Range into a regional, west-plunging antiform, which is cored by Devonian plutons. The schist belt constitutes the southern portion of the antiform.

The Angayucham and adjoining Ruby terranes are intruded by a series of mid-Cretaceous granitic plutons that stitch together the boundary between the two (Dillon, 1989, p. 158). These plutons are significant because they are associated with several mineralized areas in the district. On the upper Jim River, fine placer gold is associated with the Jim River Pluton. On the Kanuti Kilolitna River, the Sithylemenkat Pluton hosts tin greisens (Barker and Foley, 1986). In addition this pluton has been deeply eroded, and the resulting alluvium contains concentrations of placer tin (Barker, 1991). Placer gold is associated with the Ray Mountains Batholith near the headwaters of the Kanuti Kilolitna River. The Kanuti Pluton hosts tungsten skarns near the headwaters of Bonanza Creek (Clautice, 1987).

Cretaceous andesitic volcanic rocks occur near Indian Mountain in the southwestern corner of the district. Hydrothermally altered zones within these rocks are anomalous in gold. Cretaceous(?) to Tertiary felsic volcanic rocks consisting of rhyolite tuff, flows, breccia, and conglomerate are concentrated in the southern portion of the district. The rhyolite hosts minor lead-zinc mineralization near the headwaters of the Kanuti River. Tuffaceous flows near Indian Mountain contain obsidian nodules. Possibly as much as 6,000 years ago, Alaska Natives used the obsidian for tool making (Patton and Miller, 1966; Patton and others, 1978; Clark, 1993a, 1993b).

The northern portion of the Koyukuk Mining District has been affected by a series of at least four major glacial advances ranging in age from Tertiary(?) to Quaternary. Glacial ice shaped much of the present landscape and played a significant role in formation of the district's placer deposits. The last advance ended about 10,000 years ago, and cirque glaciers still exist in the highest portions of the Endicott Mountains (Hamilton, 1986, 1989).

Figure 9. Middle Devonian granitic meta-intrusive rocks in the Arrigetch Peaks area at the western border of the Koyukuk Mining District.

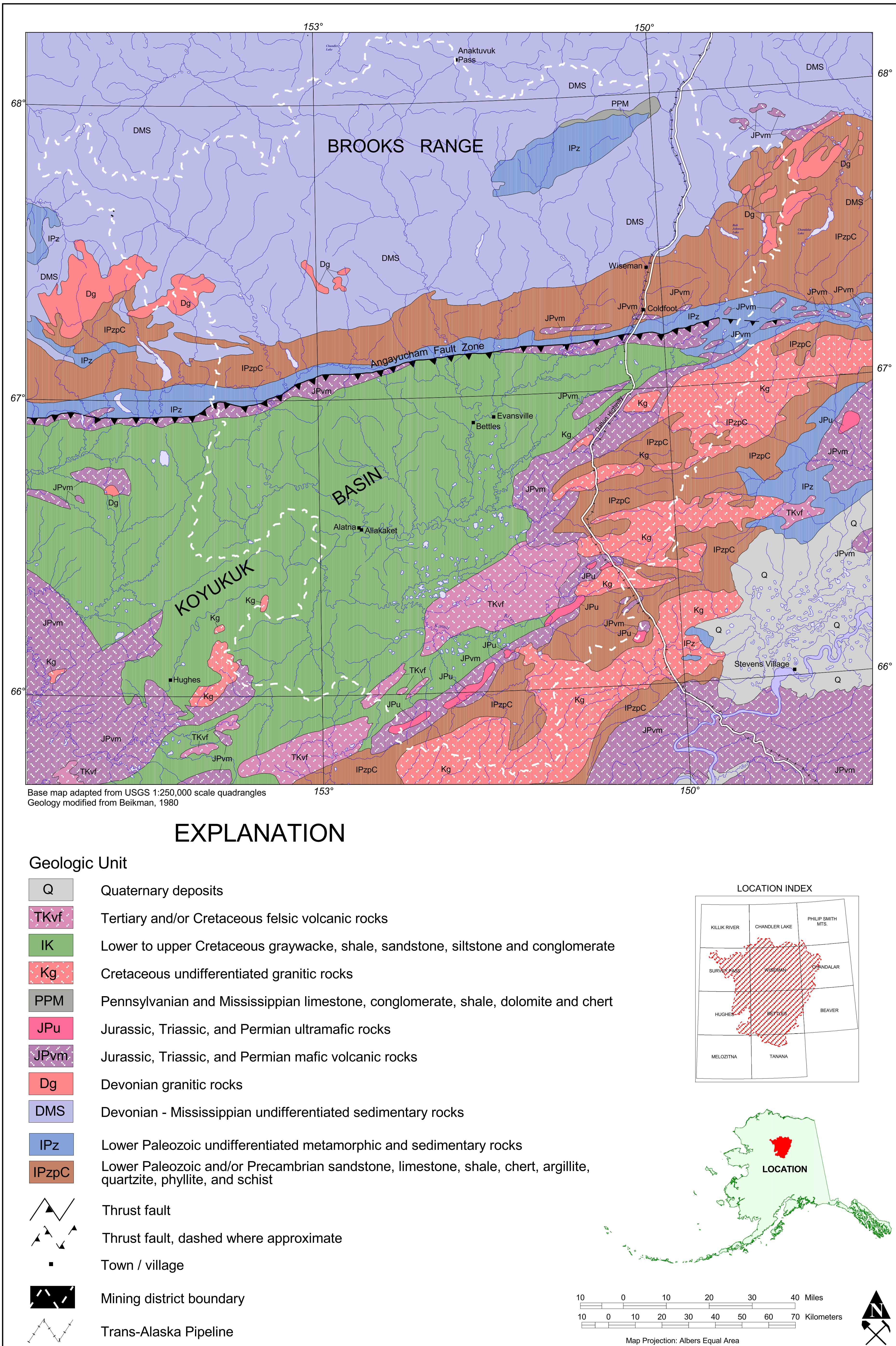


Figure 10. Geologic map of the Koyukuk Mining District and vicinity.

MINERAL DEPOSIT TYPES

PLACER GOLD

Gold placers are the only mineral deposits in the Koyukuk Mining District that have undergone extensive exploration and development. Documented production totals 333,893 oz. These deposits occur throughout the district, but the highest production comes from placers in the Coldfoot-Wiseman area. From youngest to oldest, the placers consist of modern stream deposits, bench placers, and deep channels. The formation of the placer deposits is closely tied to glaciation as the area has been affected by at least four major ice advances. The gold varies from rounded, water-worn nuggets in the deep channels to angular, rough gold with attached quartz fragments on the benches. The BLM has estimated that the district contains an inferred resource of nearly 3.2 million cy of potentially gold-bearing gravel. The sources of the gold in the placers include gold-bearing quartz veins and pyritic schist. The mean fineness for Koyukuk gold is 914 (Maddren, 1913, p. 75, 82-83; Reed, 1938, p. 19-22; Metz and Hawkins, 1981, p. 36).

Modern stream placers

Modern placers are shallow, unfrozen gravel deposits in the bottoms of gulches, creeks, and rivers. Gold is concentrated in bedrock fractures and in the lower 1 to 2 feet of the overlying, mostly unfrozen stream gravel. Overburden thickness varies from a few inches to 5 or 6 feet. The shallow placers were the first deposits in the district to be discovered and exploited. Gold (map no. C50)[6], Myrtle (map no. C70) and Mascot Creeks (map no. W70) were the most profitable examples of this deposit type (Maddren, 1913, p. 68). Flood gold deposits occur on point bars in the modern channel of the Koyukuk River, mostly near Bettles (map no. B7) and Red Mountain (map no. H7). These deposits are extremely low grade, but renewable on a yearly basis depending on the runoff activity of the Koyukuk River.

Bench placers

Bench placers were formed on bedrock benches cut by meandering streams. These benches lay anywhere from 2 to 360 feet above modern stream levels (figure 11). They occupy either or both sides of stream valleys and are probably the result of a rise in base level caused by ice damming(?) during glacial advance. They can be divided into low and high benches, depending on their relative height above modern stream levels. They can be further divided into shallow and deep bench placers. The shallow benches occur where the modern stream does not flow over them, and the gold is associated with gravels only a few feet thick. Gold is concentrated on either a “false” clay bedrock or true bedrock. The most profitable of the low benches was Gold Bench (map no. B5) on the South Fork Koyukuk River. This deposit was first mined with hand methods and later with dragline shovels. The deep channel benches contain gold-bearing gravels that are covered by considerable overburden. The most profitable of these occur on the east side of the Nolan Creek valley and were drift mined with mechanized equipment as recently as 1999. Erosion of the bench placers through down cutting by modern streams has probably produced the modern stream placers (Maddren, 1913, p. 75-83; Reed, 1938, p. 62-72; Cobb, 1973, p. 155-160).

[6] Refer to Plate 1 in volume II for map number location. See Appendices B through I for detailed descriptions of mines, prospects, and mineral occurrences. Numerical and alphabetical listings of the sites are provided in appendices J and K in volume II.

Figure 11. Gold-bearing bench gravels (arrow) on the upper Hammond River, above Vermont Creek. Placer samples from these benches contain up to 0.006 oz/cy gold (map no. W88).

Deep buried channel placers

These placers formed in the bottoms of deeply incised bedrock channels that have been covered by 10 to over 200 feet of stream gravel. The channels were probably the result of rapid down cutting, possibly caused by tectonic uplift of the Brooks Range. Erosion, concurrent with the uplift, deposited gold in the channel bottoms. These channels were subsequently filled with stream gravel during later periods of glaciation. The deep channels of the lower Hammond River (map no. W106), Linda Creek (map no. C45), and Sheep Creek (map no. C46) all occupy side valleys to the Middle Fork Koyukuk River and are truncated by it. This indicates that they predate the last major glacial advance in the area. The deep channel deposits proved to be the richest in the district, but also the most difficult to exploit because the gravel is mostly frozen and a considerable barren overburden must be removed to reach gold-bearing gravel. Consequently, these types have been mined mostly by underground drifting. The richest channels are on Nolan Creek (map no. W96) and lower Hammond River (map no. W106). These placers are known for coarse, showy nuggets. The third largest documented gold nugget found in Alaska (138.8 oz) was recovered from a deep channel beneath the Hammond River (Maddren, 1913; Reed, 1938, p. 19-22; Bundtzen, written communication, 1999).

The modern stream deposits were the first to be mined as the gold could be easily recovered using mostly hand methods. The deep frozen placers, though richer, were much more costly to mine because ground-thawing equipment and drifting were needed to extract the gold. Bench placers were mined by removing the overburden through ground sluicing or hydraulic methods. These methods required the building of ditches, sometimes several miles long, to provide the required hydraulic head (Purington, 1905).

Sources of placer gold

The placer gold in Nolan Creek and the Hammond River is mostly derived from two gold-bearing vein systems that outcrop in the area (map nos. W90, W97) (Eden, 2000, p. 78). Gold-bearing creeks in the Mascot, Wild Lake, and John River areas all cut an east-west-trending belt of Devonian schist and phyllite that lies along the regionally metamorphosed, southern boundary of the Arctic Alaska terrane. It has been proposed that metamorphic quartz veins and pyrite within the schist are an additional source of placer gold. A sample of unaltered euhedral pyrite crystals from Nolan Creek was reported to contain $1.24 gold per ton (0.06 oz/ton) (Maddren, 1913, p. 82). The BLM collected a series of pyritic schist and phyllite samples in the Nolan-Hammond River area and obtained a high value of 73 ppb gold from bedrock on Vermont Creek (map no. W89). Some of the metamorphic quartz veins in the Wild Lake area are weakly mineralized and could be the source of the placer gold in nearby creeks (map nos. W24, W60). Placer deposits on the Indian River (map no. H11) and on Prospect Creek (map no. B13) appear related to contact aureoles surrounding plutons.

PLACER TIN

In the southern portion of the district, placer tin occurrences are associated with the Cretaceous Sithylemenkat Pluton. The pluton contains tin-bearing greisens (map no. B29), the weathering of which has resulted in the formation of cassiterite-bearing gravels along the east fork of the Kanuti Kilolitna River (map nos. B22, B28, T3). These occurrences have been evaluated by drilling and trenching. The results indicate that the placers contain up to 1.75 lbs/cy tin. The gravels have an average depth of about 20 feet, and pieces of cassiterite up to 0.75 inch across have been recovered. It is estimated that an indicated resource of 3.5 million cy of cassiterite-bearing gravel averaging 0.67 lbs/cy tin exists in the district (WGM Inc., 1980a, 1980b; Patino Inc., 1981; Barker and Foley, 1986).

VEIN DEPOSITS

A variety of vein deposits occur in the study area. They are Cretaceous in age and appear to be the result of hydrothermal fluids related to regional metamorphism and not plutonic activity (Eden, 2000). The most significant are stibnite-gold and gold-quartz veins in the northeastern portion of the district. Most are uneconomic, but are probably the source of much of the placer gold in that part of the district. Other types include polymetallic veins and galena-quartz veins containing high silver values.

Stibnite-gold veins

Quartz-calcite veins near Sukakpak Mountain (map no. C42) (figure 12) contain stibnite, arsenopyrite, and gold. The stibnite can be coarsely crystalline and locally comprise up to 50% of the vein. Sukakpak Mountain is composed of marble of the Devonian Skajit Limestone that has deformed into a nearly recumbent syncline. On the south side of the mountain, high-angle faulting has placed the marble in contact with Cambrian(?) muscovite-chlorite-quartz schist. The veins occur along the northeast-trending fault and in the adjacent marble. The veins are locally rich in gold, with samples collected by the BLM containing up to 65.4 ppm (1.9 oz/ton). They are lenticular, up to 7.5 feet wide, and are intermittently exposed for nearly 600 feet along strike. The quartz lenses may have originally been one continuous vein that was dismembered by postmetamorphic faulting (Huber, 1988). The BLM has estimated that the prospect has an indicated resource of 31,000 tons, averaging 39.35 ppm (1.22 oz/ton) gold and 18.4% antimony.

Stibnite-bearing quartz-carbonate veins occur on lower Smith Creek (map no. W97), 15 miles to the southwest of Sukakpak Mountain. These northeast-trending veins and veinlets range from less than 1.0 inch to 3.5 inches wide, have nearly vertical dips, and can be traced intermittently for up to 300 feet along strike. They crosscut the metamorphic cleavage in the phyllite host rock. The veins also contain arsenopyrite and samples contain up to 15.3 ppm (0.45 oz/ton) gold. These veins are roughly parallel to several northeast-trending thrust faults that cross Smith Creek and are probably the source of the placer gold in that drainage (Eden, 2000). A series of rotary drill holes placed by Silverado Gold Mines Ltd., intersected vein material to depths of 90 feet beneath the surface exposures. One 5-foot intercept contained 0.086 oz/ton gold (E. Armstrong, written communication, 1998). Some of the stibnite-rich vein material was stockpiled in 1942, but reportedly never shipped out of the district (Joestring, 1943; Saunders, 1954). The narrow and sporadic nature of the veins make them uneconomic.

Gold-quartz veins

Parallel (sheeted) quartz veinlets occur from near the mouth to the headwaters of the Right Fork of Vermont Creek (map no. W90) (figure 13). The veinlets contain visible gold along with minor arsenopyrite, chalcopyrite, and stibnite. The veinlets average 0.5 inch wide and fill a northwest-trending, steeply-dipping, fracture set with variable spacing. A 100-foot-wide exposure on the west side of the Right Fork contains an average of one veinlet every 6 feet. The veinlets crosscut the schistosity of the Upper Devonian phyllite and mica schist wallrock. A northeast-trending fault has been projected to underlie the bed of the Right Fork (Eden, 2000). Samples of these veinlets collected by the BLM contain up to 63.6 ppm (1.9 oz/ton) gold. The veinlets are too widely spaced to be economic.

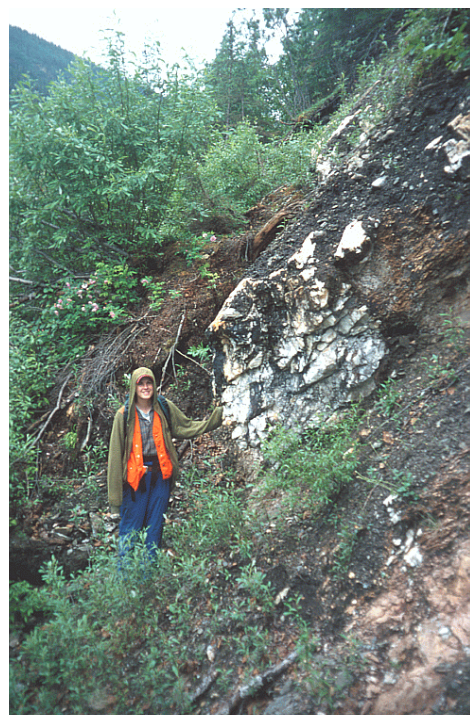
Galena-quartz veins

Galena-bearing quartz veins occur on lower Michigan Creek, a tributary of the Wild River (figure 14). The best examples are at the Silver King prospect (map no. W45). Bedrock on lower Michigan Creek consists of Middle Devonian calcareous schist interbedded with quartz-mica schist and marble (Dillon and others, 1986). The schist is crosscut by numerous quartz and quartz-carbonate veins that range in width from 0.5 to 7.0 feet and can be traced for up to 80 feet along strike. The veins contain isolated clots and stringers of galena with minor amounts of pyrrhotite, chalcopyrite, and ankerite. Vein trends range from northwest to northeast. The veins are lenticular and discontinuous. Samples from these veins contain up to 2.6 oz/ton silver. The veins examined by the BLM are not extensive enough to be economic.

Polymetallic Veins

Scattered small occurrences of polymetallic veins are related to thrust-fault contacts between the Middle Devonian Skajit Limestone and Upper Devonian phyllite and schist. Pyrite along with minor amounts of galena, malachite, stibnite(?), chalcopyrite, and tetrahedrite(?) occur in metamorphic quartz veins that are associated with the thrust contact. A series of these occurrences is scattered along a 5-mile-long section of the fault contact between the Allen and John Rivers (map nos. W20-W22). Select samples of sulfide-bearing quartz collected by the BLM contain up 16.5% copper and 78.6 ppm silver. These occurrences, though too small to be economic, may be the result of remobilization of mineralized fluids from larger concealed stratiform deposits (WGM Inc., 1976, 1978).

Figure 12. Stibnite-gold veins exposed along a faulted contact on the south side of Sukakpak Mountain (map no. C42). Samples contain up to 65.4 (1.9 oz/ton) gold.



(Left) **Figure 13.** Fractures in phyllite containing gold-bearing quartz veinlets near Friday 13th Pup. Samples contain up to 63.6 ppm (1.86 oz/ton) gold (map no. W90).

(Right) **Figure 14.** Quartz carbonate vein exposed along Michigan Creek near the Silver King prospect. Select samples from the vein system contain up to 121.9 ppm silver and 5.8% lead (map no. W45).

PLUTON-RELATED GOLD

Gold geochemical anomalies are associated with several Cretaceous quartz monzonitic plutons in the district. These bodies may be the source of the gold, which would indicate potential for pluton-related lode deposits. Several streams draining the Jim River Pluton, near the eastern border of the district, contain fine placer gold and pan concentrate samples contain up to 514 ppb gold (map nos. B9-B11). Quartz monzonite float found along the Jim River shows the effects of tourmalinization.

Gold, tin, and tungsten geochemical anomalies occur along the Kanuti Kilolitna River, which drains the north side of the Cretaceous Ray Mountains Batholith (map no. T3). Visible fine gold was observed in test pans collected from river gravels and pan concentrates contain up to 6,976 ppb gold. A contact aureole consisting of hornfels and gneiss occurs along the margin of the batholith. Mineralization associated with this aureole may be the source of the gold.

At Black Creek, on the southwestern border of the district, placer and lode gold geochemical anomalies are associated with a contact aureole bordering the Late Cretaceous Indian Mountain Pluton (map nos. H8-H9). Rock samples from altered hypabyssal(?) dikes along the margins of the pluton contain up to 717 ppb gold. Extensive hornfelsing indicates that the mineralized area may overlie a shallow cupola of the pluton.

EPITHERMAL DEPOSITS

Late Jurassic to Early Cretaceous andesitic rocks in the Indian Mountain area contain mineralized alteration zones. The andesites have been brecciated, silicified, and contain disseminated pyrite and sphalerite(?). Samples contain anomalous amounts of lead, zinc, copper, molybdenum, and gold (Miller and Ferrians, 1966). Select float samples of silicified andesite collected by the BLM on the lower Indian River (map no. H13) contain up to 8.2 ppm gold and 1,771 ppm lead. Select samples collected by the BLM at Hill 1342 (map no. H14) contain up to 21.1 ppm gold and 21.6 ppm silver.

SKARNS

Skarn deposits within the Koyukuk Mining District are the result of Devonian and Cretaceous granitic plutons intruding the extensive Devonian carbonate units of the Arctic Alaska terrane and the much thinner carbonate units of the Ruby terrane. Prospects cited in this report include tin skarns within the Gates of the Arctic National Park, copper skarns north of Bettles River, and tungsten skarns near Bonanza Creek.

Tungsten Skarns

Skarns occur along the northern contact of the mid-Cretaceous Kanuti Pluton with Paleozoic metasediments on the South Fork Koyukuk River. At the Bonanza prospect (map no. B17), the pluton consists of multiple-phase granite-monzogranite, with abundant pegmatite and aplite. The pluton intrudes pelitic and calcareous schist which contains small discontinuous masses of marble, less than 50 feet thick. The marble has locally been altered to calc-silicate rock, ranging from fine-grained siliceous pyroxene-garnet skarn to coarse-grained dark green pyroxene skarn. Trenches at the prospect expose skarn up to 16 feet wide and extending for 50 feet along strike. The skarns contain up to 10% coarse-grained scheelite, pyrrhotite, sphalerite, along with trace chalcopyrite, molybdenite, and galena. Samples collected by the BLM from a trench contain up to 1.44% tungsten, 1,438 ppm zinc, and 936 ppm lead.

The skarns are reported to be too sporadic and of insufficient grade to warrant further exploration (Union Carbide; 1979 WGM Inc., 1979, 1983; Patino Inc., 1983; Clautice, 1987).

Tin Skarns

Tin and base metal-bearing skarns occur in contact zones surrounding Middle Devonian granite orthogneiss making up the Arrigetch Peaks, near the western boundary of the district (map no. SP4). The granites are believed to be anatectic in origin, peraluminous, and emplaced at moderate depths. Regional metamorphism effected the area in the mid-Mesozoic, with uplift and cooling in the Late Cretaceous. The contact-metamorphic zone adjacent to the pluton contains hornfels, calc-silicate marble, skarns, and veins. The skarns are anomalous in tin, copper, and zinc. Garnetites and magnetite-rich skarns are reported to contain the highest tin concentrations, which range from 940 to 1,850 ppm. The known occurrences are reported to be quite small (less than 100,000 tons) with modest grades. This may be the result of extensive removal by erosion of the higher grade material from the cupola portion of the pluton (Newberry and others, 1986). Samples of magnetite-rich skarn, collected by the BLM near the Arrigetch Peaks, contain up to 7,269 ppm tin (figure 15).

Figure 15. Magnetite-rich skarn (dark outcrop) near the Arrigetch Peaks (map no. SP4).

Copper Skarns

The Chandalar copper belt comprises skarn occurrences over a 15-mile-long, northeast-trending zone located north of the Bettles River. The skarns are the result of the Early Devonian Horace Mountain plutons intruding the thick carbonate sequences of the Arctic Alaska terrane. They exhibit both prograde and retrograde mineral assemblages. The skarns also exhibit regional zoning: Cu-Ag skarns occur adjacent to mineralized meta-plutonic rocks along the southern portion of the belt, and Pb-Zn-Ag skarns occur distal to meta-intrusive rocks in the north (Newberry and others, 1986).

The Chandalar copper skarns contain massive, stringer, and disseminated pyrite, pyrrhotite, chalcopyrite, and local magnetite. Skarns sampled by the BLM at the Victor (map no. C12), Evelyn Lee (map no. C14), Ginger (map no. C17), and Hurricane-Diane (map no. C19) sites all contain significant copper-silver-gold values (figure 16). Significant values are loosely defined as greater than 3% copper, 10 ppm silver, and 1 ppm gold. The Evelyn Lee prospect has undergone the most extensive evaluation. It contains an indicated resource of approximately 1.1 million tons of 5% copper (DeYoung, 1978).

At the northern end of the Chandalar copper belt, mineralized skarns have a more complicated mineralogy and structure. At the Luna prospect (map no. C20) (figure 17) calc-silicate and schistose rocks host massive, stringer, and disseminated sulfides. These consist of pyrite, pyrrhotite, chalcopyrite, sphalerite, and magnetite. Devonian meta-intrusive rocks occur nearby. Drilling by WGM Inc.

intersected zones up to 6.1 feet thick containing 6.3% copper, 0.5% zinc, and 1.0 oz/ton silver (WGM Inc., 1978, 1979, 1980). Samples collected by the BLM contain up to 1.1 ppm gold along with elevated levels of copper, silver, lead, zinc, gold, cobalt, cadmium, arsenic, and mercury. Compared to other occurrences in the Chandalar copper belt, Luna is unique in its zinc content. This has led some to identify it as possibly volcanogenic in origin (WGM Inc., 1979; Nicholson, 1990; Ventures Resource Corporation, 1999). Similar polymetallic mineralization occurs at the nearby Cindy occurrence (map no. C23). Samples collected by the BLM of siliceous marble from Cindy average 955.5 ppb gold, 48.5 ppm silver, 225 ppm copper, 809.5 ppm lead, and 14,514 ppm arsenic.

Figure 16. Malachite-stained skarn outcrop at Hurricane-Diane, near Robert Creek (map no. C19).

Figure 17. Looking northeast along a sulfide bearing schist horizon (outlined) at the Luna prospect, near Robert Creek. Select samples of the sulfides contain up to 1.4 ppm gold, 98.4 ppm silver, 5.1% copper, and 29.9% zinc.

MASSIVE SULFIDES

Stratabound and carbonate-hosted massive sulfides

A series of lead-zinc-silver massive sulfide prospects and occurrences are located in the Endicott Mountains near Ernie Lake. These lie along the regionally metamorphosed southern margin of the Arctic Alaska terrane and may be metamorphosed stratabound(?) deposits. Some, such as those found at the Ann (map no. W8), Buzz (map no. W7), Abo (map no. W13), and Frog (map no. W9) prospects, have undergone detailed investigations, which included geophysical surveys and exploration drilling. The occurrences consist mostly of discontinuous pods and lenses of sulfides, hosted mostly in carbonates of the Middle Devonian Skajit Limestone. Massive sulfides occur in pods up to 9 feet in diameter and contain up to 25% galena, 25% sphalerite, and 50% pyrite. Samples collected from these prospects all contain anomalous silver, lead, and zinc values. At the Abo prospect, sulfides occur intermittently along a zone that is at least 5,000 feet long. A sample of mineralized dolomite float collected by the BLM contains 22.41% zinc and 1.80% lead. Select surface samples from the Frog prospect contain up to 34.7% zinc, 17.1% copper, 4.4% lead, and 32.8 ppm silver. Drilling by WGM Inc. at Frog intersected sulfide-bearing zones up to 11.7 feet thick. The Frog prospect is unique in its elevated copper content. These occurrences have been interpreted by some to be polymetallic veins or remobilized strata-bound sulfides (WGM Inc., 1977, 1978; Nokleberg and others, 1987).

Volcanogenic massive sulfides

At the Roosevelt Creek prospect (map no. W139) a belt of metarhyolite and associated felsic schist hosts semi-massive to massive sulfide mineralization consisting of pyrite, sphalerite, galena, and chalcopyrite. These rocks occur within a greenschist facies metamorphic belt on the southern margin of the Arctic Alaska terrane. The sulfides are not exposed at the surface, but drilling by the Anaconda Company intercepted a 12.5-foot-thick massive sulfide zone containing 7.29% zinc, 2.87% lead, 0.76% copper, and 2.96 oz/ton silver. The sulfide horizons are thin and lack continuity between drill holes (Marrs, 1978, 1979). This prospect has been classified as a Kuroko-type volcanogenic massive sulfide occurrence (Nokleberg and others, 1987).

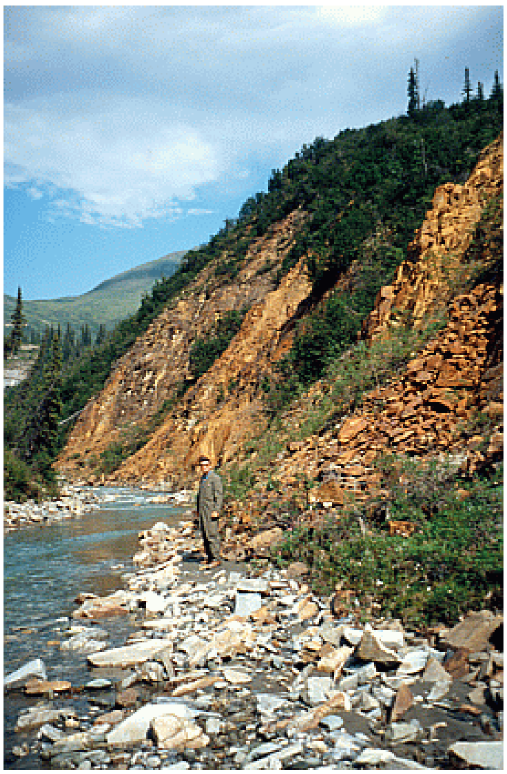
The host rocks at the Roosevelt Creek prospect are grossly similar to massive sulfide-bearing felsic rocks in the Ambler district, 100 miles to the west. It has been proposed that this prospect lies along an eastward extension of that belt and that it extends another 110 miles to the northeast to host massive sulfide occurrences at the Luna prospect (map no. C20) in the Chandalar copper belt. Luna is believed by some to be a skarn deposit (Nicol, 1983, Newberry and others, 1986; Newberry and others, 1997). This belt has been heavily prospected, but no sizeable occurrences have been discovered.

PORPHYRY DEPOSITS

Porphyry deposits are associated with strongly foliated Early Devonian granite and granodiorite in the northeastern portion of the Koyukuk district. These rocks are grouped into the Horace Mountain plutons and the Baby Creek batholith, which intrude Paleozoic carbonates and calcareous shales of the Arctic Alaska terrane.

The Horace Mountain plutons, are relatively small (0.5 to 10 square miles), and classified as metaluminous granite gneiss and hornblende granodiorite gneiss. The Baby Creek batholith is predominantly peraluminous biotite muscovite granite, and consists of four major and several minor granitic masses (possibly connected at depth) with a total surface area of more than 140 square miles. The Horace Mountain plutons and the Baby Creek batholith are both Early Devonian and have experienced subsequent metamorphic events that have resulted in schistose and foliated textures (Newberry and others, 1986; Dillon, 1989; Dillon and others, 1996).

Porphyry copper and molybdenum are associated with intense quartz-sericite-chlorite alteration zones occurring locally along the margins of these plutons. Quartz stockworks in the alteration zones contain disseminated pyrite, chalcopyrite, molybdenite, and occasionally epidote alteration. Documented sites occur on lower Big Spruce Creek (map no. C13) and upper Geroe Creek (map nos. C24-C25). The plutons are proximal to copper-silver skarns and distal to lead-zinc skarns (WGM Inc., 1973; Eakins and others, 1983).



At the Venus prospect (map no.C13), altered meta-intrusive rocks contain up to 5% pyrite and chalcopyrite. Four core holes drilled into the altered intrusive by WGM Inc., averaged 0.14% copper (WGM Inc., 1973). Nicholson (1990) estimated an indicated resource of 300,000 tons, averaging 0.3% copper at Venus. Select samples collected by the BLM contain up to 2,073 ppm copper and 1,473 ppm molybdenum. However, 14 samples, collected intermittently along a 1,800-foot-length of the alteration zone, average only 759 ppm copper. Samples of quartz-sericite-altered meta-granite collected by the BLM at Geroe Creek contain up to 1,457 ppm copper and 5,212 ppm molybdenum. The mineralization at these sites appears to be confined mostly to the intrusive margins and is limited in extent.

Figure 18. Sulfide-bearing granodiorite porphyry at the Venus prospect on Big Spruce Creek. Samples contain up to 0.47% copper.

TIN GRANITES

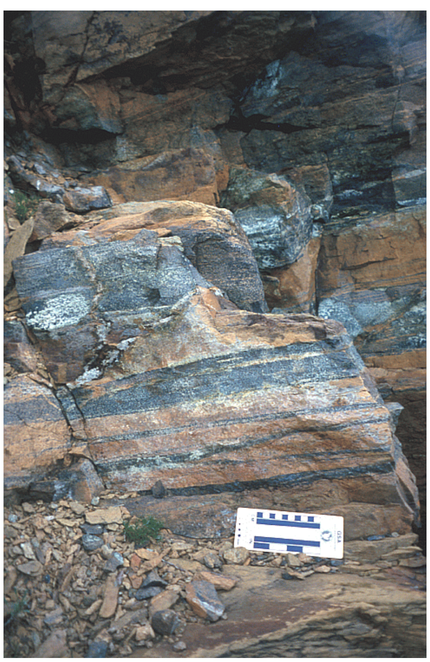
A series of Early Cretaceous, large granitic plutons intrude phyllite and schist of the Ruby terrane and mafic/ultramafic rocks of the Angayucham terrane in the southeast corner of the district. They are composed mainly of coarsely porphyritic biotite granite, but locally include granodiorite and monzonite. The Sithylemenkat pluton (map no. B29) is a two-phase granite that is locally altered and contains low-grade disseminated tin and tungsten. Mineralized zones show variable effects of greisenization with cassiterite, tourmaline, and magnetite sometimes present. Cassiterite has been identified as the tin mineral (Barker and Foley, 1986).

The greisen zones appear to be concentrated near intersections of high-angle linear structural features. These zones range between 10 and 15 feet wide and can be traced for up to 1,200 feet. These may represent the roots of a previously more extensive mineralized area, much of which has been removed by erosion, leaving only residual tin placer material. Samples of greisen contain up to 2,300 ppm tin (Barker and Foley, 1986, p. 10). Weathering of the granite has produced tin-bearing placers on the Kanuti and Kanuti Kilolitna Rivers which drain the pluton (map nos. B22, B28) (WGM Inc., 1980a, 1980c; Warner, 1985, p. 5; Patton, 1989, p. 28).

PODIFORM CHROMITE

The Caribou Mountain-Melozitna ultramafic belt, also known as the Kanuti ultramafic belt, trends northeast for 62 miles in the Kokrine-Hodzana Highlands. This belt follows the contact between the upper Paleozoic-Mesozoic Angayucham terrane to the north and the Proterozoic(?) and Paleozoic miogeoclinal rocks of the Ruby Geanticline to the south. A portion of the Ruby Geanticline underlies the highlands and consists of pelitic schist, quartzite, and phyllite with subordinate marble, metamorphosed graywacke, and slate (Patton, 1989, p. 27-30).

The metamorphosed sedimentary rocks are overlain by a sequence of Jurassic through Permian mafic volcanic and intrusive rocks that include pillow basalt, diabase and gabbro with subordinate basaltic and andesitic volcaniclastic rocks, chert, and cherty mudstone. The mafic rocks appear to be erosional remnants of allochthonous sheets of ophiolite and allied oceanic crustal rocks that were thrust over the metasedimentary sequence in late Mesozoic time. The mafic rocks are commonly metamorphosed to greenstone. It is with these mafic rocks that the ultramafic rocks of the Caribou Mountain-Melozitna belt are associated. The belt is composed of six Permian(?) through Jurassic(?) ultramafic bodies that represent a dismembered ophiolite assemblage consisting of serpentinized dunite and pyroxene-peridotite, pyroxenite, gabbro, diabase, altered pillow basalt, and associated chert. The ultramafic rocks outcrop as layered masses and grade upward into gabbroic and basaltic rocks. Bordering the ultramafic belt on the north are Cretaceous sedimentary and volcanic rocks of the upper Koyukuk basin (Foley and McDermott, 1983; Patton, 1989, p. 27-30; Foley, 1992).



In the lower Kanuti River area (map no. B24), 14 chromite occurrences are scattered over a 10-mile-long exposure of serpentinized dunite and peridotite. Chromite occurs in banded and disseminated forms in the dunite (figure 19). Select samples contain up to 25.8% chromium with an average content of 1.7% chromium (Foley and McDermott, 1983). The U.S. Bureau of Mines conducted a beneficiation test of a bulk sample from the site. The sample contained 53.8% chromic oxide (Cr_2O_3) with a chromium to iron ratio of 2.4:1. Chromium recovery was 87%. The chromite occurrences are small and discontinuous, but it is possible that larger buried deposits exist. The occurrences are reported to contain a total inferred resource of 31,000 tons chromic oxide (Foley and McDermott, 1983; Dahlin and others, 1983; Foley, 1992). Select samples of chromite-serpentine-bearing dunite contain up to 1,337 ppb platinum and 377 ppb palladium (Foley, 1992, p. 15).

Figure 19. Podiform chromite bands (black) hosted by dunite of the lower Kanuti ultramafic complex. Select samples contain up to 25.8% chromium and 1,359 ppm nickel.

COAL

Isolated exposures of coal occur on the north side of the Middle Fork Koyukuk River near Tramway Bar (map no. W122) (figure 20). The beds occur near the northeastern edge of the Koyukuk Basin, a broad Cretaceous through Tertiary trough that stretches across west-central Alaska. The coal was reportedly used by early miners in the district for blacksmithing purposes. There are no indications of recent use of the coal. The coal beds in this portion of the Koyukuk basin have the potential to contain methane, which could be tapped to run electrical generators in the nearby communities of Bettles and Coldfoot (Schrader, 1900, p. 485; Collier, 1903, p. 48-49; Rao, 1980; Meyer, 1990).

Samples collected by the BLM indicate the coal is bituminous in quality with individual seams measuring up to 11 feet thick. Clay partings are interbedded with the coal. Analysis shows the coal to contain low sulfur and high ash contents which places it in the unclean category. An inferred coal resource of 18,000 tons has been estimated by the BLM.

Figure 20. A 4-foot-thick bituminous coal seam interbedded with Late Cretaceous sandstone near Tramway Bar (map no. W122).

PRODUCTION AND RESOURCES

Placer gold has been the principal mineral commodity produced in the Koyukuk Mining District. Total gold production by year is illustrated in figure 6. Total production from individual properties is listed in Appendix J. (For yearly production from individual properties, refer to the property summaries listed in Appendices B-I.) This information was gathered from a variety of sources: U.S. Bureau of Mines permanent individual mine records, U.S. Mint records, U.S. Geological Survey Bulletins, unpublished company reports, and personal communications. Much of the early placer gold production in the district was reported in dollars. This was converted to troy ounces (oz), using the historical gold price adjusted by the reported gold fineness.

Early production is well documented since the majority of the gold was purchased by the U.S. Mint. After the early 1970s, records are incomplete due to deregulation of the gold price and the ability of miners to sell their gold on the open market. Documented production obtained from the sources listed above totals 333,893 oz gold, but it has been reported to be as high as 342,489 oz (Swainbank and others, 2000). Approximately 70% of this gold comes from creeks in the Wiseman-Coldfoot area. Nolan Creek and its tributaries have produced the majority (175,000 oz), followed by the Hammond River drainage (34,600 oz). Lode production consists of a few tons of antimony ore recovered from Smith Creek in 1942 and again in the 1980s. There is no record of the ore being shipped out of the district (Joesting, 1943; Saunders, 1954).

Resource classifications are based on the following criteria developed by the BOM and USGS (U.S. Geological Survey, 1980):

> Measured - Quantity is computed from dimensions revealed in outcrops, trenches, workings, or drill holes; grade and/or quality are computed from the results of detailed sampling. The sites for inspection, sampling, and measurement are spaced so closely and the geologic character is so well-defined that size, shape, depth, and mineral content of the resource are well established.
>
> Indicated - Quantity and grade and/or quality are computed from information similar to that used for measured resources, but the sites for inspection, sampling, and measurement are farther apart or are otherwise less adequately spaced. The degree of assurance, although lower than that for measured resources, is high enough to assume continuity between points of observations.
>
> Inferred - Estimates are based on an assumed continuity beyond measured and/or indicated resources for which there is geologic evidence. Inferred resources may or may not be supported by samples or measurements.

Resource classifications were determined by the BLM when sufficient information concerning the continuity and grade at a site was available. Lode resources were calculated using the average length, width, and depth of a mineralized body. If the depth could not be determined, it was assumed equal to half the strike length. Tonnage factors were obtained from standard tables (McKinstry, 1948). Placer resources were determined by estimating the surface dimensions and average thickness of gold-bearing gravels. Placer grades were determined by the collection of 0.1 cy placer samples.

Shallow and moderately deep (less than 50 feet) placers in the district have been depleted for the most part. Potentially large resources still exist in high bench gravels and in deep buried channels. Small, but potentially high-grade resources exist on the margins of previously mined channels and in creeks that can be mined with a suction dredge.

Placers on Slisco bench (map no. W106) near Vermont Creek on the west side of the Hammond River contain a measured resource of 31,099 oz gold with grades of up to 0.3 oz/cy. Inferred resources on the same bench range from 50,000 to 150,000 oz. The placer gold underlies barren gravel up to 80 feet thick (Silverado Gold Mines Ltd., 2002). Bench placers on the east side of Nolan Creek (map no. W96) contain a measured resource of 2,500 oz (Silverado Gold Mines Ltd., 2002). Underground drifting would be required to develop these deposits. In addition, water for sluicing would have to be pumped up several hundred vertical feet to the mine sites.

Deep channel placers underlying Nolan Creek contain an inferred/indicated resource of 114,760 oz (Silverado Gold Mines Ltd., 2002). The deep channels are up to 200 feet beneath the surface and, like the benches, would require mining by underground methods. A buried channel containing an inferred resource of 2.4 million cy of gold-bearing gravel may exist in an abandoned channel of Gold Creek (map no. C45). Only a small portion of this channel has been explored by underground drifting. Streams on the east fork of the Kanuti Kilolitna River contain an indicated resource of 3.5 million cy averaging 0.67 lb/cy of placer tin (WGM Inc., 1980).

Few resource estimates have been made for lode deposits in the district. An indicated resource of 1.1 million tons averaging 5.0% copper has been outlined at the Evelyn Lee prospect near Big Spruce Creek (map no. C14) (DeYoung, 1978). Other estimates included the potential for tens of millions of tons of 1% to 5% copper with additional gold and silver credits (WGM Inc., 1973; Ventures Resource Corporation, 1999). An inferred lode gold resource ranging from 0.3 to 1.0 million oz is reported to exist in the Nolan drainage (Silverado Gold Mines Ltd., 2002). An inferred resource of 30,000 tons averaging 1.22 oz/ton gold and 18.44% antimony exists at the Sukakpak Mountain prospect (map no. C42), as estimated by the BLM. This site is within the Trans-Alaska Pipeline corridor and is currently closed to mineral entry.

Ultramafic rocks in the southern portion of the district contain an inferred resource of 31,200 tons of chromic oxide (map nos. B20, B24, T2) (Foley, 1992). An inferred resource of 18,000 tons of bituminous coal exists near Tramway Bar (map no. W122), as estimated by the BLM.

MINERAL DEVELOPMENT POTENTIAL

All the located mines, prospects, and occurrences in the Koyukuk Mining District were classified with regard to their respective resources and grades of mineralization. The classifications were based on the following criteria:

High Mineral Development Potential - High grades and probable continuity of mineralization exist. The property is likely to have economically mineable resources under current economic conditions. A high potential exists for developing tonnage or volume with reasonable geologic support for continuity of grade.

Moderate Mineral Development Potential - Either a high grade or continuity of mineralization exists, but not both. Mineralization has a limited extent due to deposit geology and/or grades are low and tend to stay low. The property is not economically mineable (i.e. due to low tonnages and grades) under existing conditions (i.e., economical, political, technological). It could serve as a material source if economics are not a factor.

Low Mineral Development Potential - The property exhibits uneconomic grades and/or little evidence of continuity of mineralization. There is little or no potential for developing ore resources, nor is it a significant source of the material of interest.

Unevaluated - This category includes all properties not located or visited in the field. Data are only available from previous reports.

Unknown - Insufficient work was done at the prospect for an evaluation.

Placer samples were rated according to the following classification based on Bureau sampling:

Highly significant - recovered values higher than 0.05 oz/cy gold.
Significant - recovered values from 0.005 to 0.05 oz/cy gold.
Background - recovered values less than 0.005 oz/cy gold.

Appendix J presents summary information on all mines, prospects, and mineral occurrences identified in the Koyukuk Mining District, including mineral resource potential. These are listed by map numbers shown on Plate 1. Areas having mineral development potential are illustrated on figure 21.

In the north-central part of the district, Lake (map no. W57) and Mascot Creeks (map no. W70) have moderate mineral development potential for placer gold. Mining has taken place at both sites in recent years.

On the Middle Fork Koyukuk River, high bench gravels on Nolan Creek (map no. W96), Smith Creek (map no. W97), and the lower and upper Hammond River (map nos. W88, W106) have moderate mineral development potential. Modern channels with limited amounts of placer gold include Sheep (map no. C46), Nugget (map no. C48), and Gold Creeks (map no. 50). Deep channels in Nolan and Linda Creeks (map no. C45) also have moderate potential. All of these sites are accessible via the Dalton Highway and many have active claims.

Moderate potential exists for lode gold on Sukakpak Mountain (map no. C42). The site is located within the Trans-Alaska Pipeline inner corridor and is closed to mineral entry.

Fine gold was consistently panned along 15 miles of the South Fork Koyukuk River; however, three sites were noteworthy. High potential exists for placer gold in low bench gravels at Ironside Bench (map no. B4) and moderate potential, for modern channel and bench placer gold at Davis (map no. B2) and Bear Creeks (map no. W132).

In the southwestern portion of the district, there is high mineral development potential for a small-scale placer gold operation at Black Creek (map no. H8). Also, there is moderate potential for lode gold in the upper Indian River area (map nos. H9, H13, H14).

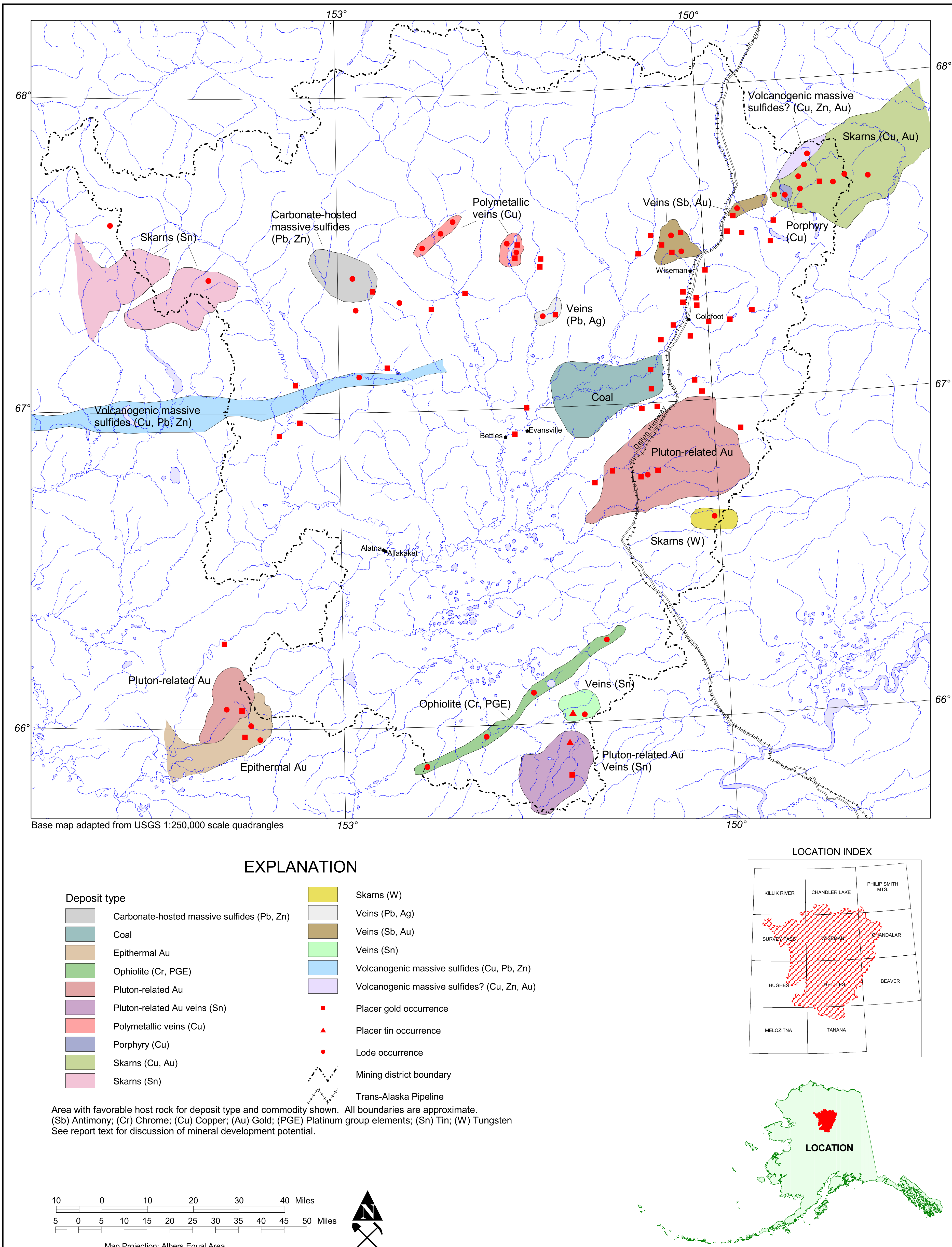


Figure 21. Areas in the Koyukuk Mining District containing significant mineral occurrences and favorable host rocks for lode mineral deposits.

SUMMARY

The BLM identified and evaluated 269 mines, prospects, and mineral occurrences in the Koyukuk Mining District. This includes 27 previously undescribed occurrences. Site evaluations included rock, stream sediment, pan concentrate, placer, and soil sampling, as well as geologic mapping. Mineral commodities occurring in the district include placer and lode gold, silver, tin, copper, lead, zinc, tungsten, chromium, and coal. Industrial minerals, including construction materials, were not evaluated as part of this study.

Upper Black Creek and Ironside Bar contain high mineral development potential for small, but potentially high-grade gold-bearing gravel. Moderate development potential for placer gold exists in the Nolan-Hammond River area which contains a measured resource of 34,600 oz. Moderate potential exists for an extensive resource of gold-bearing gravel near Linda Creek. Moderate development potential exists at Davis Creek for gold-bearing gravel that could support a small-scale mining operation.

Sulfide-bearing hornfels and altered intrusive rocks in Black Creek have moderate development potential for lode gold. Quartz veins on Sukakpak Mountain contain moderate development potential for small, but high-grade gold resources. Quartz veinlets on Vermont Creek contain up to 63.6 ppm gold, but development potential is low as the veins do not occur in high enough concentrations to be economic.

In the Bettles River area, a 15-mile-long trend contains copper skarns associated with Devonian meta-intrusive rocks. The Evelyn Lee prospect, which is the largest of these bodies, drilling has outlined an indicated resource of 1.1 million tons averaging 5.0% copper. In addition, select samples contain up to 1.9 ppm gold. The limited extent of the known resource gives the site low development potential for copper. At the headwaters of Bonanza Creek, small pyroxene skarn bodies contain up to 1.44% tungsten, but have low development potential due to the limited extent of the resource.

A belt of meta-rhyolite and felsic schist in the Roosevelt Creek area is grossly similar to massive sulfide-bearing rocks in the Ambler District, 100 miles to the west. Drilling at this site has intercepted massive sulfide beds up to 13 feet thick with up to 0.76% copper, 2.87% lead, 7.29% zinc, and 2.96 oz/ton silver. The site has low development potential as drilling results indicate that the sulfides are not extensive.

Possible stratabound massive sulfides are associated with carbonate rocks at the Buzz, Abo, and Frog prospects near Ernie Lake. Select samples contain up to 22.7% zinc, 7.21% lead, 5.72 oz/ton silver, and 2.34 ppm gold. However, drilling results indicate that the sulfides occur in small, discontinuous pods and lenses which have low development potential.

A 62-mile-long belt of ophiolitic rocks in the southern portion of the district contains inferred resources totaling 31,000 tons of chromic oxide. Samples contain up to 26% chromium and 1,359 ppm nickel. The occurrences are small and have low development potential.

Coal resources exist near Tramway Bar on the Middle Fork Koyukuk River. Samples collected by the BLM indicate the coal to be bituminous in quality with individual seams measuring up to 11 feet thick. The coal is low in sulfur but has a high ash content, which places it in the unclean category. As determined by the BLM, an inferred coal resource of 18,000 tons exists at the site. The coal has low mineral development potential due to the limited extent of the exposed resource and the high ash content.

Additional significant results from this study include the following: (1) the delineation of anomalous gold values within volcanic and hornfelsed rocks on the upper Indian River, (2) gold anomalies associated with the Jim River Pluton, (3) anomalous placer gold in bench gravels on the upper Hammond River, and (4) gold anomalies in skarns and massive sulfides north of the Bettles River.

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Appendix A

Analytical procedures

APPENDIX A

ANALYTICAL PROCEDURES

Rock, soil, and stream sediment samples were analyzed for a standard suite of 36 elements. Pan, placer, and sluice concentrates were also analyzed for platinum, palladium, and (when warranted) uranium and thorium. Intertek Testing Services[1] of Vancouver, Canada conducted the analyses. Pan concentrate and rock samples were dried and pulverized to minus 150 mesh. Stream sediment and soil samples were dried and sieved through to minus 80 mesh.

Gold was analyzed by a pre-concentration fire assay followed by either an atomic absorption (AA) finish or an induction couple plasma (ICP) atomic emission spectroscopy finish. Platinum and palladium were also analyzed by a pre-concentration fire assay followed by an ICP finish. The detection limits for gold, platinum, and palladium are illustrated in Table A-1. Occasionally, a sample was analyzed for gold multiple times with erratic results. In such cases, the laboratory reported the averaged result.

The standard method for all other elements (except mercury) was ICP atomic emission spectroscopy. The samples were prepared by aqua regia digestion, which is a (3:1) HCl-HNO_3 solution. The minimum detection for the elements tested by ICP methods are presented in Table A-2.

Special analyses were needed when the upper limits of the ICP atomic emission spectroscopy were exceeded or when ICP was not the best method. Concentrations of gold and silver which exceeded the upper detection limit (>10,000 and >500 ppb, respectively) for the AA finish were re-analyzed by fire assay gravimetric methods. Elevated concentrations of antimony, bismuth, copper, iron, lead, and zinc were re-analyzed by multi acid digestion followed by atomic absorption. Barium, tin, tungsten, thorium, and uranium were analyzed by X-ray fluorescence. The analysis for mercury consisted of aqua regia digestion followed by cold vapor measurement. The detection limits (and methods) for these special runs are listed in Table A-3.

In 1994, 56 samples were collected during a brief visit to the Koyukuk Mining District. They were analyzed by different analytical methods than the 1997 to 2001 samples. The methods and detection limits for the 1994 samples are presented in Table A-4. The complete analyses for some of these samples were not received and the pulps were subsequently lost.

The coal samples were analyzed by Commercial Testing & Engineering Company[2] of Lombard, Illinois. The moisture, ash, volatile, fixed carbon, and sulfur contents were measured according to American Society for Testing Materials specifications (ASTM-D-3302, -3174, -3175, -3172, -4239, respectively). The Btu/lb and coal classification were determined by specifications ASTM-D-3286 and ASTM-D-388-66, respectively.

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[1] Mention of Intertek Testing Services does not signify BLM endorsement.
[2] Mention of Commercial Testing & Engineering Company does not signify BLM endorsement.

Table A-1. Standard fire assay analysis for gold, platinum, and palladium.

Element symbol	Element name	Minimum detection	Finish method
Au	gold	5 ppb	atomic absorption
Au	gold	1 ppb	ICP
Pt	platinum	5 ppb	ICP
Pd	palladium	1 ppb	ICP

Table A-2. Minimum detections for ICP - atomic emission analysis (standard run).

Element symbol	Element name	Minimum detection	Element symbol	Element name	Minimum detection
Ag	silver	0.2 ppm	Mo	molybdenum	1 ppm
Al	aluminum	0.01%	Na	sodium	0.01%
As	arsenic	5 ppm	Nb	niobium	1 ppm
Ba	barium	1 ppm	Ni	nickel	1 ppm
Bi	bismuth	5 ppm	Pb	lead	2 ppm
Ca	calcium	0.01%	Sb	antimony	5 ppm
Cd	cadmium	0.2 ppm	Sc	scandium	5 ppm
Co	cobalt	1 ppm	Sn	tin	20 pm
Cr	chromium	1 ppm	Sr	strontium	1 ppm
Cu	copper	1 ppm	Ta	tantalum	10 ppm
Fe	iron	0.01%	Te	tellurium	10 ppm
Ga	gallium	2 ppm	Ti	titanium	0.01%
K	potassium	0.01%	V	vanadium	1 ppm
La	lanthanum	1 ppm	W	tungsten	20 ppm
Li	lithium	1 ppm	Y	yttrium	1 ppm
Mg	magnesium	0.01%	Zn	zinc	1 ppm
Mn	manganese	1 ppm	Zr	zirconium	1 ppm

Table A-3. Methods and minimum detection limits for special runs.

Element symbol	Element name	Analytical method	Minimum detection
Ag	silver	fire assay, gravimetric finish	0.7 ppm
Au	gold	fire assay, gravimetric finish	0.17 ppm
Ba	barium	atomic absorption	0.01%
Ba	barium	X-ray fluorescence	10 ppm
Bi	bismuth	atomic absorption low level assay	0.005%
Cu	copper	atomic absorption low level assay	0.01%
Fe	iron	atomic absorption low level assay	0.01%
Pb	lead	atomic absorption low level assay	0.01%
Sb	antimony	atomic absorption low level assay	0.01%
Sn	tin	X-ray fluorescence	4 ppm
Th	thorium	X-ray fluorescence	1 ppm
U	uranium	X-ray fluorescence	1 ppm
W	tungsten	X-ray fluorescence	4 ppm
Zn	zinc	atomic absorption low level assay	0.01%

Table A-4. Analytical methods and detection limits by element for 1994 samples.

Element symbol	Element name	Analytical method	Minimum detection
Au	gold	neutron activation	5 ppb
Au	gold	fineness	0.10 ppt
Pt	platinum	fire assay - DCP	5 ppb
Pd	palladium	fire assay - DCP	1 ppb
Ag	silver	neutron activation	5 ppm
Ag	silver	fire assay	0.02 oz/ton
Cu	copper	atomic absorption	0.01%
Pb	lead	atomic absorption	0.01%
Zn	zinc	neutron activation	200 ppm
Mo	molybdenum	neutron activation	2 ppm
Ni	nickel	neutron activation	20 ppm
Co	cobalt	neutron activation	10 ppm
Cd	cadmium	neutron activation	10 ppm
As	arsenic	neutron activation	1 ppm
Sb	antimony	neutron activation	0.2 ppm
Sb	antimony (ore grade)	atomic absorption	0.01%
Hg	mercury	cold vapor AA	0.010 ppm
Fe	iron	neutron activation	0.5%
Te	tellurium	neutron activation	20 ppm
Ba	barium	neutron activation	100 ppm
Cr	chromium	neutron activation	50 ppm
Sn	tin	neutron activation	200 ppm
W	tungsten	neutron activation	2 ppm
La	lanthanum	neutron activation	5 ppm
Na	sodium	neutron activation	0.05%
Sc	scandium	neutron activation	0.5 ppm
Ta	tantalum	neutron activation	1 ppm
Zr	zirconium	neutron activation	500 ppm

PROPERTY SUMMARY DEFINITIONS

Name: Historical or most commonly used name listed first, followed by associated claim names.

Map No: The properties are listed by map number. The number is prefaced by a letter designating the 1:250,000 quadrangle in which the site occurs. For example, Bettles (B), Chandalar (C), Chandler Lake (CL), Hughes (H), Melozitna (M), Survey Pass (SP), Tanana (T), and Wiseman (W). Refer to Plate 1 (in pocket).

MAS No: U.S. Bureau of Mines Minerals Availability System sequence number.

Kardex No: Alaska Mineral Property Reference File.

ARDF No: U.S. Geological Survey Alaska Resource Data Files.

ADL No: Alaska Division of Land reference number.

Deposit Type: As defined by the U.S. Geological Survey (Nokleberg and others, 1987; Cox and Singer, 1992).

Location: Coordinates, public land survey grid, and geographic descriptions are stated for each site. Land status is mentioned only if it directly effects mineral entry.

Coordinates: Coordinates are in degree-minute format, and use the North American datum 1927.

Quadrangle: Refers to U.S. Geological Survey 1:63,360 quadrangle.

Production: This information was gathered from a variety of sources, including U.S. Bureau of Mines Permanent Individual Mine Records (PIMRs), U.S. Mint records, U.S. Geological Survey Bulletins, unpublished company reports, and personal communications.

Bureau Investigation: The following placer gold size definitions are used throughout the text:

>2.0 mm - very coarse
1.0 - 2.0 mm - coarse
0.5 - 1.0 mm - fine
<0.5 mm - very fine

Resource Estimate: See definitions p. 33.

Mineral Development Potential: See definitions p. 35.

Appendix B

Summaries of mines, prospects, and mineral occurrences in the Bettles quadrangle (listed by map number)

Property Summary

Name(s): Blahuta Creek

Map No: B1
MAS No: 0020390041
Alaska Kardex 039-013

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Bettles D-1
SW¼ sec. 17, T. 25 N., R. 12 W.
Meridian: Fairbanks
Elevation: 1,820 feet
Latitude: 66° 59.341' N.
Longitude: 150° 15.049' W.
Geographic: Local name for a north-flowing tributary of South Fork Koyukuk River.

History:

1985 - Four placer claims staked by A. Blahuta (Kardex).

Production: Unknown.

Workings and Facilities: None observed.

Geologic Setting:

Blahuta Creek is just south of the South Fork fault, which separates the Ruby and Angayucham terranes. The Ruby terrane is composed of Proterozoic to lower Paleozoic continentally associated metasedimentary rocks and protoliths. The Angayucham terrane is derived from oceanic crust and contains diabase, pillow basalt, chert, and graywacke. Mid-Cretaceous granitic plutons intrude both terranes, providing an upper age limit for thrusting of the Angayucham over the Ruby (Dillon and others, 1989). The bedrock at Blahuta Creek is a Cretaceous porphyritic biotite quartz monzonite of the Jim River Pluton (Patton and Miller, 1973; Blum and others, 1989)

Bureau Investigation:

No bedrock was observed on Blahuta Creek at the site examined. Stream float consisted of granitic rock with textures ranging from porphyritic to fine grained. Potassium feldspar veinlets cut the granitic float. Select pieces of the float attracted a magnet due to a high magnetite(?) content. Minor diabase was also observed.

A stream sediment and pan concentrate sample (11911-11912, table B-1) were collected at Blahuta Creek. The assay results were not anomalous. Other creeks draining the Jim River Pluton are anomalous in gold. This includes Hidden Creek (map no. W129) and the Jim River Canyon (map no. B9).

Resource Estimate: None.

Mineral Development Potential: Low development potential for placer gold.

Recommendations: None.

References:

Blum, J.D., Dillon, J.T., and Blum, A.E., 1989, Regional significance of the Jim River and Hodzana plutons *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 2, p. 189-190.

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Property Summary

Name(s): Davis Creek
Davis Creek 1-2 claims

Map No: B2
MAS No: 0020390037
Alaska Kardex 039-002

Deposit Type: Placer

Commodities: Au, W, Bi

Location:

Quadrangle: Bettles D-1 — NW¼ sec. 17, T. 25 N., R. 13 W.
Meridian: Fairbanks — Elevation: 1,100 feet
Latitude: 66° 59.649' N. — Longitude: 150° 28.150' W.
Geographic: A three-mile-long southern tributary to the South Fork Koyukuk River, 6 miles downstream from the Dalton Highway. Access via boat down river from the Dalton Highway.

History:

1908 - Good pay reported on Davis Creek (Fairbanks Daily Times, 1908).
1938 - Reed (1938) reported considerable mining occurring on Davis Creek in "early days" (circa 1900).
1978 - D. Carnell staked 37 placer claims (Kardex).
1995-2001 - Small-scale bulk sampling and production by L. and S. Greene (Bundtzen and others, 1996).

Production:

1900-09 - 242 oz Au (Maddren, 1913). Records incomplete.

Workings and Facilities:

Davis Creek is reported to be one of the first known placer gold streams in the valley of the South Fork Koyukuk River (Maddren, 1913). The lower quarter of a mile of Davis Creek has been extensively mined by hand and mechanized methods. A large tailings dump is located near the creek mouth. There are several opencuts and a shallow shaft on the north bank of the creek, leftover from attempts to expose pay in bench gravels. A water ditch along the north side of the creek was probably used in efforts to remove overburden from bench placers. Recent operators used a suction dredge to mine small pockets of gold-bearing gravel left by previous operations. A small excavator sets upstream from the shaft. A cabin is located near the creek mouth and another sets across the Koyukuk River.

Geologic Setting:

Davis Creek is immediately south of the South Fork fault, which trends east-northeast. The fault is one of several Late Cretaceous to early Tertiary generally east-west-trending, high-angle fault zones that have many miles of right slip. It is characterized by gouge that separates equivalent portions of the Angayucham terrane and marks the northern limit of Cretaceous granites in Alaska (Dillon and others, 1989).

The bedrock at Davis Creek consists of Upper Paleozoic to Mesozoic Angayucham terrane units. The mouth contains Paleozoic pelitic schists with subordinate quartzite. Overlying the schist are: (1) Jurassic mafic volcanic and intrusive rocks including pillow basalt, diabase, and gabbro with subordinate volcaniclastic rocks and cherty units; (2) coeval ultramafic rocks (serpentinized peridotite and dunite); and (3) Cretaceous quartz-pebble conglomerates. Bedrock near the creek mouth is chlorite schist containing lenses of metamorphic quartz up to 1.0 foot thick and parallel north-south-trending schistosity. The quartz contains ankerite, minor pyrrhotite and trace chalcopyrite(?). Small amounts of chalcopyrite have been found in gabbro outcrops one mile upstream from the mouth of Davis Creek. The schist near the mouth of the creek lies within the core of a large southwest-plunging anticline (Patton and Miller, 1973).

In Davis Creek, placer gold occurs in two modes: on bedrock in the modern stream and on benches on the north side of the stream. In the modern stream, gold-bearing gravel lies on an irregular bedrock surface containing numerous potholes. These deposits have been mostly mined out, but a few of the potholes have been mined recently, using a suction dredge. The bench deposits consist of gold-bearing gravel lying on an old erosional surface located about 10 feet above the modern stream channel. Due to thick overburden, these deposits have only been partially mined. The bench deposits contain few large boulders. The modern stream channel on upper part of Davis Creek contains numerous large boulders, some up to 4 feet in diameter.

The lower quarter of a mile of Davis Creek cuts through a 50-foot-thick sequence of fluvial gravel deposited by the ancestral South Fork Koyukuk River. This sequence contains fine placer gold associated with clay layers in the gravel. The lower portion of this sequence has been mined for placer gold at several places along the South Fork including the Ironsides Bench (map no. B4) and Gold Bench (map no. B5).

Bench placers may have been formed by an ancestral channel of the Koyukuk River. The modern stream placers probably resulted from downcutting through the bench deposits by Davis Creek, which reworked the gold and deposited it in the modern channel. Maddren (1913) believed the source of the gold to be the ridge on the south side of the river.

Bureau Investigation:

Test pans taken off bedrock in the modern stream contained coarse, smooth gold flakes. However, little gravel resource remains. Test panning of the bench deposits showed gold to be concentrated in a two-foot-thick section of fractured bedrock with a thin blue clay layer cap overlain by gravel. Gold was observed in a series of pans taken at intervals from a 150-foot stretch of the bench gravels that are exposed on the north side of the creek. Two placer samples taken from this section (11998-11999, table B-1) average 0.016 oz/cy. The samples contained very coarse, flat, smooth, rounded flakes of gold. Overburden ranges from 5 to 50 feet of gravel containing a moderate amount of boulders. Bench deposits were not observed on the south side of the creek.

The bench placers may have been deposited in a channel cut by the ancestral Koyukuk River. If so, then the placers could be quite extensive. Another possibility is that the bench was cut by a meander of ancestral Davis Creek. If true, then the benches may be small in extent. The placer gold is well worn which indicates a long transport distance such as that provided by the river rather than Davis Creek. This evidence supports a Koyukuk River origin for the gold. A water-filled shaft was apparently sunk through the overburden to test the extent of the pay in the bench gravels north of the creek. It does not appear to have reached bedrock. A small sluice box next to the shaft was apparently used to test material brought up from the shaft. A sample of sluice concentrates (11997) contained a moderate amount of magnetite and 181 ppm gold.

In addition to gold, placer samples are anomalous in bismuth, tungsten, zinc, and copper. A placer sample (11999) contains 1,591 ppb bismuth. A small soft metallic grain observed in the concentrates could be native bismuth. The copper values may be related to chalcopyrite-bearing gabbro, which has been reported to outcrop in upper Davis Creek (Patton and Miller, 1973a). Scheelite was identified in the samples. One of 3 test pans taken on top of clay layers in the Koyukuk River bluffs, just north of Davis Creek, contained fine gold. Select samples of the pyrrhotite-bearing sheared quartz lenses cutting bedrock in the creek bottom contain up to 150 ppb gold and 444 ppm copper (11949, 11993).

Resource Estimate:

Inferred resource: 23,000 cy averaging 0.016 oz/cy gold.

Mineral Development Potential:

Moderate potential for gold in bench placers. Portions may not be economic due to excessive overburden.

Recommendations: Drill out benches on north side of the creek. .

References:

Bundzten, T.K., Swainbank, R.E., Clough, A.H., Henning, M.W., and Charlie, K.M., 1996, Alaska's mineral industry 1995: Alaska Division of Geological and Geophysical Surveys Special Report 50, p. 23.

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____1978, Summary of references to mineral occurrences (other than mineral fuels and construction materials) in the Beaver, Bettles, and Medfra quadrangles, Alaska: U.S. Geological Survey Open-File Report 78-94, p. 8.

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Mulligan, J.J., 1974, Mineral resources of the Trans-Alaska Pipeline corridor: U.S. Bureau of Mines Information Circular 8626, 24 p. 10.

Patton, W.W., Jr., and Miller, T.P., 1973a, Analyses of stream-sediment samples from the Bettles and the southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Open-File Report 73-219, p. 6, 1 sheet, scale 1:250,000.

____1973b, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 161.

Property Summary

Name(s): Rock Creek - South Fork tributary
Rock Creek No. 1 claim

Map No: B3
MAS No: 0020390042

Deposit Type: Placer

Commodities: Au

Location:
Quadrangle: Bettles D-2 — SE¼ sec. 13, T. 25 N., R. 14 W.
Meridian: Fairbanks — Elevation: 1,000 feet
Latitude: 66° 59.867' N. — Longitude: 150° 31.917' W.
Geographic: A short northern tributary of the South Fork Koyukuk River, 2.8 miles east of Gold Bench.

History:

1900s - Reed (1938) reported that $800 was mined in the “early days.” No other data is known.

Production:

1900s - 39 oz Au (Reed, 1938)

Workings and Facilities: None observed.

Geologic Setting:

Rock Creek is at the fault zone that divides the Ruby and Angayucham terranes. The Ruby terrane is composed of Proterozoic to lower Paleozoic continentally associated metasedimentary rocks and protoliths. The Angayucham terrane is derived from oceanic crust and contains diabase, pillow basalt, chert, and graywacke. Mid-Cretaceous granitic plutons intrude both terranes, providing an upper limit for thrusting of the Angayucham over the Ruby (Dillon and others, 1989).

Bedrock in the vicinity of Rock Creek is predominantly Cretaceous igneous pebble-cobble conglomerate. The unit contains poorly sorted clasts of mafic volcanic and intrusive rocks, chert, and graywacke. It occurs along the south edge of the Brooks Range and the west edge of the Kokrines-Hodzana Highlands (Patton and Miller, 1973).

Bureau Investigation:

A stream sediment and a pan concentrate sample (11585-11586, table B-1) were collected from the mouth of Rock Creek. Both samples were anomalous in gold, measuring 167 ppb and 301 ppb respectively. No gold was observed in test pans. Bedrock was not exposed at the sample site.

Resource Estimate: None.

Mineral Development Potential: Low potential for placer gold on lower creek due to low gold values.

Recommendations: Prospect upstream from the creek mouth.

References:

Cobb, E.H., 1972, Metallic mineral resources map of the Bettles quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-387, 1 sheet, scale 1:250,000.

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Dillon, J.T., Solie, D.N., Decker, J.E., Murphy, J.M., Bakke, A.A., and Huber, J.A., 1989, Road log from South Fork Koyukuk River (mile 156.2) to Chandalar Shelf (mile 237.1) *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 1, p. 74-100.

Patton, W.W., Jr., and Miller, T.P., 1973, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 160-161.

Property Summary

Name(s): Ironside Bench
Ironside Bar
Alaskan Aqua Nos. 2-3 claims

Map No: B4
MAS No: 0020390043
Alaska Kardex 039-011

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Bettles D-2
SE¼ sec. 15, T. 25 N., R. 14 W.
Meridian: Fairbanks
Elevation: 920 feet
Latitude: 66° 59.147' N.
Longitude: 150° 36.491' W.
Geographic: On the south bank of the South Fork Koyukuk River, 9 miles downriver from the Dalton Highway and 1 mile upriver from Gold Bench.

History:

1900 - First recorded production from Ironside Bench (Maddren, 1913).
1900s - H. Missaporvity and F. Werther mined by ground sluicing (Reed, 1938).
1930 - One hole drilled by Capt. E.G. Rowden with uncertain results (Reed, 1938).
1936-41 - H. Missaporvity mined and prospected (U.S. Bureau of Mines PIMRs, 1936-1941).
1938 - Claims owned by F. Werther (Kardex).
1999 - V. Malatek prospected Ironside placers.

Production: (oz Au) (Maddren, 1913)

1900 - 27	1938 - 11
1901-09 - 80	1939 - 11
1936 - 45	1940 - 33
1937 - 34	1941 - 2
	Total: 243 (Records incomplete.)
	Average fineness: 907.5 (Reed, 1938)

Workings and Facilities:

Early mining at Ironside bench consisted of ground sluicing and shoveling in. Water was brought in by a ditch from nearby Ironside Creek. In 1937 a reported 40-acre area had been mined by hand methods (Reed, 1938). A later operation used a dragline(?) shovel - a method similar to that used at Gold Bench (map no. B5). The mining may have in fact been done by the same operator. The mine workings are currently water filled. The site contains numerous test pits, tailings piles, one cabin, a lean-to, and a large stack of fuel drums. A small portable gold recovery plant sets near a small pit about 250 feet from the river bank.

Geologic Setting:

The South Fork Koyukuk River lies along the trend of the South Fork fault, a late Cretaceous to Tertiary structure with many miles of right offset. Rocks north of the fault near Ironside Bench consist of Early Cretaceous pebble-cobble and quartz-pebble conglomerate and late Early Cretaceous volcanic graywacke and mudstone. South of the fault, pelitic schist and mafic volcanic and intrusive rocks occur in the core of a southwest-plunging anticline. Lenses and pods of rusty metamorphic quartz with chlorite partings occur in the schist. No sulfides were observed in either the schist or the quartz. Gneissic biotite-hornblende-bearing dikes occur locally (Patton and Miller, 1973; Dillon and others, 1989).

At Ironside Bench, gold occurs on a false bedrock(?) surface of blue clay that seems to be decomposed shale. The gravel is very coarse with few large boulders. Depth to the clay ranges from 6 to 30 feet with the upper 5 to 6 feet being muck and ice. The gold is fine, flaky, and waterworn. It occurs throughout the gravel, but is mostly on the clay surface. Values ranged from 0.007 to 0.016 oz/cy. This appears to be the same bench that was mined at Gold Bench, 1 mile to the west. It is thought that the Ironside placer deposits extend parallel to the river for at least 2 miles (Reed, 1938).

The origin of the gold is unknown. One theory is that it could have been washed in from Tramway Bar (map no. W125) through an ancestral channel that crossed between the two forks of the Koyukuk River. Another theory is that the source lies in the hills south of Gold Bench (Maddren, 1913). It is also possible that the gold is reworked from glacial deposits (Cobb, 1973).

Bureau Investigation:

Of 5 test pans taken off the tailings pile facing the river, one contained fine gold. A pan concentrate sample (11566, table B-1) contains 6,708 ppb gold. Test pans from a 7-foot-deep pit about 250 feet south of the river consistently contained 6 fine to coarse gold flakes. A placer sample of the material (12021) contains 0.107 oz/cy gold. The gold was flat and rounded with individual pieces larger than 4 mm. The sample was collected from large cobble gravel, and the concentrate contained abundant magnetite. This site did not appear to have been previously mined on a large scale.

Resource Estimate: Inferred resource of 50,000 cy at 0.107 oz/cy gold.

Mineral Development Potential:

Moderate to high potential for placer gold due to high gold values and the potential for extensive resources.

Recommendations: Test pits to determine the extent of the gold-bearing gravel.

References:

Cobb, E.H., 1972, Metallic mineral resources map of the Bettles quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-387, 1 sheet, scale 1:250,000.

____1973, Placer deposits of Alaska: U.S. Geological Survey Bulletin 1374, p. 159-160.

____1978, Summary of references to mineral occurrences (other than mineral fuels and construction materials) in the Beaver, Bettles, and Medfra quadrangles, Alaska: U.S. Geological Survey Open-File Report 78-94, p. 12.

Dillon, J.T., Solie, D.N., Decker, J.E., Murphy, J.M., Bakke, A.A., and Huber, J.A., 1989, Road log from South Fork Koyukuk River (mile 156.2) to Chandalar Shelf (mile 237.1) *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 1, p. 74-100.

Maddren, A.G., 1910, The Koyukuk-Chandalar gold region *in* Brooks, A.E., Mineral resources of Alaska, report on progress of investigations in 1909: U.S. Geological Survey Bulletin 442, p. 312.

____1913, The Koyukuk-Chandalar region, Alaska: U.S. Geological Survey Bulletin 532, p. 107.

Mulligan, J.J., 1974, Mineral resources of the Trans-Alaska Pipeline corridor: U.S. Bureau of Mines Information Circular 8626, 24 p. 10.

Patton, W.W., Jr., and Miller, T.P., 1973, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 154-155.

Schrader, F.C., 1904, A reconnaissance in northern Alaska across the Rocky Mountains, along the Koyukuk, John, Anaktuvuk, and Colville Rivers and the Arctic coast to Cape Lisburne, in 1901: U.S. Geological Survey Professional Paper 20, p. 102.

U.S. Bureau of Mines, 1936-1941, Permanent Individual Mine Records (PIMR) for placer mines in Alaska: U.S. Bureau of Mines unpublished reports. [available from BLM Anchorage, Alaska]

Property Summary

Name(s): Gold Bench

Map No: B5
MAS No: 0020390001
Alaska Kardex 039-010

Deposit Type: Placer

Commodities: Au, Ag, Sn, W, Pb, Cu, U, Bi

Location:

Quadrangle: Bettles D-2
NE¼ sec. 21, T 25 N., R. 14 W.
Meridian: Fairbanks
Elevation: 940 feet
Latitude: 66° 58.833' N.
Longitude: 150° 38.000' W.
Geographic: On the South Fork Koyukuk River, 10 miles downstream from the Dalton Highway.

History:

1900-10 - Miners placer worked on gravel bar using hand methods (Maddren, 1913).

1910 - H. Missaporvity mined bench gravels (U.S. Bureau of Mines PIMR, 1910).

1925 - Frank J. Miller and two others operating on Gold Bench, on ground under option by Norman Stines (Fairbanks Daily News-Miner, 1925).

1928 - Ben Bromberg and Axel Johnson invented an 800-pound portable drill with a 4-inch casing and a 5-inch shoe. They prospected the South Fork Koyukuk River with enough casing to reach 60 feet; however, the expedition proved "disappointing" (Fairbanks Daily News-Miner, 1928).

1929 - Captain Rowden, owner of the Detroit Company, optioned 16 claims on the South Fork, where he planned extensive drilling operations. A Keystone drill was reportedly brought down the river from Wild Lake/Hammond River(?) on a scow and then moved seven miles across country under its own power. Employees include Victor Neck, Jim Kelly, and Ike Spinks (Fairbanks Daily News-Miner, 1929).

1938 - "Dutch Henry" Missaporvity mined an open cut at Gold Bench (Fairbanks Daily News-Miner, 1938).

1940s - Mined with heavy equipment (Mulligan, 1974).

1945-48 - Elmer Keturi, Gus and Eugene Uotila, Victor Nick, and John Ogriz are reported partners in the South Fork Mining Company. Dragline operated on creek (Fairbanks Daily News-Miner, 1948).

1945 - The South Fork Mining Co. optioned its property on the South Fork Koyukuk River to Northland Mines, Inc. Northland Mines will be a closed corporation composed of Andrew Nerland, G.A. Gustafson, Glenn Carrington, Jack Chandler, Gil Skinner, and Ray Anderson. The deal was negotiated through Norman Stines, who held an option on the property (Fairbanks Daily News-Miner, 1945).

1949 - South Fork Mining Company, owned by Dan Sailors and John Hankee, staked 56 placer claims at Gold Bench (Kardex).

2001 - Some pits dug to test ground (K. Woodward, personal communication, 2001).

Production: (oz Au) (Maddren, 1910; U.S. Bureau of Mines PIMRs)

1901 - 1,209
1902 - 2,897
1903 - 967
1904 - 726
1905-10 - 1,210
1911 - 15
1915 - 72
1945 - 1,692
Total: 8,788 (Records incomplete.)
Gold fineness: 872 (Calculated from PIMRs)

Workings and Facilities:

In the early days Gold Bench was considered to be one of the richest spots in the Koyukuk River watershed. The site shows several generations of placer workings. Early operations used ground sluicing and shoveling in. By 1937 about 100 acres had been mined by hand methods. Later operations used hydraulicking and a dragline. Water was probably brought in from John R. (Jean D'Arc) Creek (Reed, 1938). The site contains numerous tailings piles left over from the dragline operation. There are several buildings and associated mining equipment onsite with an overgrown airstrip nearby. Amalgamation was used for fine gold recovery. A gridwork pattern of lines cut through the vegetation south of the mine site may be the result of test drilling in that area.

Geologic Setting:

The South Fork Koyukuk River lies along the trend of the South Fork fault, a Late Cretaceous to Tertiary structure with many miles of right offset. Rocks north of the fault near Gold Bench consist of Early Cretaceous pebble-cobble and quartz-pebble conglomerate and late Early Cretaceous volcanic graywacke and mudstone. South of the fault, pelitic schist and mafic volcanic and intrusive rocks occur in the core of a southwest-plunging anticline. Lenses and pods of rusty metamorphic quartz with chlorite partings occur in the schist. No sulfides were observed by the BLM in either the schist or the quartz. Gneissic biotite-hornblende-bearing dikes occur locally. The middle Cretaceous Jim River Pluton is exposed 7 miles to the southeast of Gold Bench (Patton and others, 1973; Patton and others, 1989).

At Gold Bench, gold-bearing gravel lies on top of a sloping bench of thick, unconsolidated fluvial deposits inside a semicircular bend of the Koyukuk River. The bench, about 1,000 feet wide and 0.75 mile long, slopes gently to the south and lies from 30 to 60 feet above the modern stream. On the west, the bench has been eroded away by John R. (Jean D'Arc) Creek and on the east and south by the Koyukuk River. To the north, it is a gradually rising slope and marks the edge of the ancestral river channel. The northern limit is ill-defined, and in 1937 it was not known how far the gold-bearing gravel extended in that direction. At this end of the bench, only the top gravels had been mined due to a lack of grade needed to dispose the tailings (Schrader, 1904; Maddren, 1913; Reed, 1938).

Reed (1938) reported that placer gold rested on a false bedrock of blue clay coming from decomposed shale. This is similar to the occurrence of gold at nearby Ironside Bench (map no. B4). The overlying gravel is medium-fine river wash containing many large waterworn boulders. Depth to this false bedrock has been estimated at 6 to 10 feet. Shafts sunk to 20 feet failed to reach solid bedrock. Gold is reported to occur throughout the gravel, but the best pay was from a layer 18 to 24 inches thick. Maddren (1913) reported that most of the gold rested on a false bedrock of reddish sand with the richest yield from an area 150 to 200 feet wide and 0.25 miles long. Some of the ground was so rich that it yielded from 4.3 to 4.8 oz a day to the man. The gold is fine, flattened, and flaky, being similar in character to the Ironside and Davis Creek gold. Pieces as large as 0.12 oz have been found. At the foot of the bench, though, the gold is of a different character - angular, rough, and honeycombed, which suggests a short transport distance (Schrader, 1904; Maddren, 1913; Reed, 1938). Pleistocene bones are reported to have been common in the gravels of Gold Bench (Reed, 1938). According to newspaper accounts, a placer drill was brought into the area in the late 1920s (Fairbanks Daily News-Miner, 1929). The results of any drilling are unknown.

Placer concentrates from Gold Bench are reported to contain magnetite, hematite, garnet, and small amounts of pyrite, chalcopyrite, cinnabar, rutile, cassiterite, scheelite, monazite, uranothorianite, galena, sphene, and bismuthinite(?) (Cobb, 1973). A concentrate sample collected by the USGS in 1952 contained 0.18% equivalent uranium that was due primarily to uranothorianite and, to a lesser extent, monazite. Radiometric traverses on the ground revealed no significant radioactivity (Nelson and others, 1954; White, 1952; Wedow and others, 1953).

The origin of the gold is unknown. One theory is that it could have been washed in from Tramway Bar (map no. W125) through an ancestral channel that crossed between the two forks of the Koyukuk River. Another theory is that the source lies in the hills south of Gold Bench (Maddren, 1913). It is also possible that the gold is reworked from glacial deposits (Cobb, 1973).

Bureau Investigation:

Fine gold was found in test pans taken in the bottom of the excavations inside the river bend. A sample of sluice concentrates leftover from mining operations (11583, table B-1) contains 5.1 ppm uranium and 27 ppm thorium. The BLM samples were not found to contain the heavy minerals reported by the U.S. Geological Survey (Nelson and others, 1954). River gravels are well exposed in a 30-foot-high bluff on the north side of the river, 150 feet north of the mine workings. Test pans showed very fine gold occurring throughout the gravel section, but concentrations were highest in an 8-foot-thick cobble gravel layer. A placer sample (12151) from this site contains 0.005 oz/cy gold. The gold was similar in character to that mined nearby, consisting of fine to very fine flat, smooth colors. This section of gravel probably lies above the blue clay false bedrock.

Resource Estimate: Inferred resource of 160,000 cy of 0.005 oz/cy gold

Mineral Development Potential:

Low potential for placer gold. The bench gravels have been mostly mined out, and modern channel gravel is sub-economic.

Recommendations: None.

References:

Cobb, E.H., 1972, Metallic mineral resources map of the Bettles quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-387, 1 sheet, scale 1:250,000.

____1973, Placer deposits of Alaska: U.S. Geological Survey Bulletin 1374, p. 159-160.

____1978, Summary of references to mineral occurrences (other than mineral fuels and construction materials) in the Beaver, Bettles, and Medfra quadrangles, Alaska: U.S. Geological Survey Open-File Report 78-94, p. 10.

Fairbanks Daily News-Miner newspaper, Fairbanks, Alaska, November 15, 1945.

Maddren, A.G., 1910, The Koyukuk-Chandalar gold region *in* Brooks, A.E., Mineral resources of Alaska, report on progress of investigations in 1909: U.S. Geological Survey Bulletin 442, p. 292, 311-312.

____1913, The Koyukuk-Chandalar region, Alaska: U.S. Geological Survey Bulletin 532, p. 70, 105-107.

Mulligan, J.J., 1974, Mineral resources of the Trans-Alaska Pipeline corridor: U.S. Bureau of Mines Information Circular 8626, p. 10.

Nelson, A.E., West, W.S., and Matzko, J.J., 1954, Reconnaissance for radioactive deposits in eastern Alaska: U.S. Geological Survey Circular 348, p. 16, 18-19.

Overstreet, W.C., 1967, The Geologic occurrence monazite: U.S. Geological Survey Professional Paper 530, p. 110.

Patton, W.W., Jr., Miller, T.P., and Box, S.E., 1989, Road log from Yukon Crossing (mile 56) to South Fork Koyukuk River (mile 156.2), *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 1, p. 71.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 153-154.

Schrader, F.C., 1904, A reconnaissance in northern Alaska across the Rocky Mountains, along the Koyukuk, John, Anaktuvuk, and Colville Rivers and the Arctic coast to Cape Lisburne, in 1901: U.S. Geological Survey Professional Paper 20, p. 101-102.

U.S. Bureau of Mines, 1908-1945, Permanent Individual Mine Records (PIMR) for placer mines in Alaska: U.S. Bureau of Mines unpublished reports.

Wedow, H., Jr., White, M.G., and Moxham, R.M., 1952, Interim report on an appraisal of the uranium possibilities of Alaska: U.S. Geological Survey Open-File Report 51, p. 95.

Wedow, H., Jr., and others, 1953, Preliminary summary of reconnaissance for uranium and thorium in Alaska: U.S. Geological Survey Circulation 248, 15 p.

White, M.G., 1952, Radioactivity of selected rocks and placer concentrates from northeastern Alaska: U.S. Geological Survey Circulation 195, p. 8, 10-11.

Property Summary

Name(s): Eldorado Creek
Pope claims

Map No: B6
MAS No: 0020390045
Alaska Kardex 039-006

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Bettles D-2
NW¼ sec. 32, T. 25 N., R. 15 W.
Meridian: Fairbanks
Elevation: 1,400 feet
Latitude: 66° 57.285' N.
Longitude: 150° 54.993' W.
Geographic: Located on a south-flowing tributary of South Fork Koyukuk River, 4.5 miles northeast of Pope Creek Dome.

History:

1968 - C.B. Woodruff staked 5 lode claims in area (Kardex).

Production: Unknown.

Workings and Facilities: None observed.

Geologic Setting:

Bedrock at Eldorado Creek is Cretaceous graywacke interbedded with mudstone. The graywacke is poorly sorted first- and second-cycle volcanic debris of mafic and intermediate composition (Patton and Miller, 1973). The creek lies north of the South Fork fault, which trends east-northeast. The fault is one of several Late Cretaceous to early Tertiary east-west-trending, high-angle fault zones that have many miles of right slip. It is characterized by gouge that separates equivalent portions of the Angayucham terrane and marks the northern limit of Cretaceous granites in Alaska (Dillon and others, 1989).

Bureau Investigation:

Eldorado Creek has very little water and does not cut bedrock in many locations. A pan concentrate sample collected from gravel at 1,360 feet elevation, 1.5 miles upstream from the Koyukuk River (11548, table B-1), contains 8.79 ppm gold. One coarse gold piece was observed in the pan. A second test pan was collected at the same site, but did not contain visible gold. Three other test pans collected from mudstone bedrock about 150 feet downstream of the original pan did not contain visible gold.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential due to very limited bedrock exposure and limited amounts of gravel.

Recommendations: None.

References:

Dillon, J.T., Solie, D.N., Decker, J.E., Murphy, J.M., Bakke, A.A., and Huber, J.A., 1989, Road log from South Fork Koyukuk River (mile 156.2) to Chandalar Shelf (mile 237.1) *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 1, p. 74-100.

Patton, W.W., Jr., and Miller, T.P., 1973, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Property Summary

Name(s): Bettles Bars
Bettles Riffle

Map No: B7
MAS No: 0020390049
Alaska Kardex 039-005

Deposit Type: Placer

Commodities: Au

Location:
Quadrangle: Bettles D-4
NE¼ sec. 12, T. 24 N., R. 19 W.
Meridian: Fairbanks
Elevation: 590 feet
Latitude: 66° 55.606' N.
Longitude: 151° 34.219' W.
Geographic: Located on gravel bars of the Koyukuk River, between Evansville and Bettles. What is presently referred to by most residents as Bettles is labeled "Evansville" on U.S. Geological Survey maps. The original site of Bettles (now abandoned) is about 6 miles downriver.

History:

1901 - Schrader (1904) noted gold mining on the bars of the Koyukuk River.
1937 - Reed (1938) reported mining of fine gold from gravel bars near Bettles.
1957 - A. Withrow staked a placer claim near Bettles.

Production:

The total production is unknown. Reed (1938) reported that with diligent work a man could make as much as $10 (0.28 oz) per day. One man was reported to have produced about $600 (17 oz) in two weeks from a bar a short distance above Bettles in late fall of 1937. Interviews with Evansville residents during the present study, indicate that some have recovered up to several hundred dollars worth of gold by mining the bars on the Koyukuk River.

Workings and Facilities: None observed.

Geologic Setting:

Bedrock comprising the river bluffs near Bettles, is predominantly Upper Cretaceous volcanic graywacke and mudstone. The graywacke is composed of first- and second-cycle volcanic debris of mafic to intermediate composition. Gravel bars along the river are composed of Quaternary deposits (alluvial, colluvial, and glacial material) (Patton and Miller, 1973).

Fine flood gold occurs intermittently along the gravel bars of the Koyukuk River. These were the first placer deposits discovered in the Koyukuk Mining District (Schrader, 1904). Reed (1938) describes a gold-bearing bar across the river from Bettles. Gold was concentrated in a cobble and sand layer as much as 15 feet above the low water level, which was capped with sands and silts. The gold was concentrated in the upper layers of the deposit and didn't extend over 3 feet beneath the surface.

Local residents have mentioned seeing bedrock exposed in the channel of the Koyukuk River, just downstream from Evansville, during periods of low water. This may be what has been historically referred to as the "Bettles Riffle." Placer gold is said to have concentrated at this site.

Bureau Investigation:

Aerial reconnaissance along the section of river between Evansville and Bettles did not locate bedrock that could form natural riffles across the river. The Bettles riffle either could not be observed through the silt-laden water, or it has been covered by the continual shifting of fluvial material. This stretch of river was floated and numerous test pans were taken from the bars that have formed on the inside of bends in the river. A total of 5 pan concentrate and hydraulic concentrator samples were collected. The best results came from a sample obtained from a bar on the north side of the river, 1.6 miles west of Evansville. At this site as many as 100 very fine flat colors were observed in a single pan. Most of the gold is extremely fine (<0.5 mm) and concentrates near the upper end of point bars that have formed on the inside portion of river bends. The gold-bearing gravels are usually only a few inches thick; hence the name "skim bars." Much of the gold is fine enough to float on water and can be renewed on a yearly basis. As a test, 0.5 cy of material was processed through a hydraulic concentrator in one hour. The results showed the gravel to average 0.02 oz/cy of very fine gold (12000, table B-1). Some of the finest gold was lost as amalgamation was not used as part of the recovery process. The concentrate contained abundant magnetite.

The site described by Reed (1938) near Bettles, was also sampled using a hydraulic concentrator. The gravel was found to contain 0.002 oz/cy gold (12001). This is a much lower value than that described by Reed, and it may be that the gold which once concentrated there has since shifted downriver.

In general Koyukuk River flood gold appears to concentrate in pebble and sand skim bars only a few inches thick. These are located at the highest point and near the upstream end of larger bars. It seems that the concentration and location of gold on the bars varies from year to year, depending on river activity. Due to the extremely fine nature of the gold, amalgamation would be required to obtain complete recovery.

Resource Estimate:

Skim bars containing an inferred resource of at least 25 cy of material averaging 0.02 oz/cy gold.

Mineral Development Potential:

Low development potential due to low gold content and small gravel volumes. This resource can change on a yearly basis, depending on runoff activity by the river.

Recommendations:

Check river for evidence of bedrock riffles during periods of extremely low, clear water. Prospect river bars on a yearly basis after peak runoff to check for concentrations of gold.

References:

Cobb, E.H., 1978, Summary of references to mineral occurrences (other than mineral fuels and construction materials) in the Beaver, Bettles, and Medfra quadrangles, Alaska: U.S. Geological Survey Open-File Report 78-94, p. 7.

Patton, W.W., Jr., and Miller, T.P., 1973, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 163-164.

Schrader, F.C., 1904, A reconnaissance in northern Alaska across the Rocky Mountains, along the Koyukuk, John, Anaktuvuk, and Colville Rivers and the Arctic coast to Cape Lisburne, in 1901: U.S. Geological Survey Professional Paper 20, p. 98.

Property Summary

Name(s): Ranger

Map No: B8
MAS No: 0020390048
Alaska Kardex 039-026

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Bettles D-3 — SW¼ sec. 7, T. 23 N., R. 16 W.
Meridian: Fairbanks — Elevation: 700 feet
Latitude: 66° 49.981' N. — Longitude: 151° 06.590' W.
Geographic: Gravel bar on north side of the South Fork Koyukuk River, 4 miles upstream of the confluence with the Jim River.

History:

1977 - W. Guenther staked 11 placer claims (Kardex).

Production: No known production.

Workings and Facilities: Bulldozer trenches were observed near the site.

Geologic Setting:

The prospect area is within the Angayucham terrane, near the contact with the Ruby terrane. The Ruby terrane is composed of Proterozoic and lower Paleozoic metasedimentary rocks and continental protoliths. The Angayucham terrane is derived from oceanic crust, containing diabase, pillow basalt, chert, graywacke, and serpentized perdotite. Mid-Cretaceous granitic plutons intrude both units (Dillon and others, 1989).

The South Fork flows along the South Fork fault and cuts conglomerates and mafic volcanics. These include pillow basalts, disbase and gabbros some of which have been metamorphosed. Some small pods of ultramafic sepentinized peridotite and dunite can be found in the mafic volcanics (Patton and Miller, 1973).

Bureau Investigation:

Seven test pans taken along the gravel bar produced a total of 4 fine and 6 very fine flakes of flood gold. The test pans also contained abundant magnetite and some garnet. A pan concentrate sample (11572, table B-1) contains only 6 ppb gold even though 3 very fine and 1 fine gold flakes were observed in the pan. The gold seems to be concentrated in a 30-by 200-foot crescent-shaped layer of pebble gravel a few inches thick that is located near the upper end of the bar. This thin veneer of gravel, or “skim bar,” overlays coarser cobble gravel.

Resource Estimate: None.

Mineral Development Potential:

Low development potential for placer gold due to low gold values and a limited resource.

Recommendations:

Prospect river bars in the vicinity after peak runoff to check for concentrations of flood gold.

References:

Dillon, J.T., Lamal, K.K., and Huber, J.A., 1989, Gold deposits in the upper Koyukuk and Chandalar mining districts, Alaska *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 2, p. 196-201.

Patton, W.W., Jr., and Miller, T.P., 1973, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, 169 p.

Property Summary

Name(s): Jim River Canyon
Lucky Fortune claims
Shalom Association

Map No: B9
MAS No: 0020390047
Alaska Kardex 039-015
Alaska Kardex 039-016

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Bettles D-2
SW¼ sec. 31, T. 23 N., R. 15 W.
Meridian: Fairbanks
Elevation: 770 feet
Latitude: 66° 46.383' N.
Longitude: 150° 53.881' W.
Geographic: Located in the Jim River canyon about 6 miles downstream from Prospect Creek Camp.

History:

early 1900s - Maddren (1913) reported prospecting along Jim River.
1977 - Placer claims staked just upstream of Jim River canyon (Kardex).
1977-85 - Placer claims staked on Jim River (Kardex).

Production: Unknown.

Workings and Facilities: None observed.

Geologic Setting:

The prospect area is within the Angayucham terrane, near the contact with the Ruby terrane. The Ruby terrane is composed of Proterozoic and lower Paleozoic metasedimentary rocks and continental protoliths. The Angayucham terrane is derived from oceanic crust, containing diabase, pillow basalt, chert, graywacke, and serpintized perdotite. Mid-Cretaceous granitic plutons intrude both units (Dillon, 1989).

The bedrock at the Jim River canyon is Triassic to Jurassic mafic and intrusive rocks that include pillow basalt, diabase, and gabbro with subordinate amounts of basaltic and andesitic volcanoclastic rocks, chert, and cherty mudstone. The mafic rocks are altered to "greenstone" and locally foliated (Patton, and Miller, 1973b).

Bureau Investigation:

Nine pan concentrate samples collected in the Jim River canyon (table B-1) average 27.2 ppm gold. The gold was composed of mostly fine and very fine flakes. The samples were collected from fractured bedrock and underneath boulders along gravel bars.

Gravel bars on the Jim River, upstream of the canyon, also contain fine flood gold (map nos. B10-B11). The Jim River pluton is a possible source of the gold, but this has not been verified.

The bedrock in the narrows is altered greenstone volcanics. The rocks are sheared and slightly serpentinized. Pillow basalts are also found in the canyon. Two samples of greenstone with malachite staining (12124, 12161) average 283 ppm copper. Also, sulfides were observed in hornfels, chert, and diorite samples; however, the samples are not anomalous in precious metals.

Resource Estimate: Unknown.

Mineral Development Potential:

There is moderate potential for placer gold, but gravel resources on shallow bedrock are small. A diligent miner may be able to recover fine flood gold from gravel bars during periods of low water. Any placer operation within the confines of the canyon would be subject to periodic flooding.

Recommendations:

Prospect river bars in the canyon after peak runoff to check for concentrations of flood gold.

References:

Dillon, J.T., 1989, Structure and Stratigraphy of the southern Brooks Range and Northern Koyukuk basin near the Dalton Highway *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 2, p. 157-187.

Maddren, A.G., 1913, The Koyukuk-Chandalar region, Alaska: U.S. Geological Survey Bulletin 532, p. 105.

Patton, W.W., Jr., and Miller, T.P., 1973a, Analyses of stream-sediment samples from the Bettles and the southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Open-File Report 73-219, 1 sheet, scale 1:250,000.

____1973b, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 162-163.

Property Summary

Name(s): Jim River Confluence

Map No: B10
MAS No: 0020390046
Alaska Kardex 039-014
Alaska Kardex 039-027A

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Bettles D-2
NW¼ sec. 26, T. 23 N., R. 15 W.
Meridian: Fairbanks
Elevation: 850 feet
Latitude: 66° 47.549' N.
Longitude: 150° 44.362' W.
Geographic: Located on Jim River at its confluence with Prospect Creek, about 2 miles west of the Dalton Highway.

History:

early 1900s - Maddren (1913) reported prospecting along Jim River.
1977 - R. Martinez and R. Hammond staked 4 placer claims (Kardex).

Production: None.

Workings and Facilities: None.

Geologic Setting:

This portion of the Jim River lies within the Angayucham terrane, just north of the contact with the Ruby terrane. The Ruby terrane is composed of Proterozoic and lower Paleozoic metasedimentary rocks and continental protoliths. The Angayucham terrane is derived from oceanic crust, containing diabase, pillow basalt, chert, graywacke, and serpintized perdotite. Mid-Cretaceous granitic plutons intrude both units (Dillon, 1989).

Fine gold occurs on gravel bars between Prospect Creek and the Jim River Canyon. Jim River does not cut bedrock in this area. The hills to the north are mid-Cretaceous granite. Bedrock is also exposed about 5 miles downstream, in the Jim River canyon. It is composed of Triassic to Jurassic mafic and intrusive rocks that include pillow basalt, diabase, and gabbro with subordinate amounts of basaltic and andesitic volcanoclastic rocks, chert, and cherty mudstone. The mafic rocks are altered to “greenstone” and locally foliated (Patton, and Miller, 1973).

Bureau Investigation:

Three samples were collected on the upstream side of a gravel bar along the river (table B-1). A placer sample with 13 very fine gold particles (11015) contains 0.0003 oz/cy. A pan concentrate (11014) collected on the same bar contains 1,590 ppb gold. Fine flood gold has also been panned from the Jim River canyon (map no. B9) and upper Jim River (map no. B11). The Jim River pluton is a possible source of the gold, but this has not been verified.

Resource Estimate: None.

Mineral Development Potential:

Low development potential due to the limited amounts of fine flood gold on gravel bars. This resource can change on a yearly basis, depending on runoff activity. The potential for recreational gold panning is also good since this location is accessible by car from the Dalton Highway.

Recommendations:

Further evaluation of the surrounding gravel bars would be beneficial in evaluation of the recreational panning. Examination for the source of the gold upstream is necessary along with examination downstream for possible concentration points of the gold.

Prospect river bars on a yearly basis after peak runoff to check for concentrations of gold.

References:

Dillon, J.T., 1989, Structure and Stratigraphy of the southern Brooks Range and Northern Koyukuk basin near the Dalton Highway *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 2, p. 157-187.

Maddren, A.G., 1913, The Koyukuk-Chandalar region, Alaska: U.S. Geological Survey Bulletin 532, p. 105.

Patton, W.W., Jr., and Miller, T.P., 1973a, Analyses of stream-sediment samples from the Bettles and the southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Open-File Report 73-219, 1 sheet, scale 1:250,000.

____1973b, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 162-163.

Property Summary

Name(s): Upper Jim River
Jim River
Black sands
Jack's diggins
Alice K mine

Map No: B11
MAS No: 0020390040
Alaska Kardex 039-020
Alaska Kardex 039-021
Alaska Kardex 039-022
Alaska Kardex 039-023
Alaska Kardex 039-024
Alaska Kardex 039-028
Alaska Kardex 039-029
Alaska Kardex 039-035
Alaska Kardex 039-036

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Bettles D-1
SE¼ sec. 10, T. 24 N., R. 13 W.
Meridian: Fairbanks
Elevation: 1,250 feet
Latitude: 66° 54.855' N.
Longitude: 150° 19.939' W.
Geographic: Located on the upper Jim River, east of the Dalton Highway, about 3 miles upstream of the confluence with Grayling Creek.

History:

1977 - Numerous placer claims staked by C. Herbrecht and others (Kardex).

Production: No recorded production.

Workings and Facilities: None observed.

Geologic Setting:

Upstream from Grayling Creek, the Jim River follows the contact between Triassic to Jurassic mafic volcanic and intrusive rocks and Lower Cretaceous granitic rocks. The mafic rocks consist of pillow basalt, diabase, gabbro with subordinate amounts of basaltic and andesitic volcanoclastic rocks, chert, and cherty mudstone. These have been mostly altered to "greenstone" and locally foliated. The granitic rocks consist of porphyritic biotite quartz monzonite, which comprises the Jim River pluton. This pluton lies just south of the South Fork fault which marks the northern limit of Cretaceous intrusive rocks in Alaska (Patton and Miller, 1973; Dillon and others, 1989).

The mafic rocks are included in the Angayucham terrane derived from oceanic crust. The Jim River Pluton intrudes rocks of both the Angayucham and neighboring Ruby terrane to the south. Northeast-trending faults cut both the granitic and mafic rocks (Patton and Miller, 1973; Dillon and others, 1989).

Gravel bars on the Jim River, west of the Dalton Highway, contain fine flood gold (map nos. B9-B10). The Jim River pluton is a possible source of the gold, but this has not been verified.

Bureau Investigation:

No bedrock was observed at the site of the reported occurrence. A concentration of large boulders (greater than 2 feet) on the north side of the creek was investigated for possible placer gold. One very fine gold flake was recovered from a series of test pans taken from the downstream sides of boulders (11580, table B-1). A select float sample of mafic rock (amphibolite?) (11581) contains 193 ppm copper. A select float sample of garnet-tourmaline(?) granite (11582) contains 237 ppm chromium.

An aerial reconnaissance was made of the Jim River for a distance of about 5 miles upstream from this site. No bedrock was observed in the stream bed. Stream sediment and pan concentrate samples were collected at a fork in the river, 1.5 miles southwest of hill 2415. Gold was not observed in any test pans taken in this area. However, a pan concentrate from the northern tributary just west of hill 2415 (12142) contains 514 ppb gold. This tributary follows a northeast-trending fault between granitic and mafic rocks. A pan concentrate collected from the Jim River upstream of the northern tributary (12168) contains 51 ppb gold. A minor amount of biotite hornfels(?) was observed in stream float. A sample (12170) was not anomalous in precious metals.

Resource Estimate: None.

Mineral Development Potential:

Low development potential for placer gold as only trace amounts of gold were found in test pans. Numerous large boulders and apparent lack of bedrock could make mining difficult. Low potential for pluton-related lode gold deposits.

Recommendations:

Sample gravel on bedrock along the Jim River. Conduct a geochemical survey around the Jim River and neighboring plutons to outline potential lode gold targets.

References:

Blum, J.D., Dillon, J.T., and Blum, A.E., 1989, Regional significance of the Jim River and Hodzana plutons *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 2, p. 189-190.

Dillon, J.T., Lamal, K.K., and Huber, J.A., 1989, Gold deposits in the upper Koyukuk and Chandalar mining districts, Alaska *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 2, p. 196-201.

Maddren, A.G., 1910, The Koyukuk-Chandalar gold region *in* Brooks, A.E., Mineral resources of Alaska, report on progress of investigations in 1909: U.S. Geological Survey Bulletin 442, p. 105.

Patton, W.W., Jr., and Miller, T.P., 1973, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 162-163.

Property Summary

Name(s): Douglas Creek

Map No: B12
MAS No: 0020390039
Alaska Kardex 039-017
Alaska Kardex 039-018
Alaska Kardex 039-019

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Bettles D-2
W½ sec. 5, T. 23 N., R. 13 W.
Meridian: Fairbanks
Elevation: 1,430 feet
Latitude: 66° 51.150' N.
Longitude: 150° 24.333' W.
Geographic: Located at the midpoint of Douglas Creek, a west-flowing tributary of Jim River.

History:

1973 - Patton and Miller (1973a) report two stream sediment samples with detectable gold on Douglas Creek.
1977 - Several placer claims staked by three different parties (Kardex).

Production: Unknown.

Workings and Facilities: None observed.

Geologic Setting:

The prospect area is within the Angayucham terrane, near the contact with the Ruby terrane. The Ruby terrane is composed of Proterozoic and lower Paleozoic metasedimentary rocks and continental protoliths. The Angayucham terrane is derived from oceanic crust, containing diabase, pillow basalt, chert, graywacke, and serpintized peridotite. Mid-Cretaceous granitic plutons intrude both units (Dillon, 1989).

Bedrock at Douglas Creek is composed of Triassic to Jurassic mafic and intrusive rocks. The unit includes pillow basalt, diabase, and gabbro with subordinate amounts of basaltic and andesitic volcanoclastic rocks, chert, and cherty mudstone. The mafic rocks are altered to “greenstone” and locally foliated (Patton and Miller, 1973b).

Bureau Investigation:

One stream sediment and three pan concentrate samples (11009-11012, table B-1) were collected at Douglas Creek. No anomalous results were noted in any of the samples.

Resource Estimate: None.

Mineral Development Potential: Low mineral development potential due to lack of gold in samples.

Recommendations: None.

References:

Dillon, J.T., 1989, Structure and Stratigraphy of the southern Brooks Range and Northern Koyukuk basin near the Dalton Highway *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 2, p. 157-187.

Patton, W.W., Jr., and Miller, T.P., 1973a, Analyses of stream-sediment samples from the Bettles and the southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Open-File Report 73-219, 1 sheet, scale 1:250,000.

____1973b, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Property Summary

Name(s): Prospect Creek
Jubilee Mines
C & W claims
Midnight Mining Assoc. claims
Tiara claims

Map No: B13
MAS No: 0020390038
Alaska Kardex 039-003
Alaska Kardex 039-027
Alaska Kardex 039-032
Alaska Kardex 039-033
Alaska Kardex 039-034
Alaska Kardex 039-037

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Bettles D-2
NW¼ sec. 26, T. 23 N., R. 14 W.
Meridian: Fairbanks
Elevation: 1,150 feet
Latitude: 66° 47.546' N.
Longitude: 150° 32.198' W.
Geographic: A 22-mile-long eastern tributary of the Jim River. Recent mining activity is concentrated approximately 6.5 miles upstream from the Jim River.

History:

1909 - Maddren (1913) reported that a U.S. Geological Survey party panned colors off the upper part of the south branch of Jim River. They named it Prospect Creek.
1930s - Reed (1938) reported that miners were unable to find Prospect Creek.
1970s-80s - Prospect Creek heavily staked and prospected by multiple claim parties (Kardex).
1993 - J. Thomas worked placers on Prospect Creek.
1997 - J. Hunt worked placers on Prospect Creek.
1998-2001 - G. Tainter (Jubilee Mines) worked placers on Prospect Creek.

Production: Unknown.

Workings and Facilities:

Historic mining activity has concentrated on the lower 6.5 miles of Prospect Creek. There are tailings piles and numerous test pits along this stretch, which meanders through a canyon before exiting onto the Jim River flood plain. In 2001 there was an active operation with camp, mechanized equipment and wash plant located near the mouth of a north tributary, 6.5 miles upstream from the Jim River.

Geologic Setting:

Rocks on the south side of the Prospect Creek canyon consist of an interlayered sequence of slate, siltstone, phyllite and andalusite schist. The slate, siltstone, and phyllite are reported to contain a zone of mineralized quartz veins (Patton and others, 1989). This sequence has also been intruded by small, scattered felsic stocks and dikes that locally contain sphalerite and galena. The schist is in contact with the Early Cretaceous Bonzanza pluton, 2.5 miles south of the creek. On the north side of the creek is a sequence of Triassic to Jurassic volcanic and intrusive rocks consisting of basalt, diabase, and gabbro that has been thrust over the sedimentary sequence. The mafic rocks are locally altered to “greenstone.”

Prospect Creek lies along the boundary between the Ruby and Angayucham terranes. The Ruby terrane is composed of Proterozoic to lower Paleozoic continentally associated metasedimentary rocks and protoliths. The Angayucham terrane is derived from oceanic crust and contains diabase, pillow basalt, chert, and graywacke. Early Cretaceous granitic plutons intrude both terranes, providing an upper limit for thrusting of the Angayucham over the Ruby terrane. Prospect Creek may have been a side glacial channel along the edge of the early Pliestocene Anaktuvuk ice advance (Patton and Miller, 1973; Blum and others, 1989; Patton and others, 1989).

Mining near the mouth of a north tributary appears to be following gold deposited on elevated bedrock benches cut by a meander of ancestral Prospect Creek. These benches could have also been cut by an ancestral stream that drained a glacial lake in the headwaters of this tributary. Overburden ranges from 3 to 20 feet of gravel with blue clay layers, overlying blocky greenstone bedrock. In 1997 miners found the best pay associated with the clay layers, with values dropping off beneath. Values of 0.007 oz/cy were reported. Due to its resistant nature and lack of natural riffles, the greenstone bedrock contains little pay (J. Hunt, personal communication, 1997).

In 2000 the best pay was contained in a 6 to 10 foot layer of sandy through coarse cobble gravel that overlyies greenstone bedrock. Values averaged 0.04 oz/cy. The -12 mesh fraction contained 40% of the gold. Nuggets weighing up to 0.7 oz were recovered. Indications were that the bench and associated pay zone extended to the north along the tributary (G. Tainter, personal communication, 1999).

Bureau Investigation:

Sluice concentrate samples collected from the active placer operation (12493-12494, table B-1), contain up to 1,205 ppm vanadium, 543 ppm copper, 398 ppm lead, 358 ppm chromium, 196 ppm arsenic, 153 ppm nickel, and 153 ppm molybdenum. The high vanadium, copper, chromium, and nickel values are probably related to the weathering of the greenstones.

A test pan taken off bedrock, 5 miles upstream from the Jim River, contained 1 fine and 6 very fine gold flakes (11574). The sample was collected from broken bedrock consisting of chert beds, which provided excellent natural riffles. Samples collected from a south tributary, 1 mile upstream, contained 1 very coarse and 3 coarse, rounded, nuggety gold pieces. Evidence of test pits were observed along this tributary. The banded chert bedrock at this site contains numerous northeast-trending quartz veins up to 2.5 inches wide. The limonite stained veins contain trace pyrite and form parallel to the cleavage in the chert. A chip sample (12511) is not anomalous in any metals. The veins may be the result of hydrothermal activity related to intrusion of the Bonzana pluton. Felsic dikes exposed 1.2 miles downstream contain sphalerite and galena (map no. B14).

Test pits were observed from the air as far as 9.5 miles upstream from the Jim River. Bedrock was not observed in the creek above the active operation and pan concentrate samples from the site were not anomalous in gold (11549-11550, 11576-11577).

Resource Estimate: None.

Mineral Development Potential:

Moderate development potential for placer gold on north and south tributaries of Prospect Creek, approximately 6 miles upstream from the Jim River.

Recommendations: Prospect benches on creek margins.

References:

Bundzten, T.K., Swainbank, R.E., Clough, A.H., Henning, M.W., and Hansen, E.W., 1994, Alaska's mineral industry 1993: Alaska Division of Geological and Geophysical Surveys Special Report 48, p. 23.

Blum, J.D., Dillon, J.T., and Blum, A.E., 1989, Regional significance of the Jim River and Hodzana plutons *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 2, p. 189-190.

Cobb, E.H., 1978, Summary of references to mineral occurrences (other than mineral fuels and construction materials) in the Beaver, Bettles, and Medfra quadrangles, Alaska: U.S. Geological Survey Open-File Report 78-94, p. 15.

Maddren, A.G., 1910, The Koyukuk-Chandalar gold region *in* Brooks, A.E., Mineral resources of Alaska, report on progress of investigations in 1909: U.S. Geological Survey Bulletin 442, p. 311.

____1913, The Koyukuk-Chandalar region, Alaska: U.S. Geological Survey Bulletin 532, p. 105-106.

Mulligan, J.J., 1974, Mineral resources of the Trans-Alaska Pipeline corridor: U.S. Bureau of Mines Information Circular 8626, p. 15.

Patton, W.W., Jr., and Miller, T.P., 1973, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Patton, W.W., Jr., Miller, T.P., and Box, S.E., 1989, Road log from Yukon Crossing (mile 56) to South Fork Koyukuk River (mile 156.2) *in* Mull C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 1, p. 68-69.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 162-163.

Property Summary

Name(s): Prospect Creek Lode

Map No: B14
MAS No: 20390066

Deposit Type: Stockwork quartz veinlets

Commodities: Zn, Pb, Cu, Au

Location:

Quadrangle: Bettles D-2
SE¼ sec. 33, T. 23 N., R.14 W.
Meridian: Fairbanks
Elevation: 1,250 feet
Latitude: 66° 46.509' N.
Longitude: 150° 35.354' W.
Geographic: In Prospect Creek canyon, 4.5 miles upstream from the Jim River.

History:

1985 - Mineralized quartz veins reported on Prospect Creek (Patton and others, 1989).
1999 - Lode exploration in area by Avalon Development Corporation.

Production: None.

Workings and Facilities: None.

Geologic Setting:

Rocks on the south side of the Prospect Creek canyon consist of an interlayered sequence of slate, siltstone, phyllite, and andalusite schist. The slate, siltstone, and phyllite are reported to contain a zone of mineralized quartz veins. This sequence has also been intruded by small, scattered felsic stocks and dikes that locally contain sphalerite and galena. The schist is in contact with the Early Cretaceous Bonzanza pluton, 2.5 miles south of the creek. On the north side of the creek is a sequence of Triassic to Jurassic volcanic and intrusive rocks consisting of basalt, diabase, and gabbro that has been thrust over the sedimentary sequence. The mafic rocks are locally altered to "greenstone" (Patton and others, 1989).

Prospect Creek lies along the boundary between the Ruby and Angayucham terranes. The Ruby terrane is composed of Proterozoic to lower Paleozoic continentally associated metasedimentary rocks and protoliths. The Angayucham terrane is derived from oceanic crust and contains diabase, pillow basalt, chert, and graywacke. Early Cretaceous granitic plutons intrude both terranes, and provide an upper limit for thrusting of the Angayucham over the Ruby terrane. Prospect Creek may have been a side glacial channel along the edge of the early Pliestocene Anaktuvuk ice advance (Patton and Miller, 1973, Patton and others, 1989).

Bureau Investigation:

A large, east-west-trending felsic dike or sill forms a series of resistant knobs over a distance of 0.8 mile in the Prospect Creek canyon. Felsite rubblecrop on the creek bank was traced to a 60-foot-high resistant knob of felsite containing stockwork quartz veinlets. The veinlets are limonite-stained and contain minor amounts of sphalerite, galena, and chalcopyrite. Veinlets ranged from 0.5 to 4.0 inches wide. The dike is about 50 feet wide and vertical(?). The wallrocks consist of interbedded phyllite and chert, the strike of which roughly parallels the dike trend.

A sample of felsite rubblecrop on the creek bank (12516, table B-1) contains 1,523 ppm zinc, 628 ppm lead, and 130 ppm copper. A select sample from the knob outcrop (12517) contains 1,127 ppm zinc, 885 ppm lead, and 105 ppm copper. Neither sample is anomalous in gold. The felsite was examined in two other locations, but metal values in samples are considerably lower and no metallic minerals were observed. One sample, collected from a resistant knob 0.8 mile upstream (12548), contains 24 ppb gold, but is not anomalous in base metals.

Resource Estimate: Unknown.

Mineral Development Potential:

Low potential as a polymetallic vein deposit due to low base metal and gold values.

Recommendations: None.

References:

Patton, W.W., and Miller, T.P., 1973, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Patton, W.W., Jr., Miller, T.P., and Box, S.E., 1989, Road log from Yukon Crossing (mile 56) to South Fork Koyukuk River (mile 156.2) *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 1, p. 69.

Property Summary

Name(s): North Fork Bonanza Creek

Map No: B15
MAS No: 0020390053
Alaska Kardex 039-031

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Bettles C-2
NW¼ sec. 34, T. 22 N., R. 14 W.
Meridian: Fairbanks
Elevation: 870 feet
Latitude: 66° 41.422' N.
Longitude: 150° 34.781' W.
Geographic: About 2.5 miles northeast of the confluence of Bonanza Creek and the North Fork of the Koyukuk River.

History:

1978 - Claims staked by J. and M. Howland (Kardex).

Production: None.

Workings and Facilities: None.

Geologic Setting:

North Fork Bonanza Creek drains predominantly Paleozoic (and older?) pelitic schist and phyllite intruded by coarsely porphyritic Cretaceous biotite quartz monzonite. The pelitic schist includes quartz-mica schist, chlorite schist, quartzo-feldspathic schist, and subordinate quartzite. The unit also includes many small bodies of intrusive mafic rock (Patton and Miller, 1973b).

Bureau Investigation:

Garnet, abundant magnetite, but no gold was observed in test pans taken from point bars near granitic rubblecrop on the stream bank. Stream sediment and pan concentrate samples collected at this site (10999-11000, table B-1) are not anomalous in gold.

Resource Estimate: Unknown.

Mineral Development Potential:

There is a low mineral development potential for this site due to the lack placer in the creek.

Recommendations: None.

References:

Patton, W.W., Jr., and Miller, T.P., 1973a, Analyses of stream-sediment samples from the Bettles and the southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Open-File Report 73-219, 1 sheet, scale 1:250,000.

____1973b, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Property Summary

Name(s): South Fork Bonanza Creek

Map No: B16
MAS No: 0020390052
Alaska Kardex 039-030

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Bettles C-2
SW¼ sec. 8, T. 21 N., R. 14 W.
Meridian: Fairbanks
Elevation: 870 feet
Latitude: 66° 39.366' N.
Longitude: 150° 35.942' W.
Geographic: Located on the South Fork Bonanza Creek, one mile upstream from the confluence with Bonanza Creek.

History:

1978 - Two placer claims staked by M. and J. Howland (Kardex).

Production: None.

Workings and Facilities: None observed.

Geologic Setting:

South Fork Bonanza Creek drains predominantly Paleozoic (and older?) pelitic schist and phyllite intruded by coarsely porphyritic Cretaceous biotite quartz monzonite. The pelitic schist includes quartz-mica schist, chlorite schist, quartzo-feldspathic schist, and subordinate quartzite. Unit also includes many small bodies of intrusive mafic rock (Patton and Miller, 1973b).

Bureau Investigation:

The South Fork does not have exposed bedrock. Test pans were collected at two sites; neither pan contained visible gold. A stream sediment and pan concentrate sample (11007-11008, table B-1) were collected near the site and submitted for analysis. The results are not considered anomalous.

Resource Estimate: Unknown.

Mineral Development Potential:

This area has low development potential for placer gold due to lack of gold in samples.

Recommendations: None.

References:

Patton, W.W., Jr., and Miller, T.P., 1973a, Analyses of stream-sediment samples from the Bettles and the southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Open-File Report 73-219, 1 sheet, scale 1:250,000.

____1973b, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Property Summary

Name(s): Bonanza Prospect
Bonanza claims
Beef claims

Map No: B17
MAS No: 0020390051

Deposit Type: Skarn

Commodities: W, Zn, Mo

Location:

Quadrangle: Bettles C-1
SW¼ sec. 19, T. 21 N., R. 12 W.
Meridian: Fairbanks
Elevation: 2,675 feet
Latitude: 66° 37.590' N.
Longitude: 150° 01.443' W.
Geographic: On the South Fork of Bonanza Creek, just west of the divide with the Hodzana River. The prospect is located 18 miles east of the Dalton Highway.

History: (Clautice, 1987)

1976 - Regional stream sediment survey by BP Exploration led to discovery of skarn.
1978 - WGM Inc. evaluated area as part of the Doyon Ltd. Consortium. Drilling recommended.
1979 - Union Carbide continued evaluation of prospect.
1981 - Continued work by WGM Inc.
1982 - Patino Inc. evaluated property.

Production: Unknown.

Workings and Facilities:

There are six trenches and a cut bank located on Windy Knoll.

Geologic Setting:

The prospect area is within the Ruby terrane, near its contact with the Angayucham terrane. The Ruby terrane is composed of Proterozoic and lower Paleozoic metasedimentary rocks, protoliths, and mid-Cretaceous granitic plutons (Patton and Miller, 1973).

Skarns occur intermittently for a 5 mile strike length along the generally east-west-trending northern contact of the Kanuti Pluton with Paleozoic metasediments. The Kanuti Pluton is a biotite-rich body containing abundant pegmatite and aplite. The skarns are best exposed in a series of trenches on the south side of "Windy Knoll," a small knob on the north side of Bonanza Creek, 1.3 miles west of the headwaters. Here small masses of marble are altered to calc-silicate rocks ranging from fine-grained siliceous pyroxene-garnet skarn to coarse-grained dark green pyroxene skarn. The skarns contain up to 10% pyrrhotite, coarse-grained scheelite, sphalerite, along with trace chalcopyrite, molybdenite, and galena. The trenches expose skarn zones up to 16 feet wide that extend for 50 feet along strike. The skarn zones are intermixed with zones of pyroxene hornfels and are discontinuous and irregular in shape and thickness (Clautice, 1987).

According to WGM Inc. (1979), at Windy Knoll a 3,000-foot-long trend contains three areas of scheelite-bearing skarn and two coincident tungsten anomalies. In addition, a chip sample across a combined width of 6 feet of skarn in one of the trenches contains 1.17% tungsten trioxide and 7.67 oz/ton silver. The nearby intrusive body is only weakly altered and contains less than 0.05% tungsten trioxide. At the Beef claims, tungsten soil anomalies extend over 2,000 feet east-west and 400 feet north-south. The anomaly is open in all directions and generally parallels the intrusive contact.

Patino Inc. (1983) did not find any zones of continuous mineralization at the Bonanza Prospect that were close to economic grades over an appreciable length or width. Accessary minerals such as molybdenum and silver were found to be too sporadic and of insufficient grade to be of interest. The results of sampling by Patino Inc. at the Beef claims proved negative.

Bureau Investigation:

Three select rock samples of rubblecrop and float were collected from the trenches on Windy Knoll. (11987-89, table B-1). These contain up to 1.44% tungsten, 1,438 ppm zinc, and 936 ppm lead. A 3.5-foot-wide continuous chip sample of pyrrhotite-bearing skarn on the north bank of the creek, just southwest of Windy Knoll (11030), contains 97 ppm zinc and no tungsten. A brief examination was made of the Beef claims area, 1.6 miles east of the knoll. Trace amounts of molybdenite were observed on fracture surfaces in skarn float. One sample (12192) contains 521 ppm tungsten and 80 ppm molybdenum.

Resource Estimate: None.

Mineral Development Potential:

Low development potential for tungsten skarn deposits. This is due to the small size and spotty occurrence of the skarns in the area.

Recommendations: No further work is recommended at this site.

References:

Clautice, K.H., 1983, Geological sampling and magnetic surveys of a tungsten occurrence, Bonzanza Creek area, Hodzana highlands, Alaska: U.S. Bureau of Mines Open-File Report 80-83, 80 p.

____1987, Methods for finding and evaluating tungsten skarns, a case history of Bonanza Creek, Alaska: University of Alaska, Fairbanks, master’s thesis, 114 p.

Patino Inc., 1983, 1982 Annual report, Doyon Ltd. agreement, Bonanza I project area, Block 22, central Alaska: unpublished report 83-09 for Doyon Ltd., 9 p. [available from Doyon Ltd., Fairbanks, Alaska]

Patton, W.W., Jr., and Miller, T.P., 1973, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Union Carbide Corporation, 1979, Western Bonanza area, Doyon Ltd. project: unpublished report 79-43, p. 1-4. [available from BLM Anchorage, Alaska]

WGM Inc., 1979, 1978 Annual progress report, Doyon Ltd. project, Bonanza prospect report: unpublished report 79-01 for Doyon Ltd., 35 p. [available from Doyon Ltd., Fairbanks, Alaska]

____1983, Evaluation of the mineral potential of Doyon Ltd's Blocks 5 and 22, v. 1, Block 5: unpublished report 83-04 for Doyon Ltd., 78 p. [available from Doyon Ltd., Fairbanks, Alaska]

Property Summary

Name(s): Old Man Creek Lode
Het 1-200 claims

Map No: B18
MAS No: 0020390054
Alaska Kardex 039-007

Deposit Type: Epithermal veins

Commodities: Pb, Zn, Ag, Cu

Location:

Quadrangle: Bettles B-1 — NE¼ sec. 18, T. 19 N., R. 12 W.
Meridian: Fairbanks — Elevation: 1,130 feet
Latitude: 66° 28.533' N. — Longitude: 150° 12.250' W.
Geographic: Local name for the headwaters of the Kanuti River, about three miles south of VABM Fish and immediately east of hill 2653.

History:

1970 - Patton and Miller (1970) reported disseminated galena, sphalerite, and pyrite in oxidized and silicified rhyolite.

1972 - D. Vaughn staked 200 lode claims, named Het 1-200 (Kardex).

Production: None recorded.

Workings and Facilities: Remains of one lode(?) claim post were found on the bluff.

Geologic Setting:

The bedrock at the site is a silicified and sericitized rhyolite tuff and tuff breccia. It is composed of angular fragments of quartz and felsic rock in a fine-grained cryptocrystaline groundmass of quartz and sericite. The rhyolite, which is probably Tertiary in age, rests on and probably intrudes Cretaceous porphyritic biotite quartz monzonite of the Kanuti pluton. Scattered roof pendants of hornsfelic schist are located nearby (Patton and Miller, 1970).

Galena and sphalerite are disseminated through a pyritiferous zone about 100 yards long in the rhyolite. The zone is highly oxidized; there is abundant limonite staining associated with the mineralized rhyolite. Composite grab samples contain up to 20,000 ppm lead, 3,000 ppm zinc, 30 ppm silver, and 500 ppm copper (Patton and Miler, 1970).

Bureau Investigation:

A 500-foot-high reddish-orange weathering bluff on the west side of the creek was examined. Bedrock is predominately rhyolite tuff with a thin cap(?) of fine-grained granite. The rhyolite is heavily limonite-stained with the most intense portion concentrated on a 40-foot-wide band that extends for 200 feet across the bluff face. Here the tuff contains about 1% finely disseminated pyrite and pyrite boxworks. Minor (<8 mm) specks of galena and sphalerite were observed. Four samples of the tuff (11672-11674, 11678, table B-1) average 5.0 ppm silver, 1,360 ppm lead, and 311 ppm zinc. A sample of siliceous aplite dyke rock (11675) contains 4.4 ppm silver, 397 ppm copper, and 134 ppm zinc. The samples were not anomalous in gold.

A smaller outcrop of Tertiary rhyolite tuff about 3 miles southeast of the Old Man site was also investigated. The tuff and granite do not contain sulfides and the sample results (12175, 12191) are not anomalous.

Resource Estimate: None.

Mineral Development Potential:

The site has low mineral development potential as the samples did not contain significant amounts of gold or silver.

Recommendations: None.

References:

Cobb, E.H., 1972a, Metallic mineral resources map of the Bettles quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-387, 1 sheet, scale 1:250,000.

____1978, Summary of references to mineral occurrences (other than mineral fuels and construction materials) in the Beaver, Bettles, and Medfra quadrangles, Alaska: U.S. Geological Survey Open-File Report 78-94, p. 14.

Patton, W.W., Jr., and Miller, T.P., 1970, Preliminary geologic investigations in the Kanuti River region, Alaska: U.S. Geological Survey Bulletin 1312-J, p. J1-J10.

____1973a, Analyses of stream-sediment samples from the Bettles and the southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Open-File Report 73-219, 1 sheet, scale 1:250,000.

____1973b, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Property Summary

Name(s): Old Man Creek

Map No: B19
MAS No: 0020390055
Alaska Kardex 039-008

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Bettles B-1 — NE¼ sec. 18, T. 19 N., R. 12 W.
Meridian: Fairbanks — Elevation: 1,130 feet
Latitude: 66° 28.533' N. — Longitude: 150° 12.250' W.
Geographic: Local name for the headwaters of the Kanuti River, about three miles south of VABM Fish and immediately east of hill 2653.

History:

1970 - Patton and Miller (1970) reported disseminated galena, sphalerite, and pyrite in oxidized and silicified rhyolite.

1973 - Patton and Miller (1973a) conducted regional geochemical sampling of the area.

Production: None.

Workings and Facilities: None observed.

Geologic Setting:

Bedrock at Old Man Creek is a silicified and sericitized rhyolite tuff and tuff breccia. It is composed of angular fragments of quartz and felsic rock in a fine-grained cryptocrystaline groundmass of quartz and sericite. The rhyolite, which is probably Tertiary in age, rests on and probably intrudes Cretaceous porphyritic biotite quartz monzonite of the Kanuti pluton. Scattered roof pendants of hornsfelic schist are also located nearby (Patton and Miller, 1970).

Patton and Miller (1973a) conducted regional geochemical sampling of the area. No gold was detected in stream sediment samples collected near the site.

Bureau Investigation:

A pan concentrate sample was collected from a gravel bar on Old Man Creek (11677, table B-1), a short distance downstream of the lode occurrence (map no. B18). The pan did not contain visible gold. The sample results were not anomalous in gold or precious metals.

Resource Estimate: None.

Mineral Development Potential: Low mineral development potential due to lack of anomalous results.

Recommendations: None.

References:

Patton, W.W., Jr., and Miller, T.P., 1970, Preliminary geologic investigations in the Kanuti River region, Alaska: U.S. Geological Survey Bulletin 1312-J, p. J1-J10.

____1973a, Analyses of stream-sediment samples from the Bettles and the southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Open-File Report 73-219, 1 sheet, scale 1:250,000.

____1973b, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Property Summary

Name(s): Caribou Mountain

Map No: B20
MAS No: 0020390058

Deposit Type: Podiform chromite

Commodities: Cr, Ni, Co, PGE

Location:

Quadrangle: Bettles B-2
SW¼ sec. 6, T. 18 N., R. 14 W.
Meridian: Fairbanks
Elevation: 2,200 feet
Latitude: 66° 24.528' N.
Longitude: 150° 37.743' W.
Geographic: Located approximately 2.5 miles northeast of Caribou Mountain and just northeast of hill 2355. The Dalton Highway is 1.2 miles to the northeast.

History:

1901 - Mendenhall (1902) reported serpentinites along the Kanuti River.
1968-69 - U.S. Geological Survey completed reconnaissance geological mapping and geochemical studies in the Kanuti River region (Patton and Miller, 1970).
1979 - U.S. Bureau of Mines began investigations in area as part of assessment of lands adjacent to the Trans-Alaska Pipeline corridor (Foley and McDermott, 1983).

Production: None.

Workings and Facilities: None.

Geologic Setting:

The Caribou Mountain-Melozitna ultramafic belt, also known as the Kanuti ultramafic belt, trends northeast for 62 miles in the Kokrine-Hodzana Highlands. This belt is included in a mafic sequence that follows the contact between the upper Paleozoic-Mesozoic Angayucham terrane to the north and the Proterozoic(?) and Paleozoic miogeoclinal rocks of the Ruby Geanticline to the south. A portion of the Ruby Geanticline underlies the mafic-ultramafic belt and consists of pelitic schist, quartzite, and phyllite with subordinate marble, metamorphosed graywacke, and slate (Patton and Miller, 1970; Foley and McDermott, 1983; Patton, 1989; Foley, 1992).

Mafic rocks consist of a Permian through Jurassic volcanic and intrusive sequence including pillow basalt, diabase and gabbro with subordinate basaltic and andesitic volcaniclastic rocks, chert, and cherty mudstone. These rocks appear to comprise erosional remnants of allochthonous sheets of ophiolite and allied oceanic crustal rocks that were thrust over the metasedimentary sequence in late Mesozoic time. The mafic rocks are commonly metamorphosed to greenstone. It is with these mafic rocks that the ultramafic rocks of the Caribou Mountain-Melozitna belt are associated. The belt comprises 6 Permian(?) through Jurassic(?) ultramafic bodies that represent a dismembered ophiolite assemblage consisting of serpentinized dunite and pyroxene-peridotite, pyroxenite, gabbro, diabase altered pillow basalt and associated chert. The ultramafic rocks outcrop as layered masses and grade upward into gabbroic and basaltic rocks. Bordering the ultramafic belt on the north are Cretaceous sedimentary and volcanic rocks of the upper Koyukuk basin (Patton and Miller, 1970; Foley and McDermott, 1983;

Patton, 1989; Foley, 1992).

The Caribou Mountain complex lies at the northeast end of the ultramafic belt and is composed of interlayered dunite and pyroxene-peridotite. Dunite exposures weather to orange-brown and are sparsely vegetated. The individual layers, or faulted blocks, range from tens to thousands of feet thick. Subordinate lithologies include gabbro, pyroxenite, serpentinite, and chromitite. The highest chromite concentrations are within the dunite, but seldom exceed 1 to 2 volume percent of the rock. There are 10 individual occurrences at Caribou Mountain that consist of massive chromite, wispy concentrations of disseminated chromite grains, and continuous disseminated chromite grains. Mineralized intervals range in thickness from less than 1 inch to 5 feet and in grade from 1 to 6% chromium. Magnetite is a common accessory occurring as disseminated euhedra and rimming chromite grains. One select chromite sample contains 377 ppb palladium and 1,337 ppb platinum (Foley, 1992). The frost-heaved rubble areas are believed to be the surface expression of pods of massive and disseminated chromite mineralization. The Caribou Mountain occurrence is petrologically similar to the upper and lower Kanuti River occurrences (map nos. B21 and B24) to the southwest.

Beneficiation studies were done by the Bureau of Mines on samples collected at Caribou Mountain. A sample was concentrated to 48.7% chromite with a Cr:Fe ratio of 2.4:1, and 64% chromium recovery. No platinum minerals were observed in mineralogical examinations of the concentrates (Dahlin and others, 1983).

Bureau Investigation:

A few samples were collected in an effort to verify the results of previous extensive sampling by Foley and McDermott (1983). A random chip sample from a 1-foot-thick zone containing individual chromitite layers up to 1 inch thick (8005, table B-1) contains >30,000 ppm chromium and 2,180 ppm nickel. The average abundance of nickel in ultramafic rocks is 2,000 ppm (Levinson, 1974). A select sample from rubblecrop composed of 0.5- to 1.0-inch-thick chromitite layers (11419) contains 22.43% chromium, 1,310 ppm nickel, and 8 ppb platinum. Bureau of Mines samples contain chromium values in the 1% through 6% range while samples collected by the BLM average 19.3% chromium. This is probably due to the more select nature of the BLM samples. Two samples (8005, 8006) had cobalt analyses of 230 and 240 ppm respectively. Bureau of Mines samples had cobalt values mostly in the low- to mid-100-ppm range (Foley and McDermott, 1983).

Resource Estimate:

Inferred resource of 2,000 to 2,400 tons of chromic oxide (Cr_2O_3) in banded intervals up to 10 feet thick and exposed for up to 50 feet along strike (Foley, 1992).

Mineral Development Potential:

Low development potential for chromium and platinum group elements (PGE). The chromite occurrences are small and discontinuous. It is possible that larger buried deposits exist.

Recommendations:

A low-cost subsurface exploration and/or airborne geophysical survey of the area would better establish the extent of the podiform chromitites. Use of an auger or small scale trenching would be of use in determining if drilling is necessary. Taking large volume pan concentrates in the drainages surrounding Caribou Mountain may be beneficial in determining extent of the chromium mineralization and the potential for platinum-group elements. This may be difficult, as many of the small drainages do not contain running water.

References:

Clautice, K.H., 1978, Mineral deposits of the Kanuti River area: A summary report: U.S. Bureau of Mines Open-File Report 66-78, 63 p.

Dahlin, D.C., Brown, L.L., and Kinney, J.J., 1983, Podiform chromite occurrences in the Caribou Mountain and lower Kanuti River areas, central Alaska, part II, beneficiation: U.S. Bureau of Mines Information Circular 8916, 15 p.

Foley, J.Y., 1992, Ophiolitic and other mafic-ultramafic metallogenic provinces in Alaska (west of the 141st Meridian): U.S. Geological Survey Open-File Report 92-20B, 55 p.

Foley, J.Y., Barker, J.C., and Brown, L.L., 1985, Critical and strategic minerals investigations in Alaska: chromium: U.S. Bureau of Mines Open-File Report 97-85, p. 13-14, 1 sheet.

Foley, J.Y., and McDermott, M.M., 1983, Podiform chromite occurrences in the Caribou Mountain and lower Kanuti River areas, central Alaska, Part 1: U.S. Bureau of Mines Information Circular 8915, 27 p.

Herreid, G., 1969, Geology and geochemistry Sithylemenkat Lake area, Bettles quadrangle, Alaska: Division of Mines and Geology, Geologic Report 35, 22 p.

Levinson, A.A., 1974, Introduction to exploration geochemistry: Applied Publishing Ltd., Wilmette, Illinois, U.S.A., p. 43-44.

Mendenhall, W.C., 1902, Reconnaissance from Fort Hamlin to Kotzebue Sound, Alaska by way of Dall, Kanuti, Allen and Kowak Rivers: U.S. Geological Survey Professional Paper 10, 68 p.

Patton, W.W., Jr., 1989, Framework geology: Yukon River to Brooks Range, *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 1, p. 27-30.

Patton, W.W., Jr., and Miller, T.P., 1970, Preliminary geologic investigations in the Kanuti River region, Alaska: U.S. Geological Survey Bulletin 1312-J, p. J1-J10.

____1973, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Roberts, W.S., 1985, Bulk mineralogy and geochemistry of selected Alaskan Chromian spinel samples: U.S. Bureau of Mines Information Circular 9023, 13 p.

Property Summary

Name(s): Upper Kanuti River Lode

Map No: B21
MAS No: 0020390059

Deposit Type: Podiform chromite

Commodities: Cr, Ni

Location:

Quadrangle: Bettles B-2
SW¼ sec. 10, T. 18 N., R. 15 W.
Meridian: Fairbanks
Elevation: 1,700 feet
Latitude: 66° 24.023' N.
Longitude: 150° 44.647' W.
Geographic: Located approximately 2 miles northwest of Caribou Mountain.

History:

1901 - Mendenhall (1902) reported serpentinites along the Kanuti River.
1968-69 - U.S. Geological Survey does reconnaissance geological mapping and geochemical studies in the Kanuti River region (Patton and Miller, 1970).
1979 - U.S. Bureau of Mines (BOM) began investigations in area as part of assessment of lands adjacent to the Trans-Alaska Pipeline corridor (Foley and McDermott, 1983).

Production: None.

Workings and Facilities: None.

Geologic Setting:

The Caribou Mountain-Melozitna ultramafic belt, also known as the Kanuti ultramafic belt, trends northeast for 62 miles in the Kokrine-Hodzana Highlands. This belt is included in a mafic sequence that follows the contact between the upper Paleozoic-Mesozoic Angayucham terrane to the north and the Proterozoic(?) and Paleozoic miogeoclinal rocks of the Ruby Geanticline to the south. A portion of the Ruby Geanticline underlies the mafic-ultramafic belt and consists of pelitic schist, quartzite, and phyllite with subordinate marble, metamorphosed graywacke, and slate (Patton and Miller, 1970; Foley and McDermott, 1983; Patton, 1989; Foley, 1992).

Mafic rocks consist of a Permian through Jurassic volcanic and intrusive sequence including pillow basalt, diabase and gabbro with subordinate basaltic and andesitic volcaniclastic rocks, chert, and cherty mudstone. These rocks appear to comprise erosional remnants of allochthonous sheets of ophiolite and allied oceanic crustal rocks that were thrust over the metasedimentary sequence in late Mesozoic time. The mafic rocks are commonly metamorphosed to greenstone. It is with these mafic rocks that the ultramafic rocks of the Caribou Mountain-Melozitna belt are associated. The belt comprises 6 Permian(?) through Jurassic(?) ultramafic bodies that represent a dismembered ophiolite assembledge consisting of serpentinized dunite and pyroxene-peridotite, pyroxenite, gabbro, diabase altered pillow basalt and associated chert. The ultramafic rocks outcrop as layered masses and grade upward into gabbroic and basaltic rocks. Bordering the ultramafic belt on the north are Cretaceous sedimentary and volcanic rocks of the upper Koyukuk basin (Patton and Miller, 1970; Foley and McDermott, 1983; Patton, 1989; Foley, 1992).

The Upper Kanuti River complex is composed of interlayered dunite and pyroxene-peridotite. Dunite exposures weather to orange-brown and are sparsely vegetated. The individual layers, or faulted blocks, range from tens to thousands of feet thick. Subordinate lithologies include gabbro, pyroxenite, serpentinite, and chromitite. The highest chromite concentrations are within the dunite, but seldom exceed 1 to 2 volume percent of the rock. The disseminated chromite at the site was relatively small in area. The frost-heaved rubble areas are believed to be the surface expression of pods of massive and disseminated chromite mineralization.

The upper Kanuti River lode occurrence is petrologically similar to the Caribou Mountain (map no. B20) and lower Kanuti River lode occurrences (map no. B24).

Foley and McDermont (1983) sampled 12 locations at the upper Kanuti River occurrence. The samples contain up to 15,000 ppm chromium and 13,500 ppm nickel. The average abundance of chromium and nickel in ultramafic rocks is 2,000 ppm (Levinson, 1974). Although they reported numerous concentrations of disseminated chromite in dunite, the sites were relatively small.

Bureau Investigation:

Two rock samples (11421-11422, table B-1) were collected near the upper Kanuti River lode location. Both were select float samples that contain disseminated chromite in a dunite matrix. The samples average 3.61% chromium and 1,225 ppm nickel. Several chromite occurrences in dunite dot the area; however, they are small in areal extent.

Resource Estimate: None.

Mineral Development Potential:

Low development potential for chromium and platinum group elements (PGE). The chromite occurrences are small and discontinuous. It is possible that larger buried deposits exist.

Recommendations:

A low-cost subsurface exploration and/or airborne geophysical survey of the area would better establish the extent of the podiform chromatites. Use of an auger or small scale trenching would be of use in determining if drilling is necessary. Taking large volume pan concentrates in the drainages surrounding Caribou Mountain may be beneficial in determining extent of the chromium mineralization and the potential for platinum-group elements. This may difficult as many of the small drainages do not contain running water.

References:

Clautice, K.H., 1978, Mineral deposits of the Kanuti River area: A summary report: U.S. Bureau of Mines Open-File Report 66-78, 63 p.

Dahlin, D.C., Brown, L.L., and Kinney, J.J., 1983, Podiform chromite occurrences in the Caribou Mountain and lower Kanuti River areas, central Alaska, part II, beneficiation: U.S. Bureau of Mines Information Circular 8916, 15 p.

Eakin, H.M., 1916, The Yukon-Koyukuk region, Alaska: U.S. Geological Survey Bulletin 631, 88 p.

Foley, J.Y., 1992, Ophiolitic and other mafic-ultramafic metallogenic provinces in Alaska (west of the 141st Meridian): U.S. Geological Survey Open-File Report 92-20B, 55 p.

Foley, J.Y., Barker, J.C., and Brown, L.L., 1985, Critical and strategic minerals investigations in Alaska: chromium: U.S. Bureau of Mines Open-File Report 97-85, 54 p.

Foley, J.Y., and McDermott, M.M., 1983, Podiform chromite occurrences in the Caribou Mountain and lower Kanuti River areas, central Alaska, Part 1: U.S. Bureau of Mines Information Circular 8915, 27 p.

Herreid, G., 1969, Geology and geochemistry Sithylemenkat Lake area, Bettles quadrangle, Alaska: Division of Mines and Geology, Geologic Report 35, 22 p.

Levinson, A.A., 1974, Introduction to exploration geochemistry: Applied Publishing Ltd., Wilmette, Illinois, U.S.A., p. 43-44.

Mendenhall, W.C., 1902, Reconnaissance from Fort Hamlin to Kotzebue Sound, Alaska by way of Dall, Kanuti, Allen and Kowak Rivers: U.S. Geological Survey Professional Paper 10, 68 p.

Patton, W.W., Jr., 1989, Framework geology: Yukon River to Brooks Range, *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 1, p. 27-30.

Patton, W.W., Jr., and Miller, T.P., 1970, Preliminary geologic investigations in the Kanuti River region, Alaska: U.S. Geological Survey Bulletin 1312-J, p. J1-J10.

____1973, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Roberts, W.S., 1985, Bulk mineralogy and geochemistry of selected Alaskan Chromian spinel samples: U.S. Bureau of Mines Information Circular 9023, 13 p.

Property Summary

Name(s): Hot Springs Pluton Placer
Wallace's Folly claims

Map No: B22
MAS No: 0020390063

Deposit Type: Placer

Commodities: Sn

Location:

Quadrangle: Bettles B-2
NE¼ sec. 1, T. 17 N., R. 16 W.
Meridian: Fairbanks
Elevation: 840 feet
Latitude: 66° 20.129' N.
Longitude: 150° 52.964' W.
Geographic: On an eastern tributary to the Kanuti River, 6 miles southwest of Caribou Mountain and 1 mile downstream from Kanuti Hot Springs.

History:

1980 - Wallace's Folly 1-8 claims staked.

Production: None.

Workings and Facilities: None observed.

Geologic Setting:

The occurrence is located on a stream that drains the western end of the Hot Springs Pluton. The pluton is a mid-Cretaceous east-west-trending, elongate, 100-square-mile body composed mostly of seriate biotite granite and biotite quartz monzonite with minor hornblende. Locally it is intruded by dikes and stocks of rhyolite porphyry (see map no. B23). Near the placer occurrence, the pluton has intruded Triassic and Jurassic mafic volcanic and intrusive rocks that consist of pillow basalt, diabase, and gabbro. Samples collected by the Bureau of Mines from the pluton contain up to 12 ppm tin and 1,000 ppm uranium (Barker and Foley, 1986).

Bureau Investigation:

Several test pans taken on the alluvial fan at the mouth of the creek produced a total of only 1 very fine gold flake. A pan concentrate (11485, table B-1) contains 1,345 ppm tin, 617 ppm chromium, and 323 ppb gold. No bedrock was observed nearby.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential due to low tin values, small quantity of material, and the remoteness of the site.

Recommendations: Trench and/or drilling in the alluvial fan at the creek mouth.

References:

Barker, J.C., and Foley, J.Y. 1986, Tin reconnaissance of the Kanuti and Hodzana Rivers Uplands, Central Alaska: U.S. Bureau of Mines Information Circular 9104, p. 10.

Clautice, K.H., 1978, Mineral deposits of the Kanuti River area: A summary report: U.S. Bureau of Mines Open-File Report 66-78, 63 p.

Property Summary

Name(s): Hot Springs Pluton Lode

Map No: B23
MAS No: 0020390067

Deposit Type: Pluton-related

Commodities: U, Th

Location:

Quadrangle: Bettles B-2
NE¼ sec. 2, T. 17 N., R. 16 W.
Meridian: Fairbanks
Elevation: 1,310 feet
Latitude: 66° 20.086' N.
Longitude: 150° 55.095' W.
Geographic: A narrow, steep-sided ridge on the north side of the Kanuti river, 7 miles southwest of Caribou Mountain.

History:

1978-80 - The U.S. Bureau of Mines sampled rocks in the upper Kanuti River area that were anomalous in uranium and thorium (barker and Foley, 1986).

Production: None.

Workings and Facilities: None.

Geologic Setting:

The Hot Springs Pluton is a mid-Cretaceous east-west-trending, elongate, 100-square-mile body composed mostly of seriate biotite granite and biotite quartz monzonite with minor hornblende. Locally it is intruded by dikes and stocks of rhyolite porphyry and granular leucocratic granite. These rocks are variably altered and range in color from bleached white to iron-stained red. Near the lode occurrence, the pluton has intruded Triassic and Jurassic mafic volcanic and intrusive rocks composed of pillow basalt, diabase, and gabbro (Barker and Foley, 1986; Patton and Miller, 1973).

Altered rhyolite porphyry, biotite granite, and leucocratic granite occur as rubble on a narrow steep-sided ridge near the west end of the Hot Springs Pluton. Samples collected by the Bureau of Mines contain above average concentrations of lithium, copper, arsenic, tin, antimony, lead, and uranium. Metazeunerite was identified by X-ray diffraction in gray-green-weathering altered rhyolite porphyry that contains 1,000 ppm uranium, 2,616 ppm lead, 341 ppm copper, and 218 ppm tin (Barker and Foley, 1986). A placer tin occurrence is located 0.75 mile upstream and on the south side of the river (see map no. B22).

Bureau Investigation:

A 3-foot-wide zone of altered rhyolite porphyry was exposed for 30 feet along a N. 80° W. trend on the ridgetop described by the Bureau of Mines. The porphyry was light green and feldspar phenocrysts showed signs of argillic alteration. The porphyry was cut by numerous quartz veinlets. A sample (11487) contains 25 ppm thorium, 5.6 ppm uranium, 30 ppm lead, and 76 ppm arsenic. These values are well below the results obtained by the Bureau of Mines. Tests with a scintillometer showed samples to contain radioactivity levels 1.3 times background level.

Resource Estimate: None.

Mineral Development Potential: Low potential for lode uranium due to low analytical results.

Recommendations:

Search the area with a scintillometer and sample areas having the highest radioactivity.

References:

Barker, J.C., and Foley, J.Y., 1986, Tin Reconnaissance of the Kanuti and Hodzana Rivers uplands, central Alaska: U.S. Bureau of Mines Information Circular 9104, p. 10.

Patton, W.W., and Miller, T.P., 1973, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Property Summary

Name(s): Lower Kanuti River Lode
Dome Creek
Oil Development Co. of Texas

Map No: B24
MAS No: 0020390060

Deposit Type: Podiform chromite

Commodities: Cr, Co, PGE

Location:

Quadrangle: Bettles A-3
SE¼ sec. 24, T. 17 N., R. 16 W.
Meridian: Fairbanks
Elevation: 1,860 feet
Latitude: 66° 16.739' N.
Longitude: 150° 52.534' W.
Geographic: Approximately 8.5 miles southwest of Caribou Mountain and 18 miles northeast of Sithylemenkat Lake.

History:

1901 - Mendenhall (1902) reported serpentinites along the Kanuti River.
1968-69 - U.S. Geological Survey found ultramafic bodies during reconnaissance geological mapping in the Kanuti River region (Patton and Miller, 1970).
1975 - Oil Development Co. of Texas filed claims in lower Kanuti area (Foley and McDermott, 1983).
1979 - U.S. Bureau of Mines began investigations in area as part of assessment of lands adjacent to the Trans-Alaska Pipeline corridor (Foley and McDermott, 1983).

Production: None.

Workings and Facilities:

One pit excavated by the Oil Development Co. of Texas (Foley and McDermott, 1983).

Geologic Setting:

The Caribou Mountain-Melozitna ultramafic belt, also known as the Kanuti ultramafic belt, trends northeast for 62 miles in the Kokrine-Hodzana Highlands. This belt is included in a mafic sequence that follows the contact between the upper Paleozoic-Mesozoic Angayucham terrane to the north and the Proterozoic(?) and Paleozoic miogeoclinal rocks of the Ruby Geanticline to the south. A portion of the Ruby Geanticline underlies the mafic-ultramafic belt and consists of pelitic schist, quartzite, and phyllite with subordinate marble, metamorphosed graywacke, and slate (Patton and Miller, 1970; Foley and McDermott, 1983; Patton, 1989).

Mafic rocks consist of a Permian through Jurassic volcanic and intrusive sequence composed of pillow basalt, diabase, and gabbro with subordinate basaltic and andesitic volcaniclastic rocks, chert, and cherty mudstone. These rocks appear to comprise erosional remnants of allochthonous sheets of ophiolite and allied oceanic crustal rocks that were thrust over the metasedimentary sequence in late Mesozoic time. The mafic rocks are commonly metamorphosed to greenstone. It is with these mafic rocks that the ultramafic rocks of the Caribou Mountain-Melozitna belt are associated. The belt comprises 6 Permian(?) through Jurassic(?) ultramafic bodies that represent a dismembered ophiolite assemblage that consist of serpentinized dunite and pyroxene-peridotite, pyroxenite, gabbro, diabase altered pillow basalt, and associated chert. The ultramafic rocks outcrop as layered masses and grade upward into gabbroic and basaltic rocks. Bordering the ultramafic belt on the north are Cretaceous sedimentary and volcanic rocks of the upper Koyukuk basin (Patton and Miller, 1970; Foley and McDermott, 1983; Patton, 1989).

In the lower Kanuti area, 14 chromite occurrences are scattered over an 10-mile-long exposure of serpentinized dunite and peridotite that is up to 2 miles wide. Chromite is present in banded and disseminated high-chromium chromite in a 5-foot-thick by 80-foot-long exposure. A tabled chromite concentrate from one sample contains 340 ppb platinum (Foley, 1992). The pit is reported to expose a pod of massive chromatite. A beneficiation test of a bulk sample, collected by the Bureau of Mines, from that site produced a concentrate of 53.8% chromite with a chrome to iron ratio of 2.4:1. Chromium recovery was 87%. This site produced the best results from all the beneficiation samples collected in the ultramafic belt (Foley and McDermott, 1983; Dahlin and others, 1983; Foley, 1992).

Bureau Investigation:

Rock samples were collected at 3 sites in the lower Kanuti area (table B-1). A 6-foot continuous chip sample (11470) across a 6-foot-thick zone of banded chromite in dunite contains 10.33% chromium and 1,359 ppm nickel. The dunite contains individual chromite bands up to 0.6 feet thick that are exposed for 30 feet along strike. A select sample of the chromite bands (11471) contains 25.82% chromium, 759 ppm nickel, and 9 ppb platinum. This site is reported to be the best exposure of banded chromite in the area and is located 0.7 mile northeast of hill 2190 at the northeastern end of the ultramafic belt (Foley and McDermott, 1983).

Samples collected near Dome Creek in the central part of the belt all contain <600 ppm chromium, but one sample (11455) contains 1,357 ppm nickel. At the southeastern end of the belt, a select sample from a 3- by 50-foot patch of rubblecrop, 0.5 mile northwest of hill 1980 (11469), contains 24.15% chromium and no detectable platinum. A sample (11468) collected from rubblecrop, 0.4 miles northwest of hill 1980, contains 13.06% chromium and 1,509 ppm nickel. The reported pit was not examined.

Resource Estimate: Inferred resource of 700 to 800 tons chromic oxide (Cr_2O_3) (Foley, 1992).

Mineral Development Potential:

Low development potential for chromium and platinum group metals. The chromite occurrences in the area are small and discontinuous. It is possible that larger buried deposits exist.

Recommendations:

A low-cost subsurface exploration and/or airborne geophysical survey of the area would better establish the extent of the podiform chromatites. Use of an auger or small scale trenching would be of use in determining if drilling is necessary. Taking large volume pan concentrates in the drainages surrounding the ultramafic rocks may be beneficial in determining extent of the chromium mineralization and the potential for platinum-group elements. This may be difficult as many of the small drainages do not contain running water.

References:

Clautice, K.H., 1978, Mineral deposits of the Kanuti River area: A summary report: U.S. Bureau of Mines Open-File Report 66-78, 63 p.

Dahlin, D.C., Brown, L.L., and Kinney, J.J., 1983, Podiform chromite occurrences in the Caribou Mountain and lower Kanuti River areas, central Alaska, part II, beneficiation: U.S. Bureau of Mines Information Circular 8916, 15 p.

Eakin, H.M., 1916, The Yukon-Koyukuk region, Alaska: U.S. Geological Survey Bulletin 631, 88 p.

Foley, J.Y., 1992, Ophiolitic and other mafic-ultramafic metallogenic provinces in Alaska (west of the 141st Meridian): U.S. Geological Survey Open-File Report 92-20B, 55 p.

Foley, J.Y., Barker, J.C., and Brown, L.L., 1985, Critical and strategic minerals investigations in Alaska: chromium: U.S. Bureau of Mines Open-File Report 97-85, 54 p.

Foley, J.Y., and McDermott, M.M., 1983, Podiform chromite occurrences in the Caribou Mountain and lower Kanuti River areas, central Alaska, Part 1: U.S. Bureau of Mines Information Circular 8915, 27 p.

Herreid, G., 1969, Geology and geochemistry Sithylemenkat Lake area, Bettles quadrangle, Alaska: Division of Mines and Geology, Geologic Report 35, 22 p.

Mendenhall, W.C., 1902, Reconnaissance from Fort Hamlin to Kotzebue Sound, Alaska by way of Dall, Kanuti, Allen and Kowak Rivers: U.S. Geological Survey Professional Paper 10, 68 p.

Patton, W.W., Jr., 1989, Framework geology: Yukon River to Brooks Range, *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 1, p. 27-30.

Patton, W.W., Jr., and Miller, T.P., 1970, Preliminary geologic investigations in the Kanuti River region, Alaska: U.S. Geological Survey Bulletin 1312-J, p. J1-J10.

____1973, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Property Summary

Name(s): Dome Creek

Map No: B25
MAS No: 0020390056
Alaska Kardex 039-004

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Bettles B-3
SE¼ sec. 32, T. 17 N., R. 16 W.
Meridian: Fairbanks
Elevation: 925 feet
Latitude: 66° 15.370' N.
Longitude: 151° 00.564' W.
Geographic: Dome Creek is a local name for a southern tributary of the Kanuti River, about 5 miles southwest of Caribou Mountain.

History:

1912 - Brooks (1912) reported placer gold prospects on Dome Creek.

Production: None.

Workings and Facilities: None observed.

Geologic Setting:

The site is within the Caribou Mountain-Melozitna ultramafic belt. Bedrock for most of Dome Creek consists of Jurassic ultramafic rocks (serpentized peridotite and dunite with minor chert) that are thrust over Jurassic mafic volcanic and intrusive rocks (pillow basalt, diabase, and gabbro). The faults and contacts between the units trend northeast-southwest. Farther south, at the Dome Creek headwaters, the mafic rocks contact Upper Paleozoic (Devonian?) phyllite and fine-grained metagraywacke (Patton and Miller, 1973).

Bureau Investigation:

Dome Creek was investigated near the mafic volcanic and intrusive bluffs, at about 950 feet elevation. During the investigation, the water was running very high. One pan concentrate sample (11457, table B-1) was collected from gravel along the side of the creek because no bedrock locations could be located. The sample contained 2 fine flakes of gold and minor magnetite. The laboratory misplaced the sample before it could be analyzed for gold.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential due to limited amounts of gold found at site and lack of bedrock exposures along creek.

Recommendations:

Investigation was during period of high water. Sample during low water when bedrock may be exposed.

References:

Brooks, A.H., 1912, Mineral resources of Alaska, report on progress of investigations in 1911: U.S. Geological Survey Bulletin 520, p. 38.

Cobb, E.H., 1978, Summary of references to mineral occurrences (other than mineral fuels and construction materials) in the Beaver, Bettles, and Medfra quadrangles, Alaska: U.S. Geological Survey Open-File Report 78-94, p. 9.

Patton, W.W., Jr., and Miller, T.P., 1973, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Property Summary

Name(s): East Fork Kanuti River
Agnis claims

Map No: B26
MAS No: 0020390036
Alaska Kardex 039-001

Deposit Type: Placer

Commodities: Au, Ag

Location:

Quadrangle: Bettles A-3
SW¼ sec. 14, T. 16 N., R. 17 W.
Meridian: Fairbanks
Elevation: 570 feet
Latitude: 66° 12.456' N.
Longitude: 151° 05.315' W.
Geographic: Located on an eastern tributary of the Kanuti River, 10 miles northeast of Sithylemenkat Lake. The site is on Doyon Ltd. selected lands.

History:

1963 - Discovery placer claims filed by D. Stickman and G. Edwin. Reported to have worked on an airstrip on site (U.S. Bureau of Mines PIMR, 1963).
1969 - Stickman and Edwin sink 5 holes (U.S. Bureau of Mines PIMR, 1963).
1978-80 - Placer and lode(?) claims staked by H. Whitman (Kardex).

Production: None

Workings and Facilities: No evidence of prospecting.

Geologic Setting:

The reported placer occurrence lies on the southern edge of the Caribou Mountain-Melozitna ultramafic belt. This belt, also known as the Kanuti ultramafic belt, trends northeast for 62 miles in the Kokrines-Hodzana Highlands. It lies along the margins of two geological provinces in central Alaska: the Ruby Geanticline to the southeast and the Angayuchum volcanogenic and sedimentary province to the northwest. A portion of the Ruby Geanticline underlies the ultramafic belt and consists of pelitic schist, quartzite, and phyllite with subordinate marble, metamorphosed graywacke, and slate (Foley and McDermott, 1983; Patton, 1989).

The metasedimentary rocks are overlain by a sequence of mafic volcanic and intrusive rocks that include pillow basalt, diabase, and gabbro with subordinate basaltic and andesitic volcaniclastic rocks, chert and cherty mudstone. The mafic rocks are commonly metamorphosed to greenstone. The Caribou Mountain-Melozitna ultramafic belt is associated with these rocks and represents a dismembered ophiolite complex consisting of serpentinized dunite and pyroxene- peridotite, pyroxenite, gabbro, diabase altered pillow basalt, and associated chert. The ultramafic rocks outcrop as layered masses. To the north of the ultramafic rocks are Cretaceous conglomerates and Tertiary felsic volcanic rocks that fill the upper Koyukuk basin (Foley and McDermott, 1983; Patton, 1989).

Bedrock on the east fork of the Kanuti River consists of Jurassic ultramafic rocks (serpentinized peridotite and dunite with minor chert) that are thrust over Jurassic mafic volcanic and intrusive rocks (pillow basalt, diabase, and gabbro). Underlying the volcanic and intrusive rocks to the south are Devonian or late Paleozoic phyllite and fine-grained metagraywacke (Patton, 1989).

Bureau Investigation:

Bedrock in the vicinity of the placer occurrence consists of chlorite schist and metagraywacke cut by quartz veinlets (Patton and Miller, 1973). Eight test pans collected from the upstream end of a point bar produced 2 very fine gold flakes. A pan concentrate (11483, table B-1) contains 2,119 ppb gold and 252 ppm chromium. The source of the gold may be the granitic rocks of the Sithylemenkat Pluton (map no. B29) at the headwaters of the east fork of the Kanuti River.

Resource Estimate: None.

Mineral Development Potential:

Low development potential due to low gold values and lack of shallow bedrock.

Recommendations:

Prospect contact aureole surrounding granitic rocks at the headwaters of the east fork of the Kanuti River for lode gold deposits.

References:

Clautice, K.H., 1978, Mineral deposits of the Kanuti River area: A summary report: U.S. Bureau of Mines Open-File Report 66-78, 63 p.

Dahlin, D.C., Brown, L.L., and Kinney, J.J., 1983, Podiform chromite occurrences in the Caribou Mountain and lower Kanuti River areas, central Alaska, part II, beneficiation: U.S. Bureau of Mines Information Circular 8916, 15 p.

Eakin, H.M., 1916, The Yukon-Koyukuk region, Alaska: U.S. Geological Survey Bulletin 631, 88 p.

Foley, J.Y., 1992, Ophiolitic and other mafic-ultramafic metallogenic provinces in Alaska (west of the 141st Meridian): U.S. Geological Survey Open-File Report 92-20B, 55 p.

Foley, J.Y., Barker, J.C., and Brown, L.L., 1985, Critical and strategic minerals investigations in Alaska: chromium: U.S. Bureau of Mines Open-File Report 97-85, 54 p.

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Maddren, A.G., 1913, The Koyukuk-Chandalar region, Alaska: U.S. Geological Survey Bulletin 532, 119 p.

Mendenhall, W.C., 1902, Reconnaissance from Fort Hamlin to Kotzebue Sound, Alaska by way of Dall, Kanuti, Allen and Kowak Rivers: U.S. Geological Survey Professional Paper 10, 68 p.

Patton, W.W., Jr., 1989, Framework geology: Yukon River to Brooks Range, *in* Mull C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 1, p. 27-30.

Patton, W.W., Jr., and Miller, T.P., 1970, Preliminary geologic investigations in the Kanuti River region, Alaska: U.S. Geological Survey Bulletin 1312-J, p. J1-J10.

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U.S. Bureau of Mines, 1963, Permanent Individual Mine Records (PIMR) for placer mines in Alaska: U.S. Bureau of Mines unpublished reports. [available from BLM Anchorage, Alaska]

Property Summary

Name(s): Sithylemenkat Lake

Map No: B27
MAS No: 0020390065
ARDF BT003

Deposit Type: Podiform chromite

Commodities: Cr, Co, Cu

Location:

Quadrangle: Bettles A-3
NW¼ sec. 18, T. 15 N., R. 18 W.
Meridian: Fairbanks
Elevation: 740 feet
Latitude: 66° 07.905' N.
Longitude: 151° 26.958' W.
Geographic: Located one mile west-northwest of Sithylemenkat Lake on a ridge. The site is located on Doyon Ltd. lands.

History:

1968-69 - The U.S. Geological Survey and Alaska Division of Mines and Geology conducted geologic investigations in the area, which included mapping and collecting hundreds geochemical samples (Herreid, 1969; Patton and Miller, 1970).

Production: None.

Workings and Facilities: None.

Geologic Setting:

Sithylemenkat Lake is located along the Caribou Mountain-Melozitna ultramafic belt, also known as the Kanuti ultramafic belt, and trends northeast for 62 miles in the Kokrine-Hodzana Highlands. This belt is included in a mafic sequence that follows the contact between the upper Paleozoic-Mesozoic Angayucham terrane to the north and the Proterozoic(?) and Paleozoic miogeoclinal rocks of the Ruby Geanticline to the south. A portion of the Ruby Geanticline underlies the mafic-ultramafic belt and consists of pelitic schist, quartzite, and phyllite with extensive intrusions of Cretaceous granite (Foley and McDermott, 1983; Patton, 1989).

Mafic rocks consist of a Permian through Jurassic volcanic and intrusive sequence that includes pillow basalt, diabase, and gabbro with subordinate basaltic and andesitic volcaniclastic rocks, chert, and cherty mudstone. These rocks appear to comprise erosional remnants of allochthonous sheets of ophiolite and allied oceanic crustal rocks that were thrust over the metasedimentary sequence in late Mesozoic time. The mafic rocks are commonly metamorphosed to greenstone. It is with these mafic rocks that the ultramafic rocks of the Caribou Mountain-Melozitna belt are associated. The belt comprises 6 ultramafic bodies that represent a dismembered ophiolite assembledge consisting of serpentinized dunite and pyroxene- peridotite, pyroxenite, gabbro, diabase altered pillow basalt and associated chert. The ultramafic rocks outcrop as layered masses and grade upward into gabbroic and basaltic rocks. Bordering the ultramafic belt on the north are Cretaceous sedimentary and volcanic rocks of the upper Koyukuk basin (Foley and McDermott, 1983; Patton, 1989).

At Sithylemenkat Lake two northeast-trending ridges are composed ultramafic intrusive rocks including pyroxenite, peridotite, gabbro, and diabase. These ridges are located 1 mile west and 4.5 miles southeast of the lake. They are underlain by Paleozoic schist, which is intruded by Cretaceous granite of the Sithylemenkat Pluton. The granite contains almost no mafic minerals, but does contain small greisen zones with tourmaline, cassiterite, and magnetite sometimes present (see map no. B29) (Herreid, 1969).

The ultramafic rocks are chloritized and serpentinized with only trace amount of pyrite and pyrrhotite. Soil samples from frost boils containing serpentine and diabase rock fragments contain up to 3,000 ppm chromium and 3,000 ppm nickel (Herreid, 1969, p. 18, sample 10 and 30).

Bureau Investigation:

Ultramafic rocks along the scree slopes immediately northwest of the lake were investigated. Three samples of serpentized gabbro and dunite with minor amounts of disseminated magnetite and chromite (8001-8002, 11423, table B-1) were collected. The samples average 5,173 ppm chromium and 1,328 ppm nickel. The average abundance of chromium and nickel in ultramafic rocks is 2,000 ppm (Levinson, 1974). The area of podiform chromite mineralization is limited to rubblecrop and talus; no chromite was found in place.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential for chromite due to the low grades and the limited extent of mineralization.

Recommendations: None.

References:

Dahlin, D.C., Brown, L.L., and Kinney, J.J., 1983, Podiform chromite occurrences in the Caribou Mountain and lower Kanuti River areas, central Alaska, part II, beneficiation: U.S. Bureau of Mines Information Circular 8916, 15 p.

Foley, J.Y., 1992, Ophiolitic and other mafic-ultramafic metallogenic provinces in Alaska (west of the 141st Meridian): U.S. Geological Survey Open-File Report 92-20B, 55 p.

Foley, J.Y., Barker, J.C., and Brown, L.L., 1985, Critical and strategic minerals investigations in Alaska: chromium: U.S. Bureau of Mines Open-File Report 97-85, 54 p.

Foley, J.Y., and McDermott, M.M., 1983, Podiform chromite occurrences in the Caribou Mountain and lower Kanuti River areas, central Alaska, Part 1: U.S. Bureau of Mines Information Circular 8915, 27 p.

Herreid, G., 1969, Geology and geochemistry Sithylemenkat Lake area, Bettles quadrangle, Alaska: Division of Mines and Geology, Geologic Report 35, 22 p.

Levinson, A.A., 1974, Introduction to exploration geochemistry: Applied Publishing Ltd., Wilmette, Illinois, U.S.A., p. 43-44.

Patton, W.W., Jr., 1989, Framework geology: Yukon River to Brooks Range, *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 1, p. 27-30.

Patton, W.W., Jr., and Miller, T.P., 1970, Preliminary geologic investigations in the Kanuti River region, Alaska: U.S. Geological Survey Bulletin 1312-J, p. J1-J10.

____1973, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

Property Summary

Name(s): East Fork Kanuti Kilolitna River

Map No: B28
MAS No: 0020390068

Deposit Type: Placer

Commodities: Sn

Location:

Quadrangle: Bettles A-3
N½ sec. 13, T. 14 N., R. 18 W.
Meridian: Fairbanks
Elevation: 1,100 feet
Latitude: 66° 02.433' N.
Longitude: 151° 13.083' W.
Geographic: Located on the east fork of the Kanuti Kilolitna River, 5.8 miles southeast of Sithylemenkat Lake. The site is on Doyon Ltd. selected lands.

History:

1968 - Alaska Division of Mines and Geology mapped the geology and sampled rocks in the Sithylemenkat Lake area (Herreid, 1969)
1968-69 - U.S. Geological Survey collected stream sediment and pan concentrate samples anomalous in tin while geologic mapping in the Kanuti River region (Patton and Miller, 1970).
1975 - Asarco reviewed data on area and concluded placer and hard-rock tin presented the greatest opportunity for economic success (Bright, 1989).
1978 - The U.S. Bureau of Mines evaluated tin-bearing greisens and tin placer deposits in the area (Barker and Foley, 1986).
1975-1979 - WGM Inc. evaluated area for a consortium assembled by Doyon Ltd. Extensive mapping, sampling, and airborne and ground radiometric surveys done (Bright, 1989).
1979 - British Petroleum - Alaska along with consultant C.F. Herbert made optimistic and encouraging “guesstimates” of reserves (WGM Inc., 1980a, 1980b).
1980-81 - Patino Inc. evaluated the placer deposits which included bulk sampling and churn drilling. It was determined that the identified reserves were too small and/or of insufficient grade to meet company criteria (Bright, 1989).
1983 - Doyon Ltd. collected bulk samples of tin-bearing placers and collected a few samples for gold analyses (Bright, 1989).

Production: None.

Workings and Facilities: Test pits and churn drill holes

Geologic Setting:

The Sithylemenkat Pluton is an Early Cretaceous 200-square-mile composite granitic batholith. There are four different phases within the pluton: porphyritic granite, granite porphyry, coarse grained granite and graphic granite. Age relationships between the four phases are unclear due to poor exposures. The pluton intrudes Paleozoic schist and phyllite near the northern edge of the Ruby Geanticline. Tin-bearing rocks have been found within the pluton (map no. B29), and mineralized float commonly occurs in the upper tributaries of the east fork of the Kanuti Kilolitna River, which drains the pluton rocks.

The drainages in and around the Sithylemenkat Pluton have potential for tin placer deposits. The principal tin-bearing drainage appears to be the 10-mile-long east fork of the Kanuti Kilolitna River. This drains approximately one-third of the known areal extent of the pluton. Extensive alluvial deposits have accumulated along its lower course. Cassiterite occurs as nuggets up to 0.75 inch across. Besides cassiterite, heavy-mineral concentrates contain wolframite, pyrite, ilmenite, hematite, garnet, traces of scheelite, and monazite(?). Churn drilling and bulk sampling have delineated placer tin resources along a 1.4 mile stretch of this drainage in what has been termed the "big banana basin." Placer samples collected from broad alluvial outwash and terrace deposits in this area contain from 0.1 to 0.404 lb/cy tin. The surface gradient along this stretch of the river is 30 feet per mile with the gravel estimated to have an average depth of 20 feet (WGM Inc., 1980a, 1980b; Patino Inc., 1981, 1982; Bright, 1989; Barker and Foley, 1986).

Bureau Investigation: The site was not examined by the BLM.

Resource Estimate: Indicated resource of 3.5 million cy containing 0.67 lb/cy tin (Patino Inc., 1982, p. 2).

Mineral Development Potential:

Low development potential for placer tin due to the limited extent and grade of the resource (Patino Inc., 1982, p. 3).

Recommendations: None.

References:

Barker, J.C., 1983, Reconnaissance of tin and tungsten in heavy mineral panned concentrates along the Trans-Alaska Pipeline corridor, north of Livengood, interior Alaska: U.S. Bureau of Mines Open-File Report 59-83, 24 p.

Barker, J.C., and Foley, J.Y., 1986, Tin reconnaissance of the Kanuti and Hodzana Rivers uplands, central Alaska: U.S. Bureau of Mines Information Circular 9104, p. 10.

Bright, M.J., 1989,Summary report: mineral potential of Doyon Ltd's Block IV (Sithylemenkat), central Alaska: unpublished report 90-18 for Doyon Ltd., 23 p. [available from Doyon Ltd., Fairbanks, Alaska]

Patino Inc., 1981, 1980 Progress report, Block 4- tin: unpublished report 81-02 for Doyon Ltd., 11 p. [available from Doyon Ltd., Fairbanks, Alaska]

____1982, 1981 Annual report, Sithy I-X project areas, Allakaket Block, v. I of II: unpublished report 82-04 for Doyon Ltd., 35 p. [available from Doyon Ltd., Fairbanks, Alaska]

Patton, W.W., Jr., and Miller, T.P., 1970, Preliminary geologic investigations in the Kanuti River region, Alaska: U.S. Geological Survey Bulletin 1312-J, p. J7-J8.

____1973a, Analyses of stream-sediment samples from the Bettles and the southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Open-File Report 73-219, p. 5, 1 sheet, scale 1:250,000.

____1973b, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

WGM Inc., 1978, 1977 Annual progress report, Block 4, tin-tungsten-uranium, v. 21: unpublished report 78-25 for Doyon Ltd, 29 p. [available from Doyon Ltd., Fairbanks, Alaska]

____1979a, 1978 Block 4 general Doyon Ltd. annual progress report: unpublished report 79-20 for Doyon Ltd., 10 p. [available from Doyon Ltd., Fairbanks, Alaska]

____1979b, 1978 Doyon Ltd. annual report, Block 4 uranium: unpublished report 79-02 for Doyon Ltd., 12 p. [available from Doyon Ltd., Fairbanks, Alaska]

____1980a, 1979 Annual progress report, Block 4- Allakaket placer tin potential: unpublished report 80-01 for Doyon Ltd., 26 p. [available from Doyon Ltd., Fairbanks, Alaska]

____1980b, 1979 Geochemistry of the Sithylemenkat Pluton, Block 4: unpublished report 80-07 for Doyon Ltd., 33 p. [available from Doyon Ltd., Fairbanks, Alaska]

Property Summary

Name(s): Sithylemenkat Pluton Prospect

Map No: B29
MAS No: 0020390061

Deposit Type: Greisen

Commodities: Sn, Zn, Pb, Ag, Cu, U, Th

Location:

Quadrangle: Bettles A-3 — E½ sec. 21, T. 14 N., R. 17 W.
Meridian: Fairbanks — Elevation: 2,320 feet
Latitude: 66° 01.522' N. — Longitude: 151° 09.033' W.
Geographic: Approximately 8.5 miles southeast of Sithylemenkat Lake and 3.3 miles due south of VABM Kan. The site is located on Doyon Ltd. lands.

History:

1968 - Alaska Division of Mines and Geology mapped the geology and sampled rocks in the Sithylemenkat Lake area (Herreid, 1969)
1968-69 - U.S. Geological Survey collected stream sediment and pan concentrate samples anomalous in tin while geologic mapping in the Kanuti River region (Patton and Miller, 1970).
1975 - Asarco reviewed data on area and concluded placer and hard-rock tin presented the greatest opportunity for economic success (Bright, 1989).
1978-80 - The U.S. Bureau of Mines evaluated tin-bearing greisens and tin placer deposits in the area (Barker and Foley, 1986).
1975-79 - WGM Inc. evaluated area for a consortium assembled by Doyon Ltd. Extensive mapping, sampling, and airborne and ground radiometric surveys done (Bright, 1989).
1979 - British Petroleum - Alaska along with consultant C.F. Herbert made optimistic and encouraging "guesstimates" of reserves (WGM Inc., 1980a, 1980b).
1980-81 - Patino evaluated the placer deposits including bulk sampling and churn drilling. It was determined that the identified reserves were too small and/or of insufficient grade to meet company criteria (Bright, 1989).
1983 - Doyon Ltd. collected bulk samples of tin-bearing placers and collected a few samples for gold analyses (Bright, 1989).

Production: None.

Workings and Facilities: One documented prospect pit located 0.8 mile due north of hill 2055.

Geologic Setting: (WGM Inc., 1980a, 1980b; Barker and Foley, 1986; Bright, 1989)

The Sithylemenkat Pluton is an Early Cretaceous 200-square-mile composite granitic batholith. There are four different phases within the pluton: porphyritic granite, granite porphyry, coarse grained granite, and graphic granite. Age relationships between the four phases are unclear due to poor exposures. The pluton intrudes Paleozoic schist and phyllite near the northern edge of the Ruby Geanticline. Tin-bearing rocks have been found within the pluton, and mineralized float commonly occurs in the upper tributaries of the east fork of the Kanuti Kilolitna River, which drains the pluton. The mineralized rock samples show variable effects of greisenization with tourmaline and magnetite sometimes present. Mineralization appears to be concentrated in small greisen zones. These zones range between 10 and 15 feet wide and can be traced for up to 1,200 feet. Fine-grained sericite- and quartz-rich veins and altered dikes contain abundant secondary chlorite and locally contain up to several percent sulfides, including pyrite, arsenopyrite, galena, and molybdenite. Greisen rubble is recognized in the field by dark green to reddish brown, well-rounded weathered surface and high specific gravity. The highest tin concentrations were found in the dark green chloritic greisen. Samples are reported to contain up to 2,300 ppm tin, 34,027 ppm lead, 5,126 ppm arsenic, 4,044 ppm zinc, and 1,808 ppm copper. Cassiterite has been identified as the tin mineral. The greisen zones appear to be concentrated near intersections of high-angle linear structural features. These zones may represent the roots of a previously more extensive mineralized area; much of which has been removed by erosion, and only tin placer material remains. Lode tin potential is reported to exist along the pluton margins, and there could be undiscovered mineralization at depth. Additionally lode potential for tin as well as tungsten and uranium exists in unexposed or partially exposed granitic cupolas in the surrounding metasedimentary rocks.

Bureau Investigation:

As the area has been extensively sampled, only a brief examination was made of the occurrence. A 10- to 15-foot-wide greisen zone, located on a broad ridgetop, could be traced for 170 feet along a N. 20° E. trend. The Bureau of Mines excavated a trench near the south end of the zone of exposed greisen float that ranges from chlorite-rich sericitized, siliceous granitic rock with trace tourmaline to a dark green chlorite-rich rock with limonite and malachite staining. Float samples from this greisen zone (11452-11453, table B-1) contain up to 1,833 ppm tin, 5,055 ppm lead, 1,704 ppm zinc, 25.9 ppm silver, 75.6 ppm uranium, and 101 ppm thorium. The same material gave a 2-times background response when tested with a scintillometer. Sample 8003 collected from a narrow zone of greisen vein float 700 feet to the northeast, contains 1,900 ppm tin and 66.5 ppm thorium.

Resource Estimate: None.

Mineral Development Potential:

Low development potential for lode and placer tin due to the limited extent and grade of the mineralization and remoteness of the site.

Recommendations:

A small scale soil and/or scintillometer survey could determine the extent of greisen mineralization.

References:

Barker, J.C., 1983, Reconnaissance of tin and tungsten in heavy mineral panned concentrates along the Trans-Alaska Pipeline corridor, north of Livengood, interior Alaska: U.S. Bureau of Mines Open-File Report 59-83, 24 p.

Barker, J.C., and Foley, J.Y., 1986, Tin reconnaissance of the Kanuti and Hodzana Rivers uplands, central Alaska: U.S. Bureau of Mines Information Circular 9104, p. 10.

Bright, M.J., 1989, Summary report: mineral potential of Doyon Ltd's Block IV (Sithylemenkat), central Alaska: unpublished report 90-18 for Doyon Ltd., 23 p. [available from Doyon Ltd., Fairbanks, Alaska]

Patton, W.W., Jr., and Miller, T.P., 1970, Preliminary geologic investigations in the Kanuti River region, Alaska: U.S. Geological Survey Bulletin 1312-J, p. J7-J8.

____1973a, Analyses of stream-sediment samples from the Bettles and the southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Open-File Report 73-219, p. 5, 1 sheet, scale 1:250,000.

____1973b, Bedrock geologic map of the Bettles and southern part of the Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, 1 sheet, scale 1:250,000.

WGM Inc., 1978, 1977 Annual progress report, Block 4, tin-tungsten-uranium, v. 21: unpublished report 78-25 for Doyon Ltd, 29 p. [available from Doyon Ltd., Fairbanks, Alaska]

____1979a, 1978 Block 4 general Doyon Ltd. annual progress report: unpublished report 79-20 for Doyon Ltd., 10 p. [available from Doyon Ltd., Fairbanks, Alaska]

____1979b, 1978 Doyon Ltd. annual report, Block 4 uranium: unpublished report 79-02 for Doyon Ltd., 12 p. [available from Doyon Ltd., Fairbanks, Alaska]

____1980a, 1979 Annual progress report, Block 4- Allakaket placer tin potential: unpublished report 80-01 for Doyon Ltd., 26 p. [available from Doyon Ltd., Fairbanks, Alaska]

____1980b, 1979 Geochemistry of the Sithylemenkat Pluton, Block 4: unpublished report 80-07 for Doyon Ltd., 33 p. [available from Doyon Ltd., Fairbanks, Alaska]

Table B-1. Selected results from samples collected in the Bettles quadrangle.

Explanation

Sample site

core	drill core
drum	55 gallon drum
dump	mine dump
flt	float
otc	outcrop
rub	rubblecrop
tail	mine tailings
trn	trench

Sample type

cont	continuous chip
grab	grab sample
pan	pan concentrate
plac	placer concentrate
rand	random chip
rep	representative chip
sed	sediment sample
sel	select
slu	sluice concentrate
soil	soil sample
spac	spaced chip

Placer gold: size classification

v. fine	< 0.5 mm
fine	0.5 - 1.0 mm
coarse	1 -2 mm
v. coarse	> 2 mm

Abbreviations:

Ck	creek
confl	confluence
Mtn	mountain
R	river

Footnotes:

Bold numbers indicate multiple erratic results, which were averaged.

Results for Au are reported in ppb unless other units are stated.

Sample description

abu	abundant
alt	altered, alteration
amph	amphibole
ank	ankerite
apy	arsenopyrite
az	azurite
ba	barite
bio	biotite
blk	black
bn	bornite
box	boxwork texture
brn	brown
ca	calcite
calc	calcareous
carb	carbonate
cc	chalcocite
cgl	conglomerate
ch	chlorite
chm	chromite
comp	composite
cpy	chalcopyrite
cst	cassiterite
cv	covellite
diss	disseminated
ep	epidote
feld	feldspar
ft	foot (12 inches)
fuch	fuchsite
gar	garnet
gd	granodiorite
gn	galena
gwy	graywacke
hbl	hornblende
hem	hematite
hfls	hornfels
hydro	hydrothermal
in	inch
intr	intrusive
lim	limonite
ls	limestone
mag	magnetite

Sample description

mal	malachite
mar	marcasite
mdst	mudstone
meta	metamorphic
MnO	manganese oxide
mod	moderate
monz	monzonite
musc	muscovite
oz/cyd	ounces per cubic yard
oz/t	ounces per ton
pct	percent
po	pyrrhotite
porph	porphyry
ppb	parts per billion
ppm	parts per million
psuedo	psuedomorph
py	pyrite
qtz	quartzite
qz	quartz
sch	scheelite
sco	scorodite
ser	sericite
serp	serpentinized
sid	siderite
silic	siliceous
sl	sphalerite
slts	siltstone
ss	sandstone
stb	stibnite
tet	tetrahedrite
tm	tourmaline
tr	trace
v	very
val	valentinite
vis	visible
vlets	veinlets
volc	volcanic
w/	with
xcut	crosscutting
xln	crystalline
xls	crystals

Elements

Ag	silver
Al	aluminum
As	arsenic
Au	gold
Ba	barium
Bi	bismuth
Ca	calcium
Cd	cadmium
Co	cobalt
Cr	chromium
Cu	copper
Fe	iron
Ga	gallium
Hg	mercury
K	potassium
La	lanthanum
Li	lithium
Mg	magnesium
Mn	manganese
Mo	molybdenum
Na	sodium
Nb	niobium
Ni	nickel
Pb	lead
Pd	palladium
Pt	platinum
Sb	antimony
Sc	scandium
Sn	tin
Sr	strontium
Ta	tantalum
Te	tellurium
Th	thorium
Ti	titanium
U	uranium
V	vanadium
W	tungsten
Y	yttrium
Zn	zinc
Zr	zirconium

Table B-1. Selected results from samples collected in the Bettles quadrangle.

Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Pt ppb	Pd ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	Ni ppm	Co ppm	Bi ppm	Cr ppm	Sn ppm	W ppm
B 1	11911	Blahuta Ck		sed		<5			<0.2	14	14	72	2	14	14	<5	20	<20	<20
B 1	11912	Blahuta Ck		pan	abu mag, no vis Au	<1	15	<1	<0.2	7	14	48	1	11	14	<5	132	<20	<20
B 2	11949	Davis Ck	otc	sel	3-in-wide qz vein w/ 2% py, po	150			<0.2	46	6	35	1	32	11	<5	179	<20	<20
B 2	11950	Davis Ck		sed		<5			<0.2	25	5	67	<1	28	15	<5	31	<20	<20
B 2	11951	Davis Ck		pan	6 coarse, 6 fine Au; no mag	**220.04 ppm**	8	2	12.3	38	10	74	3	49	19	351	265	<20	553
B 2	11993	Davis Ck	out	sel	sheared qz vein w/ 2% po, cpy	38			0.5	444	3	132	2	43	38	<5	47	<20	<20
B 2	11994	Davis Ck	out	sel	qz vein w/ 1% po	7			0.2	194	3	21	2	12	6	<5	300	<20	<20
B 2	11995	Davis Ck		pan	1 coarse, 3 fine, 3 v fine Au	265.26 ppm	6	8	10.8	74	3	54	1	33	11	<5	159	<20	30
B 2	11996	Davis Ck		pan		126.66 ppm	6	4	8.3	31	5	61	1	48	13	<5	209	<20	222
B 2	11997	Davis Ck		slu	minor mag; minor sch		5	4	1.8	51	198	175	1	60	27	<5	134	<20	25
B 2	11998	Davis Ck		plac	4 v coarse, 6 coarse, 24 fine Au	0.097 oz/cyd	<5	4	1.2	70	23	135	<1	90	33	52	108	<20	573
B 2	11999	Davis Ck		plac	9 coarse, 16 fine, 60+ v fine Au	0.134 oz/cyd	5	4	<0.2	28	6	67	<1	38	22	1591	193	<20	1468
B 2	12007	South Fork Koyukuk R		pan	5 fine Au, from tailings	**19.48 ppm**	<5	3	1.6	48	9	79	2	51	19	<5	263	<20	65
B 3	11585	Rock Ck		sed		167			<0.2	23	9	83	1	31	17	<5	26	<20	<20
B 3	11586	Rock Ck		pan	mod mag	301	<5	11	<0.2	37	9	71	3	36	22	<5	225	<20	<20
B 4	11566	Ironsides Mine		pan	1 coarse Au, mod mag	6708	7	29	<0.2	36	10	56	2	29	16	<5	275	<20	<20
B 4	12004	Ironsides Mine		pan	1 coarse, 2 fine, 2 v fine Au	711.15 ppm	<5	3	16.6	11	<2	14	<1	11	5	<5	97	<20	<20
B 4	12021	Ironsides Mine		plac	1 coarse, 32 fine, 70+ v fine Au	0.107 oz/cyd	5	4	<0.2	41	7	67	2	37	19	<5	133	<20	<20
B 4	12022	Ironsides Mine	flt	sel	porphyrtic greenstone w/ feld	<5			0.3	49	<2	52	<1	55	25	<5	189	<20	<20
B 5	8007	Gold Bench Mine		slu			<5	<1	<5			<200	<2	61	15		180	<200	4
B 5	11583	Gold Bench Mine		slu	3 fine, 11 v fine Au		<5	4	<0.2	34	12	79	2	43	16	<5	222	<20	<20
B 5	11584	Gold Bench Mine		pan		9832	<5	11	1.2	39	7	54	1	27	16	<5	204	<20	<20
B 5	12151	Gold Bench Mine		plac	29 fine, 62 v fine Au; mag, gar, Zr	0.005 oz/cyd	<5	3	<0.2	28	11	62	<1	30	20	<5	125	<20	<20
B 5	12152	Gold Bench Mine	flt	sel	ch-altered diorite w/ qz-feld augens	6			<0.2	66	12	127	2	45	7	<5	200	<20	<20
B 6	11547	Eldorado Ck		sed		<5			<0.2	47	18	173	2	53	27	<5	49	<20	<20
B 6	11548	Eldorado Ck		pan	1 coarse Au	8.79 ppm	<5	11	<0.2	70	10	142	1	96	38	<5	146	<20	<20
B 7	11521	Koyukuk R		pan	1 v fine, 1 fine Au; tr mag	2012	<5	10	<0.2	21	8	45	3	25	11	<5	260	<20	<20
B 7	11522	Koyukuk R		pan	100 v fine, 12 fine Au; abu mag	62.81 ppm	<5	10	2.6	21	14	52	<1	26	15	<5	244	<20	<20
B 7	11523	Koyukuk R		pan	6 v fine	4086	<5	9	<0.2	23	12	58	4	31	12	<5	254	<20	<20
B 7	12000	Koyukuk R		plac	hydraulic concentrator	41.63 ppm	232	5	1.6	17	21	61	<1	36	23	<5	281	<20	<20
B 7	12001	Koyukuk R		plac	hydraulic concentrator	33.81 ppm	<5	2	6.9	19	13	58	1	30	18	<5	274	<20	<20
B 8	11571	South Fork Koyukuk R		sed		<5			<0.2	24	9	71	1	28	13	<5	22	<20	<20
B 8	11572	South Fork Koyukuk R		pan	3 v fine, 1 fine Au; mag; tr gar	6	<5	9	<0.2	29	17	75	3	40	18	<5	268	<20	<20
B 9	11031	Jim R canyon		pan	from bedrock, 4 v fine Au	1231	<5	5	<0.2	86	8	115	5	79	25	<5	165	<20	<20
B 9	11032	Jim R canyon		sed		3			<0.2	21	6	76	1	22	11	<5	26	<20	<20
B 9	11033	Jim R canyon	otc	ran	silic volcanic rock w/ lim	<1			<0.2	33	4	32	7	27	7	<5	218	<20	<20

Table B-1. Selected results from samples collected in the Bettles quadrangle.

Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Pt ppb	Pd ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	Ni ppm	Co ppm	Bi ppm	Cr ppm	Sn ppm	W ppm
B 9	11960	Jim R canyon		sed		6			<0.2	24	6	98	<1	27	15	<5	26	<20	<20
B 9	11961	Jim R canyon		pan	1 fine, 7 v fine Au; minor mag	**16.5 ppm**	5	6	<0.2	29	8	50	3	31	15	<5	318	<20	<20
B 9	11966	Jim R canyon	otc	grab	aphanitic meta volc w/ 5% mag	10			<0.2	112	<2	84	<1	31	25	<5	41	<20	<20
B 9	11967	Jim R canyon	otc	rand	meta volc w/ qz veins, 3% mag	12			<0.2	179	<2	80	<1	48	33	<5	43	<20	<20
B 9	11968	Jim R canyon	otc	rand	meta volc w/ w/ 5% po, lim	30			0.2	169	<2	68	<1	36	26	<5	45	<20	<20
B 9	11987	Jim R canyon		pan	no vis Au, mod mag	557	<5	7	<0.2	99	4	93	3	163	41	<5	287	<20	<20
B 9	11988	Jim R canyon	flt	sel	basaltic greenstone w/ 1% po, ca	<5			0.3	98	<2	84	<1	36	40	<5	44	<20	<20
B 9	11989	Jim R, unnamed trib		pan	no vis Au, mod mag	34	6	6	<0.2	79	10	133	3	84	35	<5	179	<20	<20
B 9	11990	Jim R, unnamed trib		sed		12			<0.2	94	9	159	4	69	28	<5	66	<20	<20
B 9	11991	Jim R canyon	otc	sel	aplite w/ dumortierite (?)	<5			<0.2	7	60	26	3	3	<1	10	36	<20	<20
B 9	11992	Jim R canyon	otc	rand	sheared basaltic greenstone	<5			<0.2	91	30	206	2	29	17	24	93	<20	<20
B 9	12123	Jim R canyon		pan	2 fine, 6 v fine flat Au	3413	<5	2	<0.2	36	4	69	2	34	18	<5	256	<20	<20
B 9	12124	Jim R canyon	flt	sel	greenstone xcut by qz w/ mal	6			<0.2	307	3	81	<1	64	42	<5	97	<20	<20
B 9	12135	Jim R canyon		pan	1 v fine Au, mod mag	<5	<5	2	<0.2	40	4	64	2	32	16	<5	221	<20	<20
B 9	12136	Jim R canyon		pan	1coarse Au, mod fine mag	5260	<5	4	<0.2	48	10	94	2	42	20	<5	265	<20	<20
B 9	12137	Jim R canyon		pan	2 fine, 3 v fine Au; mod fine mag	1804	<5	2	<0.2	38	4	66	2	33	17	<5	257	<20	<20
B 9	12138	Jim R canyon		pan	1 v coarse, 3 fine Au; mod mag	120.55 ppm	<5	3	1.6	22	<2	30	<1	16	8	<5	67	<20	<20
B 9	12139	Jim R canyon		pan	1 fine, 4 v fine Au; minor mag	**95.45 ppm**	5	3	1.4	41	<2	61	1	32	16	<5	164	<20	<20
B 9	12140	Jim R canyon	otc	sel	meta volcanic w/ qz veins	<5			<0.2	329	<2	79	<1	49	38	<5	67	<20	<20
B 9	12161	Jim R canyon	otc	rand	greenstone w/ qz-carb vlets, mal	8			<0.2	259	3	74	<1	53	36	<5	99	<20	<20
B 9	12162	Jim R canyon	flt	sel	silic felsic volc w/ box, lim	<5			<0.2	7	6	37	13	11	<1	<5	159	<20	<20
B 9	12163	Jim R canyon	flt	sel	silic phyllite w/ 2-5% py	8			1.2	56	11	207	8	50	14	<5	189	<20	<20
B 9	12164	Jim R canyon	flt	sel	hfls xcut by qz w/ 1-2% py, po	7			<0.2	16	<2	6	1	9	1	<5	212	<20	<20
B 9	12165	Jim R canyon	otc	sel	chert/hfls xcut by qz w/ <1% py	7			0.5	14	6	34	2	26	5	<5	209	<20	<20
B 9	12166	Jim R canyon	flt	sel	hem-rich chert w/ <1% py	<5			<0.2	8	<2	14	3	12	1	<5	231	<20	<20
B 9	12167	Jim R canyon	flt	sel	diorite w/ <1% py, po	<5			<0.2	36	11	61	2	12	18	<5	53	<20	<20
B 10	11013	Jim R, Prospect Ck		sed		NA													
B 10	11014	Jim R, Prospect Ck		pan	1 v fine Au, abu fine mag	1590	5	1	<0.2	19	6	50	4	31	12	<5	285	<20	<20
B 10	11015	Jim R, Prospect Ck		plac	13 v fine Au, zircon	0.0003 oz/cyd	5	3	<0.2	21	6	54	2	23	13	<5	226	<20	<20
B 11	11579	Jim R, upper		sed		<5			<0.2	24	13	89	2	26	15	<5	30	<20	<20
B 11	11580	Jim R, upper		pan	1 v fine Au, abu mag, zircon(?)	810	<5	8	<0.2	14	9	40	4	17	12	<5	280	<20	<20
B 11	11581	Jim R, upper	flt	sel	gabbro, amphibole(?)	6			<0.2	193	<2	42	<1	17	20	<5	54	<20	<20
B 11	11582	Jim R, upper	flt	sel	gar-tm granite	<5			<0.2	7	7	17	4	12	1	<5	237	<20	<20
B 11	12141	Jim R, upper trib		sed		<5			<0.2	21	14	65	1	22	14	<5	36	<20	<20
B 11	12142	Jim R, upper trib		pan	abu mag	**514**	<5	1	<0.2	20	13	59	2	24	16	<5	228	<20	<20
B 11	12143	Jim R, upper trib	flt	sel	meta volcanic w/ 5% mag, lim	<5			<0.2	124	2	35	<1	44	23	<5	116	<20	<20

Table B-1. Selected results from samples collected in the Bettles quadrangle.

Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Pt ppb	Pd ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	Ni ppm	Co ppm	Bi ppm	Cr ppm	Sn ppm	W ppm
B 11	12168	Jim R, upper		pan		51	<5	<1	<0.2	13	4	47	4	22	12	<5	446	<20	<20
B 11	12169	Jim R, upper		sed		<5			<0.2	15	5	77	1	22	13	<5	27	<20	<20
B 11	12170	Jim R, upper	flt	sel	hfls w/ finely diss py	<5			<0.2	59	3	119	3	66	21	<5	168	<20	<20
B 11	12171	Jim R, upper		pan		12	<5	<1	<0.2	17	6	53	4	23	14	<5	414	<20	<20
B 11	12172	Jim R, upper		sed		<5			<0.2	23	11	98	2	26	16	<5	31	<20	<20
B 12	11009	Douglas Ck		sed		8			<0.2	117	6	128	3	50	25	<5	51	<20	<20
B 12	11010	Douglas Ck		pan	no mag, no vis Au	7	14	6	<0.2	115	4	133	3	63	28	<5	135	<20	<20
B 12	11011	Douglas Ck		pan	mod fine and coarse mag	9	8	6	<0.2	106	<2	124	3	60	29	<5	118	<20	<20
B 12	11012	Douglas Ck		pan	from colluvium	14	9	3	<0.2	99	10	117	6	59	25	<5	172	<20	<20
B 13	10661	Prospect Ck	tail	rand	pyroxenite(?)	10			<0.2	106	<2	81	<1	629	64	<5	259	29	<20
B 13	10662	Prospect Ck	otc	rand	pyroxenite w/ tr py	<5			<0.2	98	<2	63	<1	56	28	<5	54	<20	<20
B 13	11549	Prospect Ck trib		sed		<5			<0.2	16	8	79	<1	26	16	<5	28	<20	<20
B 13	11550	Prospect Ck trib		pan	tr mag, no vis Au	20	<5	9	<0.2	15	18	48	4	23	13	<5	382	<20	<20
B 13	11563	Prospect Ck, upper		sed		<5			<0.2	20	9	96	1	31	20	<5	30	<20	<20
B 13	11564	Prospect Ck, upper		pan	minor mag	126	7	9	<0.2	17	5	51	6	28	11	<5	437	<20	<20
B 13	11565	Prospect Ck, upper		pan	2 v fine Au, no mag	1537	15	28	<0.2	21	5	55	5	27	12	<5	448	<20	<20
B 13	11573	Prospect Ck		sed		<5			<0.2	19	5	71	1	24	13	<5	19	<20	<20
B 13	11574	Prospect Ck		pan	6 v fine, 1 fine Au	36.02 ppm	<5	13	6.9	191	11	89	4	50	8	<5	192	<20	<20
B 13	11575	Prospect Ck	otc	rep	volc(?) chert & phyllite	<5			<0.2	49	5	34	1	30	6	<5	199	<20	<20
B 13	11576	Prospect Ck		sed		<5			<0.2	20	8	90	1	28	18	<5	28	<20	<20
B 13	11577	Prospect Ck		pan		30	<5	10	<0.2	39	7	61	4	30	16	<5	285	<20	<20
B 13	11578	Prospect Ck	flt	sel	greenstone w/ 1% py	7			<0.2	210	<2	22	1	22	16	<5	77	<20	<20
B 13	12492	Prospect Ck	trn	spac	greenstone w/ serp slickensides	12			<0.2	158	3	71	<1	615	75	<5	655	<20	<20
B 13	12493	Prospect Ck		slu	fine concentrate		<5	1	12.6	193	68	68	151	62	60	<5	358	<20	<20
B 13	12494	Prospect Ck		slu	coarse concentrate		5	4	6.8	543	398	99	153	153	77	32	215	<20	260
B 13	12511	Prospect Ck trib	otc	spac	1-inch-wide qz veins w/ tr py	<5			<0.2	24	13	40	<1	17	4	<5	195	<20	<20
B 13	12512	Prospect Ck trib		pan		218.41 ppm	<5	2	13.8	26	6	99	1	48	28	<5	231	<20	45
B 13	12513	Prospect Ck trib	otc	sel	silic mdst, chert w/ tr py, box	10			0.2	74	8	77	1	20	5	<5	167	<20	<20
B 13	12514	Prospect Ck	otc	rand	6-ft-wide zone of qz veins w/ lim	<5			<0.2	14	6	56	7	9	2	<5	167	<20	<20
B 13	12515	Prospect Ck		pan	1 v fine Au, collected from pit	283	<5	2	<0.2	40	5	67	2	31	16	<5	279	<20	<20
B 14	12516	Prospect Ck	rub	sel	0.5-inch-wide qz vlet w/ gn, sl	<5			2.2	130	628	1523	<1	63	33	<5	64	<20	<20
B 14	12517	Prospect Ck	otc	sel	0.75-inch-wide qz vlet w/ gn, sl	<5			1.2	105	885	1127	<1	59	31	<5	71	<20	<20
B 14	12547	Prospect Ck	rub	rand	diorite dike w/ qz vlets, tr cpy	<5			<0.2	82	5	88	1	74	33	<5	142	<4	4
B 14	12548	Prospect Ck	flt	sel	hfls w/ qz vlets, <1% py, apy	24			<0.2	32	4	25	2	11	3	<5	157	<4	<4
B 15	10999	North Fork Bonanza Ck		sed		8			<0.2	15	7	80	1	23	13	<5	31	<20	<20
B 15	11000	North Fork Bonanza Ck		pan	abu mag	4	5	<1	<0.2	8	3	41	4	14	8	<5	289	<20	<20

Table B-1. Selected results from samples collected in the Bettles quadrangle.

Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Pt ppb	Pd ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	Ni ppm	Co ppm	Bi ppm	Cr ppm	Sn ppm	W ppm
B 16	11007	South Fork Bonanza Ck		sed		29			<0.2	19	7	84	2	27	14	<5	26	<20	<20
B 16	11008	South Fork Bonanza Ck		pan		12	<5	<1	<0.2	13	5	45	4	19	9	<5	324	<20	<20
B 17	10987	Bonanza Prospect	trn	sel	skarn w/ <10% po, tr cpy & sch	12			16.0	404	732	1438	4	16	5	45	100	<20	1.44%
B 17	10988	Bonanza Prospect	trn	sel	skarn w/ <1% po, tr gn, tr cpy	13			24.3	44	936	746	2	9	2	96	145	<20	0.11%
B 17	10989	Bonanza Prospect	trn	sel	skarn w/ diss po, lim	2			8.7	203	260	554	5	18	6	34	111	<20	0.54%
B 17	11030	Bonanza Prospect	otc	cont	3.5-ft-wide skarn w/ tr po cpy	<1			0.6	65	13	97	2	57	15	<5	109	<20	<20
B 17	12177	Beef claims	rub	sel	calc-silicate w/ 2% po, minor lim	<5			0.7	110	17	108	3	39	12	<5	69	<20	130
B 17	12192	Beef claims	flt	sel	calc-silicate w/ tr Mo, minor po	<5			0.2	38	6	45	80	18	7	<5	55	<20	521
B 17	12193	Beef claims	flt	sel	calc-silicate skarn w/ 1% po	<5			1.6	140	15	233	3	31	15	6	88	<20	9
B 18	11672	Het	flt	sel	rhyolite w/ tr po, minor gn & sl	<5			6.6	29	2853	834	2	3	1	<5	131	<20	<20
B 18	11673	Het	rub	grab	rhyolite, tuff w/ abu lim	<5			2.3	12	448	52	3	4	1	<5	103	<20	<20
B 18	11674	Het	rub	sel	rhyolite w/ qz vlets, <1% py, lim	9			7.6	311	419	29	5	2	<1	10	113	<20	<20
B 18	11675	Het	flt	sel	silic rock, aplite w/ 4% py	<5			4.4	397	35	134	16	5	<1	6	114	<20	<20
B 18	11678	Het	flt	sel	porphyritic rhyolite w/ tr gn, sl	<5			3.6	14	1719	330	3	3	<1	<5	106	<20	<20
B 19	11676	Old Man		sed		<5			<0.2	11	34	93	1	17	9	<5	23	<20	<20
B 19	11677	Old Man		pan	no mag, no vis Au	25	<5	8	<0.2	9	44	72	4	16	8	<5	355	<20	<20
B 19	12175	Peak 2472	rub	sel	volc tuff w/ granite inlcusion	<5			<0.2	5	9	48	1	9	3	<5	89	<20	<20
B 19	12191	Peak 2472	rub	sel	crystal tuff w/ qz crackles	<5			<0.2	3	16	27	<1	6	2	<5	43	<20	<20
B 20	8005	Caribou Mtn	otc	rand	chm lenses in dunite	<5	<5	<1	<5			680	<2	2180	230		>30000	<200	<2
B 20	8006	Caribou Mtn	rub	grab	chm lenses in dunite	<5	<5	<1	<5			540	<2	1700	240		>30000	<200	<2
B 20	11419	Caribou Mtn	rub	sel	dunite w/ 0.5-in-wide chm veins	<5	8	3	0.4	2	235	8	<1	1310	69	<5	22.43%	5	<20
B 20	11420	Caribou Mtn	flt	sel	dunite w/ 0.5-in-wide chm veins	<5	<5	5	<0.2	2	86	13	1	1197	137	<5	16.10%	7	<20
B 21	11421	Upper Kanuit R	flt	sel	dunite w/ diss chm	<5	<5	5	<0.2	3	23	36	<1	1296	151	<5	1.01%	<4	<20
B 21	11422	Upper Kanuit R	flt	sel	dunite w/ diss chm	<5	<5	5	<0.2	3	20	24	<1	1153	125	<5	6.20%	<4	<20
B 22	11484	Kanuti R		sed		<5			<0.2	16	9	84	<1	31	21	<5	38	<4	<20
B 22	11485	Kanuti R		pan	1 fine Au	323	<5	<1	<0.2	16	7	47	7	34	68	<5	617	1345	<20
B 23	11486	Kanuti R	flt	sel	ser granite w/ tr to minor py	<5			<0.2	33	141	47	3	15	2	<5	97	<20	<20
B 23	11487	Kanuti R	rub	sel	rhyolite porph w/ qz, feld	<5			0.3	3	30	5	6	6	<1	<5	137	<4	<20
B 24	11468	Peak 1980	rub	sel	dunite w/ 0.25-in-wide chm	8	<5	5	<0.2	5	<2	18	<1	1509	39	<5	13.06%	<20	<20
B 24	11469	Peak 1980	rub	sel	chert alt rock w/ chm	<5	<5	3	<0.2	12	<2	12	<1	820	17	<5	24.15%	<20	<20
B 24	11470	Lower Kanuti R	otc	cont	dunite w/ banded chm	<5	<5	4	<0.2	2	3	17	<1	1359	48	<5	10.33%	<20	<20
B 24	11471	Lower Kanuti R	otc	sel	serp rock w/ 0.6-ft-wide chm	8	9	4	<0.2	2	<2	6	<1	759	12	<5	25.82%	<20	<20
B 24	11454	Dome Ck lode	flt	sel	peridotite w/ mag, MnO, lim	<5			<0.2	28	14	23	<1	64	21	<5	168	<20	<20
B 24	11455	Dome Ck lode	otc	sel	gabbro, peridotite w/ mag, lim	<5			<0.2	6	12	47	<1	1357	89	<5	275	<20	<20
B 24	11679	Dome Ck lode	flt	sel	peridotite	<5			0.2	13	15	20	<1	42	24	<5	141	<20	<20
B 25	11456	Dome Ck		sed		<5			<0.2	18	9	79	<1	33	11	<5	25	<20	<20

Table B-1. Selected results from samples collected in the Bettles quadrangle.

Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Pt ppb	Pd ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	Ni ppm	Co ppm	Bi ppm	Cr ppm	Sn ppm	W ppm
B 25	11457	Dome Ck		pan	2 v fine Au, minor mag		<5	2	<0.2	25	11	97	2	84	24	<5	508	<20	<20
B 25	11458	Dome Ck		pan	minor mag	6	<5	1	<0.2	46	9	93	9	73	25	<5	425	<20	<20
B 26	11482	Kanuti R trib		sed		<5			<0.2	25	11	93	<1	33	14	<5	30	<20	<20
B 26	11483	Kanuti R trib		pan	1 v fine, flat Au	2119	<5	<1	<0.2	41	15	111	7	43	26	<5	252	<20	<20
B 27	8001	Sithylemenkat Lake	rub	grab	serp gabbro, pyroxenite, dunite	<5	<5	<1	<5			<200	<2	960	78		3100	<200	<2
B 27	8002	Sithylemenkat Lake	rub	grab	serp dunite w/ mag	<5	6	1	<5			<200	<2	2140	120		5020	<200	6
B 27	11423	Sithylemenkat Lake	flt	sel	dunite w/ qz vein, diss chm	<5	<5	6	<0.2	<1	23	17	<1	885	49	<5	0.74%	<20	<20
B 29	8003	Sithylemenkat pluton site	flt	grab	greisen vein w/ cst, ser, tm(?)	<5	<5	<1	<5			2400	<2	23	<10		140	1900	27
B 29	8004	Sithylemenkat pluton site	flt	grab	greisen vein w/ cst, ser, tm(?)	<5	<5	<1	<5			300	8	<20	<10		160	<200	<2
B 29	11452	Sithylemenkat pluton site	trn	sel	greisen granite w/ lim	<5			25.9	645	5055	1704	32	5	9	36	20	207	<20
B 29	11453	Sithylemenkat pluton site	flt	sel	greisen granite w/ mal, lim	6			10.3	241	1737	1550	11	3	10	28	67	1833	<20

Appendix C

Summaries of mines, prospects, and mineral occurrences in the Chandalar quadrangle (listed by map number)

Property Summary

Name(s): Kuyuktuvuk Creek
Moon Mine
Jaybird
Associates 101

Map No: C1
MAS No: 0020310133
Alaska Kardex 031-138
Alaska Kardex 031-142
ARDF CH107

Deposit Type: Placer

Commodities: Au

Location:
Quadrangle: Chandalar D-6
SW¼ sec. 18, T. 36 N., R. 10 W.
Meridian: Fairbanks
Elevation: 2,000 feet
Latitude: 67° 56.467' N.
Longitude: 149° 54.500' W.
Geographic: Kuyuktuvuk Creek is a northern tributary of Trembley Creek, within the Gates of the Arctic National Park.

History:

1976 - J. Worrall staked placer claim (Kardex).
1979-81 - Placer claims staked by T. Butler, F. Riedel, E. Kessler, and K. Proteur (Fechner, 1995).

Production: None recorded.

Workings and Facilities:

No workings were observed by the BLM. Placer mining has been reported on Kuyuktuvuk Creek, above the confluence with Trembley Creek (U.S. Bureau of Mines, 1973; Dillon, 1987).

Geologic Setting:

Bedrock at Koyuktuvuk Creek consists of Upper Devonian micaceous and silty limestone and calcareous to noncalcareous micaceous siltstone that has been thrust faulted over Mississippian Kayak Shale and Mississippian Lisburne Limestone. The Kayak Shale is a carbonaceous, black, fissile shale with a distinctive rusty-orange weathering limestone bed near the stratigraphic top. Lisburne Limestone is distinguished from the Kayak Shale limestone by its gray to black weathering. It consists of coarse-grained dolomite and limestone with black chert in the upper part. Lisburne Limestone in the Chandalar quadrangle does not include post-Mississippian rocks found in the Lisburne Group northeast of this area (Brosge and Reiser, 1964).

Bureau Investigation:

The creek cuts bedrock in several locations; however, several test pans did not contain visible gold. A stream sediment and pan concentrate (11462-11463, table C-1) collected 6 miles upstream of the mouth were not anomalous in precious metals. A float sample of felsic schist (8051) collected approximately 4 miles upstream from the mouth contained 1,400 ppm of barium.

Resource Estimate: None.

Mineral Development Potential: Low mineral development potential for placer gold.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Dillon, J.T., 1987, Upper Koyukuk district land and mining claim status current to 1985: Alaska Division of Geological and Geophysical Surveys, Alaska Open-File Report 158, 25 p., 1 sheet, scale 1:25,000.

Fechner, S.A., 1995, Mine hazards report-inactive mines, Kuyuktuvuk Creek, Alaska: U.S. Bureau of Mines unpublished report, 8 p. [available from BLM Anchorage, Alaska]

U.S. Bureau of Mines, 1973, Alaska 1:250,000 scale quadrangle map overlays showing mineral deposit locations, principal minerals, and number and type of claims: U.S. Bureau of Mines Open-File Report 20-73, 95 overlays (updated in 1986, 1987).

Property Summary

Name(s): Trembley Creek

Map No: C2
MAS No: 0020310055
Alaska Kardex 031-051
ARDF CH107

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar D-6
NE¼ sec. 19, T. 36 N., R. 10 W.
Meridian: Fairbanks
Elevation: 2,500 feet
Latitude: 67° 55.969' N.
Longitude: 149° 54.036' W.
Geographic: A 7.5-mile-long western tributary to the Dietrich River within Gates of the Arctic National Park.

History:

1963 - G. Herbert staked 2 placer claims at mouth of Trembley Creek (Kardex).

Production: No recorded production.

Workings and Facilities: None observed.

Geologic Setting:

Bedrock at Trembley Creek consists of Upper Devonian micaceous and silty limestone and calcareous to noncalcareous micaceous siltstone that has been thrust faulted over Mississippian Kayak Shale and Mississippian Lisburne Limestone. The Kayak Shale is a carbonaceous, black, fissile shale with a distinctive rusty-orange weathering limestone bed near the stratigraphic top. Lisburne Limestone is distinguished from the Kayak Shale limestone by its gray to black weathering. It consists of coarse-grained dolomite and limestone with black chert in the upper part. Lisburne Limestone in the Chandalar quadrangle does not include post-Mississippian rocks found in the Lisburne Group northeast of this area (Brosge and Reiser, 1964).

Bureau Investigation:

Trembley Creek cuts across schistose quartzite(?) bedrock 0.5 mile upstream from the confluence with Kuyuktuvuk Creek (map no. C1). Test pans taken off bedrock at this site contained no visible gold. A pan concentrate sample (11509, table C-1) did not contain anomalous amounts of gold, but did contain 467 ppm barium and 165 ppm zinc. A stream sediment sample collected at the same site (11508) was also anomalous in zinc, containing 490 ppm.

A sample of Kayak Shale (8052) collected from the headwaters of Trembley Creek was not anomalous in any metals.

Resource Estimate: None.

Mineral Development Potential: Low mineral development potential for placer gold.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Dillon, J.T., 1987, Upper Koyukuk District land and mining claim status current to 1985: Alaska Division of Geological and Geophysical Surveys, Alaska Open File Report 158, 25 p., scale 1:25,000, 1 sheet.

Heiner, L.E., and Wolff, E.N., 1968, Final report, mineral resources of northern Alaska: Mineral Industry Research Laboratory, University of Alaska, Fairbanks, Report 16, p. 52.

Maas, K.M., 1987, Maps Summarizing Land Availability of Mineral Exploration and Development in Northern Alaska: U.S. Bureau of Mines Open-file Report 10-87, 34 p.

Property Summary

Name(s): Nutirwik Creek

Map No: C3
MAS No: 0020310123
Alaska Kardex 031-071
Alaska Kardex 031-072
Alaska Kardex 031-291
Alaska Kardex 031-303
ARDF CH108

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar D-6 — NE¼ sec. 18, T. 36 N., R. 9 W.
Meridian: Fairbanks — Elevation: 2,400 feet
Latitude: 67° 56.727' N. — Longitude: 149° 39.278' W.
Geographic: Located about 4.5 miles upstream of the creek mouth at the prominent bend of Nutirwik Creek, an eastern tributary of the Dietrich River.

History:

1976 - M. Vostry and J. Dale staked placer claims at Nutirwik Creek (Kardex).
1985 - J. Greene and D. Jaeke staked 1 claim on the unnamed tributary of Nutirwik Creek (Kardex).
1985 - Dillon (1987) reported active claims on Nutirwik Creek.

Production: None.

Workings and Facilities: None.

Geologic Setting:

Bedrock at Nutirwik Creek includes an upper Devonian quartz-mica schist, black slate, phyllite, and phyllitic siltstone overlain by the Skajit Limestone. Numerous thrust faults are mapped within the Skajit Limestone - generally trending north-south. Devonian volcanic rocks are also mapped at the creek's prominent northern tributary (Brosge and Reiser, 1964).

Bureau Investigation:

Nutirwik Creek cuts bedrock in numerous locations in the basin. Pan concentrate samples and test pans were collected at three points: 1.5 miles upstream of the creek mouth (12551), at the prominent bend of Nutirwik Creek (11644), and at an unnamed tributary near the bend (11641). Although moderate amounts of pyrite were observed in the pans, no gold was visible. None of the samples collected were anomalous in precious metals.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential for placer gold due to low assay results on rock, sediment, and pan concentrate samples.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Dillon, J.T., 1987, Upper Koyukuk district land and mining claim status current to 1985: Alaska Division of Geological and Geophysical Surveys Public Data File 87-11, 25 p., 1 sheet, scale 1:125,000.

Property Summary

Name(s): Big Jim Creek Lode

Map No: C4
MAS No: 0020310073
ARDF CH106

Deposit Type: Polymetallic veins

Commodities: Cu, Pb

Location:

Quadrangle: Chandalar D-6
NW¼ sec. 13, T. 35 N., R. 11 W.
Meridian: Fairbanks
Elevation: 3,350 feet
Latitude: 67° 51.801' N.
Longitude: 149° 57.179' W.
Geographic: Near the headwaters of Big Jim Creek, 0.2 mile east of hill 3810, in Gates of the Arctic National Park.

History:

1959-60 - Brosge and Reiser (1964) noted copper and lead mineralization in headlands of Big Jim Creek.
1980-83 - Two placer gold claims staked on a northwest fork of Big Jim Creek (Kardex).

Production: No recorded production.

Workings and Facilities: No lode-related workings.

Geologic Setting:

Quartz veins containing copper and lead mineralization are reported to occur on the contact between upper Devonian chloritic slate and phyllite and black siliceous siltstone. These units underlie the Skajit Limestone formation (Brosge and Reiser, 1964).

Bureau Investigation:

Two rock samples (8053-8054, table C-1) were collected from a 50-foot-wide zone of quartz veins that is exposed for 100 feet along strike. There appear to be two sets of veins: one parallel to and one crosscutting the phyllite host. Both vein sets may be deformed by post-emplacement folding. One outcrop sample of a crosscutting quartz vein with chalcopyrite and trace galena (8054) contained 0.36% copper. The sample was not analyzed for lead. The vein is 3 feet wide. It has a strike of N. 17° W. and a dip of 53° W. Placer claims were reportedly staked near the mouth of Big Jim Creek (Kardex). This site was not examined.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential due to lack of precious metal values and limited extent of veins.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 10.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Grybeck, D., 1977, Known mineral deposits of the Brooks Range, Alaska: U.S. Geological Survey Open-File Report 77-166C, p. 34.

Property Summary

Name(s): Snowden Creek Lode
Gauss Mining Company
B & B Associates 1-4 claims

Map No: C5
MAS No: 0020310041
Alaska Kardex 031-107
ARDF CH105

Deposit Type: Polymetallic veins

Commodities: Cu, Li(?)

Location:

Quadrangle: Chandalar D-6
Center sec. 24, T. 34 N., R. 10 W.
Meridian: Fairbanks
Elevation: 3,400 feet
Latitude: 67° 45.301' N.
Longitude: 149° 42.622' W.
Geographic: Located on a ridge immediately north of Snowden Creek, about 3 miles south of Snowden Mountain.

History:

1959-60 - Brosge and Reiser (1964) reported a copper staining on ridge north of Snowden Creek.

1974 - Mulligan (1974) reported mineralized gypsum-calcite zone in a shaley limestone bluff above Snowden Creek.

1977 - H. Gauss staked 4 lode claims (Kardex).

Production: None.

Workings and Facilities: None.

Geologic Setting:

The bedrock at Snowden Mountain is primarily Devonian limestone, slate, phyllite, and siltstone. A small outcrop of Devonian greenschist is mapped near a reported copper mineral occurrence. Several east-west-trending faults are also mapped near the occurrence (Brosge and Reiser, 1964).

Mulligan (1974) reported a 6-inch-thick gypsum-calcite zone parallel to the apparent bedding in a shaley limestone bluff. The zone contains abundant fine-grained pyrite, but no detectable base or ferroalloy metals. Vein quartz float with traces of graphite, pyrite, and chalcopyrite was found on a talus slope uphill; however, the source of the quartz was not found. Chromium, lead, nickel, and vanadium were detected spectrographically.

Bureau Investigation:

Gypsum-calcite veins were found on both the northern and southern ridges of Snowden Creek, approximately 1.5 miles from the mouth. The veins on the northern ridge are predominantly gypsum with coarse (0.5 cm) euhedral pyrite and minor calcite. Although samples of the veins (11150-11151, table C-1) were not anomalous in metals, they average 151 ppm lithium. These values were among the highest in the district. The average range of lithium in crustal rocks is reported to be 10 to 60 ppm (Levinson, 1974).

The veins on the southern ridge contain euhedral calcite with trace pyrite and cut the limestone host in numerous orientations. An outcrop sample of calcite vein (11084) contain 354 ppm copper, although no copper minerals were observed in the outcrop.

Mulligan (1974) reported that chromium, lead, nickel, and vanadium were detected spectrographically at Snowden Creek. These elements were also detected in samples obtained during the BLM investigation; however, the results were not considered anomalous. Anomalous vanadium results for the region have been defined as approximately >200 ppm for stream sediment samples and >700 ppm for rock samples (Marsh and others, 1978; Dillon and others, 1981). Using this criteria, none of the samples collected during the Koyukuk Mining District study qualified as anomalous in vanadium.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential as only trace amounts of copper and rare earth metals were detected.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 64.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Dillon, J.T., and Reifenstuhl, R.R., 1995, Geologic map of the Chandalar C-6 quadrangle southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 105, 1 sheet, scale 1:63,360.

Grybeck, D., 1977, Known mineral deposits of the Brooks Range, Alaska: U.S. Geological Survey Open-File Report 77-166C, 45 p.

Levinson, A.A., 1974, Introduction to exploration geochemistry: Applied Publishing Ltd., Wilmette, Illinois, U.S.A., p. 43-44.

Marsh, S.P., Petra, D.E., and Smith, S.C., 1978a, Geochemical and generalized geologic map showing distribution and abundance of molybdenum, copper, and lead in stream sediments in the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-878D, 1 sheet, scale 1:250,000.

____1978b, Geochemical and generalized geologic map showing distribution and abundance of barium, arsenic, boron, and vanadium in stream sediments in the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-878G, 1 sheet, scale 1:250,000.

Mulligan, J.J., 1974, Mineral resources of the Trans-Alaska Pipeline corridor: U.S. Bureau of Mines Information Circular 8626, p. 5.

Property Summary

Name(s): Mathews River

Map No: C6
MAS No: 0020310132
ARDF CH074

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar D-5
SE¼ sec. 24, T. 34 N., R. 9 W.
Meridian: Fairbanks
Elevation: 2,490 feet
Latitude: 67° 45.250' N.
Longitude: 149° 28.250' W.
Geographic: The site is on Mathews River, 14 miles north of the confluence with Bettles River. An unnamed eastern tributary another 2 miles upstream of the site appears to be related.

History:

1967 - Claims staked in area (DeYoung, 1978).
1987 - Dillon (1987) reported one inactive claim at the upper eastern tributary and one active claim on Mathews River.

Production: Unknown.

Workings and Facilities: None.

Geologic Setting:

The bedrock of the upper Mathews River basin consists of Devonian Skajit Limestone overlying calcareous schist, marble, slate, phyllite, and siltstone. Numerous thrust faults (at varying orientations) occur in upper Mathews River. Isolated intrusions of Devonian greenschist and greenstone are reported near the site (Brosge and Reiser, 1964).

Bureau Investigation:

Mathews River does not cut bedrock at the sites examined; the river is braided with wide meanders. Pan concentrate samples were collected from a gravel bar on the upper Mathews River tributary (11147, table C-1) and a cut bank on Mathews River (11149). The samples were not anomalous in gold.

Resource Estimate: None.

Mineral Development Potential: Low mineral development potential due to lack of gold in samples.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000, unnamed location #82.

Dillon, J.T.,1987, Upper Koyukuk district land and mining claim status current to 1985: Alaska Division of Geological and Geophysical Surveys Public Data File 87-11, 25 p., 1 sheet, scale 1:125,000.

Property Summary

Name(s): Kalhabuk Creek
BVK claims

Map No: C7
MAS No: 0020310114
Alaska Kardex 031-072

Deposit Type: Placer

Commodities: Au(?)

Location:
Quadrangle: Chandalar C-6
NW¼ sec. 18, T. 33 N., R. 10 W.
Meridian: Fairbanks
Elevation: 2,000 feet
Latitude: 67° 41.050' N.
Longitude: 149° 53.750' W.
Geographic: On Kalhabuk Creek, about 1 mile upstream of the Hammond River, within Gates of the Arctic National Park.

History:

1976-80 - M. Vostry staked one placer claim (Kardex).

Production: Unknown.

Workings and Facilities: None observed.

Geologic Setting:

Kalhabuk Creek is downcutting through Quaternary deposits (glacial, alluvial, and colluvial material); it does not cut bedrock. The bedrock in the surrounding area is predominantly Devonian slate, siltstone, sandstone, and conglomerate with minor chlorite schist. A small outcrop of Devonian(?) altered schistose hornblende diorite and pyroxene diorite is reported on the ridge northwest of the site (Brosge and Reiser, 1964).

Bureau Investigation:

A stream sediment and pan concentrate sample (10875-10876, table C-1) were collected at the site. Pyrite was observed in the pan sample, but no gold. A float sample of pyritiferous quartzose schist (10877) was also collected from the site. No metal anomalies were noted in any of the sample results.

Resource Estimate: None.

Mineral Development Potential: Low mineral development potential due to lack of gold in samples.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Property Summary

Name(s): Vi Creek Lode

Map No: C8
MAS No: 0020310094
ARDF CH082

Deposit Type: Polymetallic veins

Commodities: Cu

Location:

Quadrangle: Chandalar C-6 — SW¼ sec. 3, T. 32 N., R. 11 W.
Meridian: Fairbanks — Elevation: 4,430 feet
Latitude: 67° 37.466' N. — Longitude: 149° 59.259' W.
Geographic: Located in the northeastern headwaters of Vi Creek, 1.1 miles southwest of peak 4686. It is within Gates of the Arctic National Park.

History:

1959-60 - A copper anomaly was noted by the U.S. Geological Survey during geologic mapping and stream sediment sampling of the Chandalar quadrangle (Brosge and Reiser, 1964).

Production: None.

Workings and Facilities: None.

Geologic Setting:

Bedrock in upper Vi Creek is composed of conglomerate, black slate and phyllite, and chloritc siltstone of the Middle to Upper Devonian(?) Beaucoup Formation. Copper sulfide minerals and/or malachite-azurite stains reportedly occur within the siltstone (DeYoung, 1978). A small exposure of andesite tuff(?) occurs about 0.5 miles south of the mineral occurrence (Dillon and Reifenstuhl, 1995).

Bureau Investigation:

The BLM investigated quartz veins spotted during aerial reconnaissance. One vuggy quartz vein varying from 1 to 4 inches wide crosscuts quartz-muscovite schist. The quartz contains trace amounts of chalcopyrite(?) and galena. A select sample (8032, table C-1) contains 356 ppm antimony, and 140 ppm arsenic. A piece of float from the same vein (8033) contains 580 ppm zinc and 151 ppm antimony. Neither sample was analyzed for copper and lead. The vein trends N. 73° W. with a vertical dip and an exposure length of less than 50 feet.

A piece of quartz float picked up at the mouth of Vi Creek (11836) contains 130 ppm zinc and 173 ppm antimony. Stream sediment and pan concentrate samples (11817, 11835) collected at the same site did not contain anomalous metal values. Vi Creek was also investigated for placer gold (map no. C44).

Resource Estimate: None.

Mineral Development Potential:

Low development potential for polymetallic veins. The veins are small with spotty amounts of sulfides, but no precious metals.

Recommendations: None.

References:

Berg, H.C., and Cobb, E.H., 1967, Metalliferous Lode Deposits of Alaska: U.S. Geological Survey Bulletin 1246, p. 204.

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, unnamed location #76, 1 sheet, scale 1:250,000.

Dillon, J.T., and Reifenstuhl, R.R., 1995, Geologic map of the Chandalar C-6 quadrangle southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 105, 1 sheet, scale 1:63,360.

Property Summary

Name(s): Brockman Creek
C & R Mining
Dietrich, Mathews River

Map No: C9
MAS No: 0020310119
Alaska Kardex 031-152
Alaska Kardex 031-156

Deposit Type: Placer

Commodities: Au

Location:
Quadrangle: Chandalar C-6
NE¼ sec. 22, T. 33 N., R. 9 W.
Meridian: Fairbanks
Elevation: 2,500 feet
Latitude: 67° 40.316' N.
Longitude: 149° 31.066' W.
Geographic: Local name for a 10-mile-long western tributary of the Dietrich River, about 2 miles north of Wiehl Mountain.

History:

1979 - R. and C. Wright staked placer claim approximately 2.5 miles upstream from creek mouth (Kardex).

1987 - Dillon (1987) reported active claims 2.5 miles upstream from the creek mouth and an inactive claim near the headwaters.

1997 - M. Bell and J. Dunlap staked placer claims approximately 5 miles upstream from creek mouth. T. Rogers staked claims approximately 7 miles upstream from creek mouth.

Production: No recorded production.

Workings and Facilities:

Evidence of panning and sluicing was observed approximately 5 miles upstream of the creek mouth on an eastern tributary.

Geologic Setting:

The bedrock in the Brockman Creek basin consists mostly of the Devonian Skajit Formation, which includes gray marble and limestone, finely crystalline dolomite, carbonate conglomerate, and graphitic and calcareous schist interlayers. The Skajit Formation is bounded by Ordovician to lower Paleozoic phyllite, marble, calcareous-chlorite-quartz schist, and quartzite. All of the units contact one another along a northeastern trend. Numerous high angle strike slip and thrust faults have been mapped in the area (Dillon and Reifenstuhl, 1995).

Devonian metavolcanic units outcrop on a northeastern trend along the northern flanks of Wiehl Mountain Devonian which drain into Brockman Creek. The fine- to medium-grained basic metavolcanic rocks, commonly referred to as greenschist, contain chlorite, albite, and epidote (Dillon and Reifenstuhl, 1995). A polymetallic vein lode site is located within these outcrops (map no. C10).

Bureau Investigation:

Brockman Creek cuts through the Skajit Formation for much of its length; cliffs are at least 100 feet high for the upper 6 miles. Six pan concentrate samples were collected at Brockman Creek: sample locations included the headwaters (12404, 12406, table C-1), the tributary 5 miles upstream from the creek mouth (11154, 11193), and tributaries 2 miles upstream of the creek mouth (11082-11083). Most of the samples were collected off bedrock. Although moderate amounts of sulfides were observed in many of the pans, none of the samples contained anomalous gold results.

The marble formation contains layers of semi-euhedral pyrite locally. Two samples of pyritiferous limestone and calcareous schist were collected (11152, 11192), but neither contained anomalous metal values.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential for placer gold due to lack of gold in samples.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Dillon, J.T., 1987, Upper Koyukuk district land and mining claim status current to 1985: Alaska Division of Geological and Geophysical Surveys Public Data File 87-11, 25 p., 1 sheet, scale 1:125,000.

Dillon, J.T., and Reifenstuhl, R.R., 1995, Geologic map of the Chandalar C-6 quadrangle southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 105, 1 sheet, scale 1:63,360.

Property Summary

Name(s): Mathews River Lode

Map No: C10
MAS No: 0020310091
ARDF CH074

Deposit Type: Polymetallic veins

Commodities: As, Au, Pb

Location:

Quadrangle: Chandalar C-6
NE¼ sec. 26, T. 33 N., R. 9 W.
Meridian: Fairbanks
Elevation: 3,900 feet
Latitude: 67° 39.390' N.
Longitude: 149° 30.655' W.
Geographic: Located on a ridge 4 miles northeast of Wiehl Mountain.

History:

1959-60 - Brosge and Reiser (1964) reported a lead anomaly at the Mathews River site.
1974 - Mulligan (1974) reported a quartz vein with very small amounts of sulfides.

Production: None.

Workings and Facilities: None.

Geologic Setting:

The bedrock along northeastern Wiehl Mountain consists mostly of the Devonian Skajit Formation, which includes gray marble and limestone, finely crystalline dolomite, carbonate conglomerate, and graphitic and calcareous schist interlayers. The Skajit Formation is intruded by Devonian metavolcanic and matabasite units which outcrop in a northeasterly trend. The fine- to medium-grained basic metavolcanic rocks, commonly referred to as greenschist, contain chlorite, albite, and epidote (Dillon and Reifenstuhl, 1995).

Mulligan (1974) describes the occurrence as a 3-foot-wide quartz vein that is exposed for a 100-foot strike length. Very small amounts of arsenopyrite, galena, chalcopyrite, and sphalerite were found in iron-stained quartz float. No sulfides were seen in place. A quartz vein sample contained detectable gold and silver.

Bureau Investigation:

The quartz vein is approximately 3 feet wide with an exposed strike length of 100 feet. The vein strikes east-west and dips steeply to the north. Calcite is concentrated along the quartz vein margins. Below the exposed vein is a 500-square-foot talus field of quartz vein float. A minor amount of the quartz talus is iron-oxide stained, with 2-3% fine, disseminated pyrite, arsenopyrite, chalcopyrite, galena, and sphalerite. No mineralized quartz was found in place. Three select samples of the vein quartz (11646-11648, table C-1) averaged 72 ppb gold, 2.1 ppm silver, 258 ppm copper, 1,260 ppm lead, 313 ppm zinc, and 3,454 ppm arsenic.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential due to limited extent of the vein and low values of gold.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 47.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Dillon, J.T., and Reifenstuhl, R.R., 1995, Geologic map of the Chandalar C-6 quadrangle southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 105, 1 sheet, scale 1:63,360.

Grybeck, D., 1977, Known mineral deposits of the Brooks Range, Alaska: U.S. Geological Survey Open-File Report 77-166C, p. 34.

Mulligan, J.J., 1974, Mineral resources of the Trans-Alaska Pipeline corridor: U.S. Bureau of Mines Information Circular 8626, p. 5.

Property Summary

Name(s): Eva

Map No: C11
MAS No: 0020310140

Deposit Type: Skarn

Commodities: Cu, Ag, Pb, Zn

Location:

Quadrangle: Chandalar C-5
SW¼ sec. 20, T. 33 N., R. 8 W.
Meridian: Fairbanks
Elevation: 3,850 feet
Latitude: 67° 39.981' N.
Longitude: 149° 25.296' W.
Geographic: Located on the ridge between Mathews River and Big Spruce Creek, approximately 1 mile south of peak 4626. The site is on Doyon Ltd. land.

History:

1967-70 - Bear Creek Mining Company (BCMC) initiated investigation and staked claims at Eva and other sites in the area, which was collectively designated the "Chandalar copper belt" (WGM Inc., 1978).

1970-72 - BCMC conducted sampling and geologic mapping at Eva and other sites within the Chandalar copper belt.

1973-74 - Midwest Oil Company, a subsidiary of AMOCO, contracted WGM Inc. to conduct additional mapping and sampling (WGM Inc., 1974).

1970s-80s - Intermittent geologic investigations made by WGM Inc. and Arctic Resources Inc.

1990s - Ventures Resource Corporation made brief investigations in the area.

Production: None.

Workings and Facilities: None.

Geologic Setting:

Eva is located at the southwestern portion of the Chandalar copper belt (figure C-1). The belt is comprised of porphyry and skarn occurrences along a 15-mile-long, northeastern trend. The skarns exhibit both prograde and retrograde mineral assemblages. They also exhibit what appears to be regional zoning: Cu-Ag skarns occur along the southern portion of the belt, and Pb-Zn-Ag mineralization is common in the north. The plutonic rocks within the belt are characterized as relatively small (0.5 to 7 square miles), Early Devonian, metaluminous granite gneiss and hornblende granodiorite gneiss of the Horace Mountain plutons (Newberry and others, 1986; Dillon, 1989; Dillon and others, 1996).

The bedrock at Eva is muscovite schist, quartz-sericite schist, calcareous schist, and calc-silicate. The schistose rocks contain abundant iron-oxide staining. To the west-northwest, these units contact the Skajit Limestone formation. To the east, they contact pyritic and graphitic phyllite and marble with minor meta-intrusive rocks. Chalcopyrite is reported in resistant, discontinuous calc-silicate outcrops. The meta-intrusive rocks contain no more than trace copper (WGM Inc., 1973, 1974; Nicol, 1983; Dillon and others, 1996).

Bureau Investigation:

BLM geologists examined Eva between 3,950 to 3,240 feet elevation, covering approximately one half mile of the conspicuous red-stained ridge facing Mathews River. The ridge is predominantly muscovite schist, which weathers yellow-red. Although copper mineralization was observed in quartz-sericite schist, calcareous schist, and calc-silicate rocks, it is relatively weak and spotty.

At elevation 3,950 feet, chalcopyrite, malachite, and azurite staining was observed on a 20 by 20 foot outcrop knob of quartz-sericite schist. A select outcrop sample (11737, table C-1) contained 68 ppb gold, 2.1 ppm silver, 2,853 ppm copper, 306 ppm lead, and 93 ppm zinc.

A contact between calcareous schist and underlying calc-silicate occurs at 3,900 feet elevation. The contact plane strikes N. 15° W. and dips 37° NE. A sample of the calcareous schist with pyrite stringers (11739) contained 9.7 ppm silver, 3,395 ppm lead, 3,931 ppm zinc, but only 23 ppb gold. Samples of the underlying calc-silicate (11738, 12403) average 64 ppb gold, 2.45 ppm silver, and 4,740 ppm copper.

Meta-intrusive rocks found contain trace amounts of sulfide minerals. A float sample of a mafic meta-intrusive with disseminated pyrrhotite (11740) contained only 358 ppm copper.

Resource Estimate:

Nicholson (1990) estimated grade and tonnage of skarn mineralization at the Victor (map no. C14) and Eva sites. The estimate was based on areal exposure of surface outcrops and the assumption of depth equal to one half the strike length of mineralized outcrop. The skarn pods at the Victor and Eva sites were reported to contain a combined potential of 50,000 tons of 2% copper.

Mineral Development Potential:

Eva exhibits low mineral development potential. The site contains podiform sulfide mineralization in calcareous schist and calc-silicate rocks with anomalous in copper, silver, lead, and zinc. However, the mineralization appears limited to small, discontinuous outcrops.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 70.

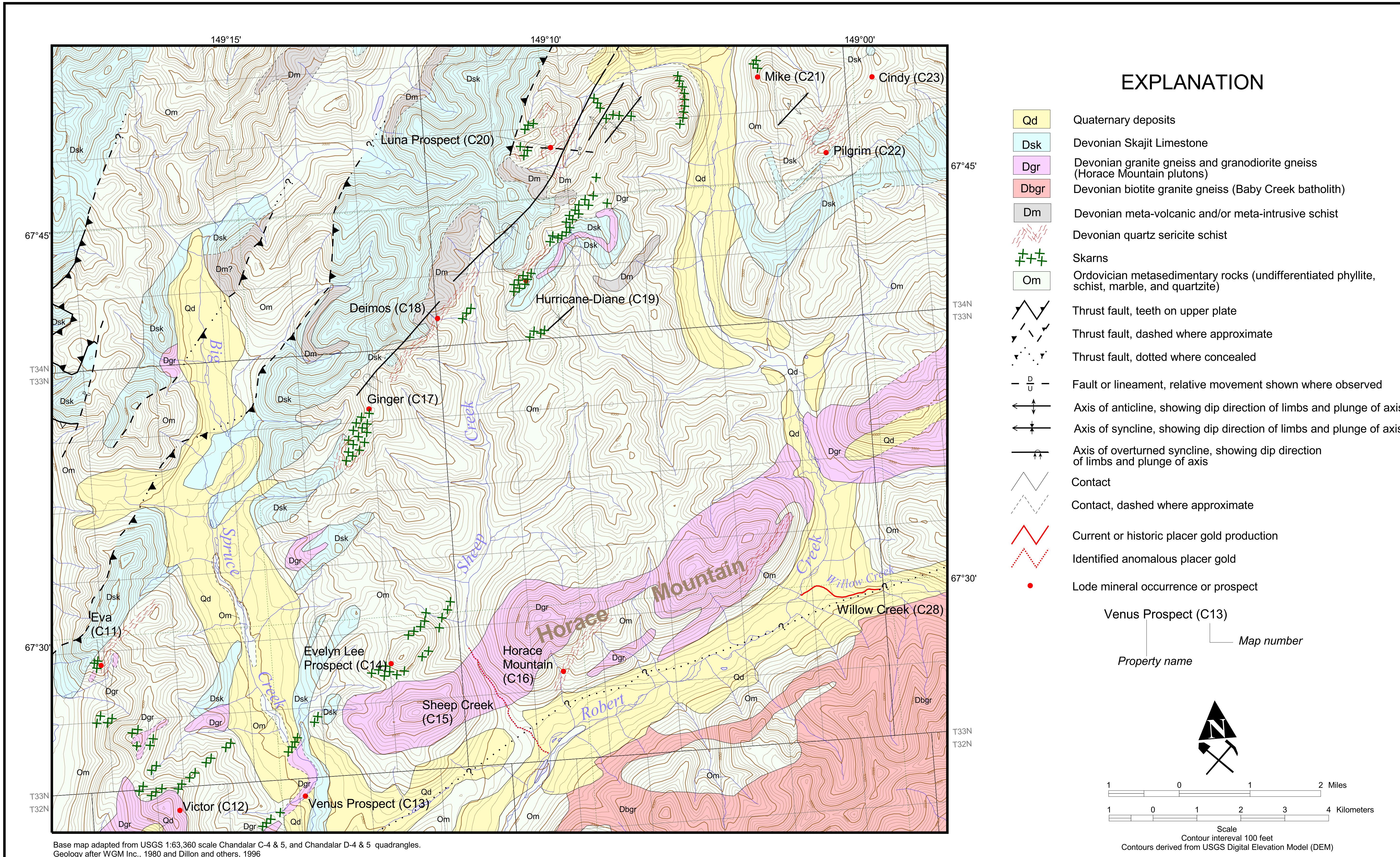

Figure C-1. Geologic and mineral occurrence location map of the Chandalar copper belt.

Dashevsky, S.S., Mines, prospects, and geochemical anomalies on Doyon Ltd. regional overselection lands Alaska, Blocks 1 - 8, v. I of II: unpublished report 86-01A for Doyon Ltd., v. 1, 42 p. [available from Doyon Ltd., Fairbanks, Alaska]

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

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Ventures Resource Corporation, 1999, 1999 Annual report: Ventures Resource Corporation, 36 p.

Property Summary

Name(s): Victor

Map No: C12
MAS No: 0020310065
ARDF CH064

Deposit Type: Skarn

Commodities: Cu, Ag, Au

Location:

Quadrangle: Chandalar C-5
NW¼ sec. 5, T. 32 N., R. 8 W.
Meridian: Fairbanks
Elevation: 4,280 feet
Latitude: 67° 38.000' N.
Longitude: 149° 23.195' W.
Geographic: Located on the ridge between Big Spruce Creek and Mathews River, north of peak 5274. The site is on Doyon Ltd. land.

History:

1967-70 - Bear Creek Mining Company (BCMC) initiated investigation and staked claims at Eva and other sites in the area, which was collectively designated the "Chandalar copper belt" (WGM Inc., 1978).

1970-72 - BCMC conducted sampling and geologic mapping at Victor and other sites within the Chandalar copper belt (WGM Inc., 1978).

1973-74 - Midwest Oil Company, a subsidiary of AMOCO, contracted WGM Inc. to conduct additional mapping and sampling (WGM Inc., 1974).

1970s-80s - Intermittent geologic investigations made by WGM Inc. and Arctic Resources Inc.

1990s - Ventures Resource Corporation made brief investigations in the area.

Production: None.

Workings and Facilities: None.

Geologic Setting:

Victor is a skarn occurrence, at the southwestern portion of the Chandalar copper belt. The belt is composed of porphyry and skarn along a 15-mile-long, northeastern trend. The skarns exhibit both prograde and retrograde mineral assemblages. They also exhibit what appears to be regional zoning: Cu-Ag skarns occur along the southern portion of the belt, and Pb-Zn-Ag mineralization is common in the north. The plutonic rocks within the belt are characterized as relatively small (0.5 to 7 square miles), Early Devonian, metaluminous granite gneiss and hornblende granodiorite gneiss of the Horace Mountain plutons (Newberry and others, 1986; Dillon, 1989; Dillon and others, 1996).

The bedrock at Victor is hornblende granodiorite gneiss that has intruded calcareous schist and limestone. Hornfels and skarn outcrop adjacent to the meta-intrusive. The skarns contain chalcopyrite and pyrite in disseminations, stringers, and pods. The meta-intrusive rocks contain no more than trace copper (WGM Inc., 1973, 1974; Nicol, 1983; Dillon and others, 1996).

Calc-silicate and skarn rocks outcrop prominently at several locations on the western ridge above Big Spruce Creek. The rocks contain massive sulfides (pyrite, chalcopyrite, pyrrhotite), and magnetite locally. Newberry and others (1986, p. 1743) reported that one rock sample contained 1.1% copper and 5.5 ppm silver.

Bureau Investigation:

Several isolated skarns were sampled between peaks 5274 and 4737, on the western ridge of Big Spruce Creek. Garnet-epidote skarn was observed in several resistant outcrop knobs, intercalated with meta-intrusive and calcareous schist rocks. The skarn contained variable amounts of pyrite, chalcopyrite, pyrrhotite, and copper-oxide coatings.

Northeast of peak 5274, a garnet-epidote skarn outcrop measures about 350 by 50 feet. The outcrop strikes N. 70° E. Chalcopyrite and pyrite zones ranged in length from 3 to 15 feet along a N. 80° E. trend. Four outcrop samples of the sulfide-bearing skarns (11697-11700, table C-1) average 354 ppb gold, 17.0 ppm silver, and 3.49% copper.

Approximately 400 feet to the south, two samples of skarn and chalcopyrite rubblecrop (8028, 8030) average 1,000 ppb gold, 18.5 ppm silver, and 6.22% copper.

Approximately 1 mile to the north, northeast of peak 4737, a garnet-epidote skarn outcrop measures 150 feet by 10 feet. The outcrop trends roughly northeast. Approximately 6 pods, up to 2 feet in diameter, contained abundant chalcopyrite and pyrite. Three continuous chip samples (11185-11187) averaged 157 ppb gold, 8.6 ppm silver, 6,965 ppm copper.

Resource Estimate:

Nicholson (1990) estimated grade and tonnage of skarn mineralization at the Victor and Eva sites. The estimate was based on areal exposure of surface outcrops and the assumption of depth equal to half the strike length of mineralized outcrop. The skarn pods at the Victor and Eva sites were reported to contain a combined potential of 50,000 tons of 2% copper.

Mineral Development Potential:

The skarns at the Victor site exhibit low to moderate mineral development potential for copper, silver, and gold; however, the exposures are relatively small and discontinuous.

Recommendations: None.

References:

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 70.

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____1980, 1979 Annual progress report, Block 5- Wiseman Chandalar Copper Belt: unpublished report 80-06 for Doyon Ltd., 28 p. [available from Doyon Ltd., Fairbanks, Alaska]

Property Summary

Name(s): Venus Prospect

Map No: C13
MAS No: 0020310060
Alaska Kardex 031-053D
ARDF CH065

Deposit Type: Porphyry copper

Commodities: Cu, Mo, Au

Location:

Quadrangle: Chandalar C-5
NW¼ sec. 3, T. 32 N., R. 8 W.
Meridian: Fairbanks
Elevation: 2,300 feet
Latitude: 67° 37.868' N.
Longitude: 149° 19.168' W.
Geographic: Located about 3 miles north of the mouth of Big Spruce Creek, at the confluence of a 1.5-mile-long, east-flowing tributary known locally as Venus Creek. The site is on Doyon Ltd. land.

History:

1967-70 - Bear Creek Mining Company (BCMC) initiated investigation and staked Federal lode claims at Venus and other sites in the area, which was collectively designated the "Chandalar copper belt" (WGM Inc., 1978).

1970-72 - BCMC conducted sampling and geologic mapping at Venus and other sites within the Chandalar copper belt.

1973 - BCMC optioned its claim holdings to Midwest Oil Company, a subsidiary of AMOCO. Watts, Griffis & McQuat Incorporated (WGM Inc.) was commissioned to supervise additional geologic investigations, which included 1,015 feet of diamond core drilling at Venus (WGM Inc., 1973).

1974 - An additional 1,415 feet was drilled at the Venus prospect (WGM Inc., 1974)

1974-79 - WGM Inc. (1980) conducted regional stream silt reconnaissance, regional geologic mapping at 1:10,000 scale, and detailed geologic mapping at 1:1,000 scale.

1970s-80s - Intermittent geologic investigations made by WGM Inc. and Arctic Resources Inc.

1990s - Ventures Resource Corporation made brief investigations in the area.

Production: None.

Workings and Facilities:

Remnants of a geologic exploration base camp are located immediately southwest of the confluence of Venus and Big Spruce Creeks. Five core holes were drilled on site, but few are visible from the air (WGM Inc., 1979). The combined length of the drill holes was 2,466 feet (WGM Inc., 1979, 1980).

Geologic Setting:

Venus is located at the southwestern portion of the Chandalar copper belt. The belt is composed of porphyry and skarn occurrences along a 15-mile-long, northeastern trend. The plutons are relatively small (0.5 to 7 square miles) and outcrop adjacent to many known skarns, north of Bettles River. The plutons are characterized as Early Devonian, metaluminous granite gneiss and hornblende granodiorite gneiss. Alteration of the plutons includes widespread, weak to pervasive sericitic zones and Cu-Mo mineralization. Schistosity is well developed along the margins of the plutons, and bodies more than one half a mile thick can exhibit continuous schistose fabric. Distinguishing these rocks from metavolcanic rocks is difficult in some locations. Although the association of porphyry copper deposits and copper skarns is a relatively common occurrence, the association of sericitically altered plutonic rocks with mildly retrograded skarns is not and suggests structural complexity (Newberry and others, 1986; Dillon, 1989; Dillon and others, 1996).

The Venus prospect is a Devonian copper porphyry with proximal skarns that outcrop along Venus Creek (figure C-2). Five core holes (totaling 2,466 feet) were drilled on the site. Four holes were located over the meta-intrusive. The drill core consisted of foliated and schistose granodiorite with disseminated pyrite and chalcopyrite and veinlets of pyrite, chalcopyrite, quartz, chlorite, minor carbonate, and local smears of molybdenite. Three of the holes averaged 0.15% to 0.2% copper, but one hole averaged only 0.08% copper. The average sulfide content was 3% to 4% with a pyrite to chalcopyrite ratio of 5:1 (WGM Inc., 1973, 1974; Nicholson, 1990).

One hole (DDH-2) was located over an exposure of mineralized skarn. The skarn has a thickness of less than 5 feet at the drill site. The hole intercepted 432 feet of alternating, weakly pyritic limestone, hornfels, and weakly pyritic schist (WGM Inc., 1973, 1974; Nicholson, 1990).

Bureau Investigation:

Sulfide-bearing granodiorite and hornfels form a canyon at the confluence of Big Spruce and Venus Creeks (figure C-2). From this point, the rocks extend approximately 4,500 feet up Big Spruce Creek and 3000 feet up Venus Creek. Relatively small (50 square feet) sulfide-bearing skarns also outcrop along Venus Creek.

Fourteen samples of the meta-intrusive averaged 759 ppm copper and only 36 ppm molybdenum (table C-1). The samples contained up to 5% pyrite and chalcopyrite with minor malachite and moderate limonite staining. They did not contain significant amounts of gold.

Although samples of meta-intrusive rock contained low molybdenum values, visible molybdenum was found in three rock samples: meta-intrusive (8050), vein quartz (11689), and sericite schist (11696). These anomalous molybdenum sample results ranged from 212 to 1,473 ppm.

The skarn adjacent to the meta-intrusive was briefly investigated. Random chip samples collected from two skarn outcrops on Venus Creek (11181, 11694) averaged 2,202 ppm copper and 1.9 ppm silver. The outcrops, measuring approximately 6 feet by 6 feet each, both contained moderate chalcopyrite, pyrite, and magnetite. Larger, more extensive skarn occurrences are located at the headwaters of Venus Creek (Victor, map no. C12).

Resource Estimate:

Nicholson (1990) estimated grade and tonnage of porphyry copper mineralization at Venus. The estimate was based on a mineralized surface exposure that measures 1,000 feet long by 40 feet wide. The available drilling data indicated grades of 0.2% to 0.52% copper and 0.015% molybdenum. The final estimate was 300,000 tons of 0.3% copper.

Young and others (1997) also evaluated the porphyry copper resources at the Victor-Venus area, estimating up to 4.56 million tons of variable grade copper-molybdenum-gold mineralization.

Mineral Development Potential:

Low mineral development potential for copper and molybdenum at Venus. The site is extremely remote. And data indicate that the porphyry is relatively small and low grade.

Recommendations:

Available literature suggests relatively low grades of copper and molybdenum; however, the extent of mineralization has not been fully characterized.

References:

Brosge, W.P., and Reiser, H.N.,1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

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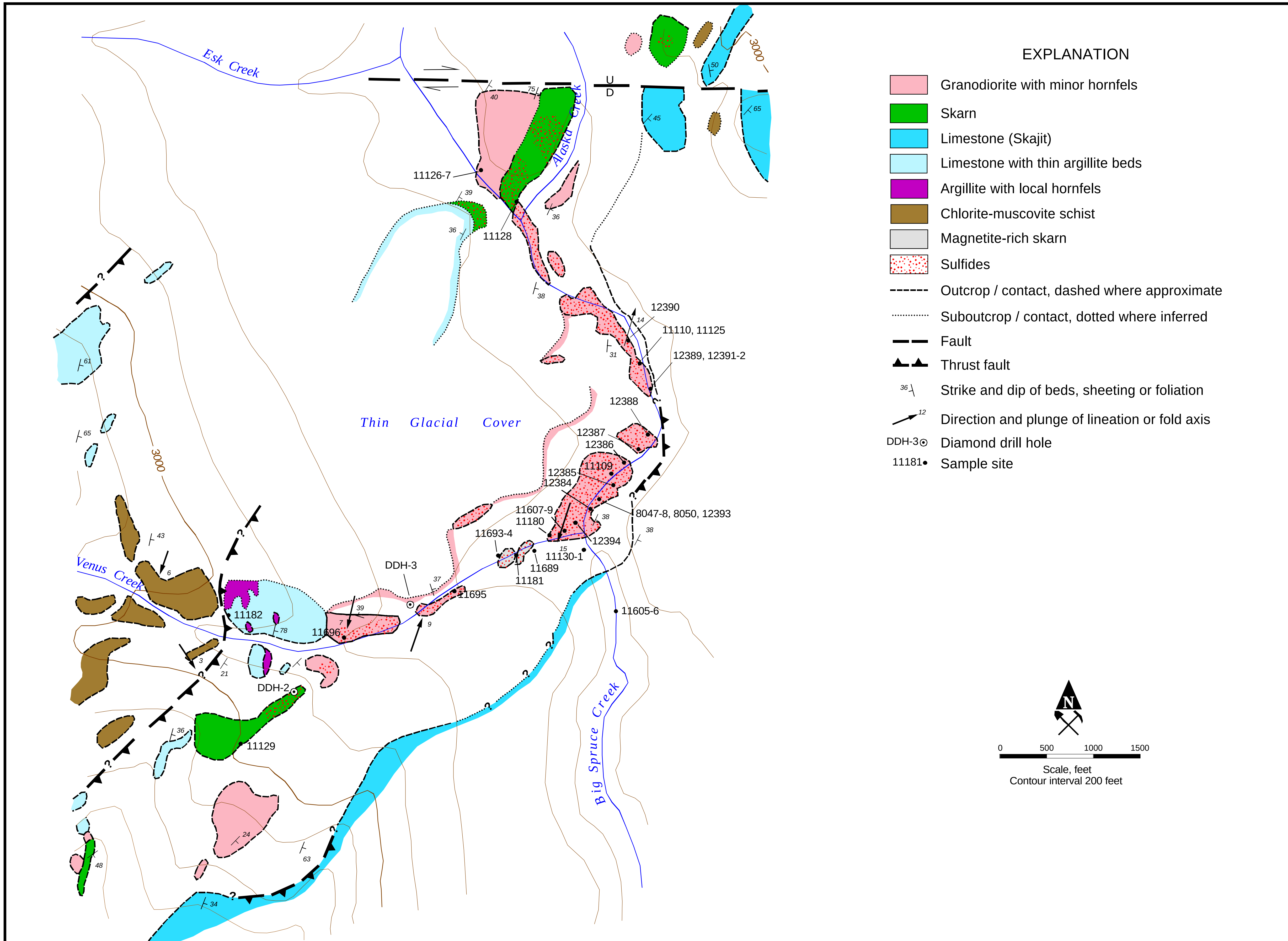

Base map adapted from USGS 1:63,360 scale Chandalar C-5 quadrangle
Geology after Watts, Griffis, and McQuat, 1973

Figure C-2. Geology and sample location map of the Venus Prospect.

Grybeck, D., 1977, Known mineral deposits of the Brooks Range, Alaska: U.S. Geological Survey Open-File Report 77-166C, p. 34.

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Swainbank, R.C., Clautice, K.H., and Nauman, J.L., 1998, Alaska’s mineral industry 1997: Alaska Division of Geological and Geophysical Surveys Special Report 52, p. 6.

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____1979, 1978 Doyon Ltd. annual progress report, Block 5 Luna volcanogenic massive sulfide and associated base-metal deposits and anomalies of the Chandalar Copper Belt: unpublished report 79-21 for Doyon Ltd., p. 1-35. [available from Doyon Ltd., Fairbanks, Alaska]

____1980, 1979 Annual progress report, Block 5- Wiseman Chandalar Copper Belt: unpublished report 80-06 for Doyon Ltd., 28 p. [available from Doyon Ltd., Fairbanks, Alaska]

Property Summary

Name(s): Evelyn Lee Prospect

Map No: C14
MAS No: 0020310062
Alaska Kardex 031-053H
ARDF CH059

Deposit Type: Skarn

Commodities: Cu, Ag, Au, Mo(?)

Location:

Quadrangle: Chandalar C-5
NW¼ sec. 25, T. 33 N., R. 8 W.
Meridian: Fairbanks
Elevation: 4,450 feet
Latitude: 67° 39.420' N.
Longitude: 149° 16.133' W.
Geographic: Located on the flanks of peak 4536, about 2 miles west of Horace Mountain, on the divide between Big Spruce and Sheep Creeks. The site is on Doyon Ltd. land.

History:

1967-70 - Bear Creek Mining Company (BCMC) initiated investigation and staked Federal lode claims at Evelyn Lee and other sites in the area, which was collectively designated the "Chandalar copper belt" (WGM Inc., 1978).

1970-72 - BCMC conducted geochemical sampling, geologic mapping, an airborne magnetics survey, and a ground geophysics investigation at sites in the Chandalar copper belt (WGM Inc., 1974).

1973 - BCMC optioned its claim holdings to Midwest Oil Company, a subsidiary of AMOCO. Watts, Griffis & McQuat Incorporated (WGM Inc.) was commissioned to supervise additional geologic investigations, which included diamond core drilling at Evelyn Lee (WGM Inc., 1973).

1974-79 - WGM Inc. (1980) conducted regional stream silt reconnaissance, regional geologic mapping at 1:10,000 scale, and detailed geologic mapping at 1:1,000 scale.

1970s-80s - Intermittent geologic investigations made by WGM Inc. and Arctic Resources Inc.

1990s - Ventures Resource Corporation made brief investigations in the area (Ventures Resources Corporation, 1999).

Production: None.

Workings and Facilities:

The Bear Creek Mining Company drilled two core holes with total depths of 512 and 183 feet. Two packsack core holes with depths of 18 feet and 23 feet were also drilled. Trenches are on the southern and northeastern flanks of peak 4536.

Geologic Setting:

Evelyn Lee is located at the southwestern portion of the Chandalar copper belt. The belt is composed of porphyry and skarn occurrences along a 15-mile-long, northeastern trend. The skarns exhibit both prograde and retrograde mineral assemblages. They also exhibit what appears to be regional zoning: Cu-Ag skarns occur along the southern portion of the belt, and Pb-Zn-Ag mineralization is common in the north. The plutonic rocks within the belt are characterized as relatively small (0.5 to 7 square miles), Early Devonian, metaluminous granite gneiss and hornblende granodiorite gneiss of the Horace Mountain plutons (Newberry and others, 1986; Dillon, 1989; Dillon and others, 1996).

Bedrock at the Evelyn Lee prospect is intercalated skarn, argillite, quartz-mica schist, and marble. These units are located immediately north of weakly mineralized hornblende granodiorite gneiss (figure C-3). Chip samples of skarn collected in trenches by WGM Inc. contained up to 7.5% copper along a strike distance of 120 feet. Two packsack core holes were collared in skarn. One hole (PS-1) intercepted 18 feet of skarn that contained 2.0% copper. The other (PS-2) intercepted 23.5 feet of skarn containing 3.5% copper. Both holes were bottomed in sulfide-bearing skarn with minor silver. A nearby diamond drill hole (DH-4), intercepted 76 feet of tactite that averaged 0.04% copper (WGM Inc., 1973, 1974; Ventures Resource, 1999).

Another diamond drill hole (DH-1) was positioned above the granite gneiss, near a coincident magnetic and IP anomaly. The hole was drilled to a depth of 512 feet. The intrusive contained trace chalcopyrite and molybdenite, but the hole intercepted grades of less than 0.1% copper. Results of the drilling did not explain either the IP or magnetic anomaly. However, the results did limit the southern extent of the target area (WGM Inc., 1973; Nicholson, 1990).

Bureau Investigation:

Sulfide-bearing skarns are concentrated at the southwestern and northeastern corners of peak 4536 (figure C-3). Copper mineralization occurs along approximately 700 feet of outcrop exposure on the south-southwestern flank of the prospect. The area of surficial copper staining is much more extensive than the area of the sulfides, because abundant malachite and azurite has leached onto barren marble. Eight samples of the skarn averaged 4.06%, copper and 11.9 ppm silver (table C-1).

Three samples of skarn were considered anomalous in gold: sample 11046 (1896 ppb), sample 11105 (270 ppb), and sample 8040 (200 ppb). Sample 11046 was collected from a vertical fault surface that strikes N. 15° E. The anomalous samples did not have a unique mineralogy that would differentiate them from other mineralized skarn samples. The Sheep Creek tributary draining the southeast portion of the Evelyn Lee prospect has been investigated for placer gold (map no. C15).

Resource Estimate:

DeYoung (1978) reported mineralization in isolated tactite bodies as much as approximately 333 feet long by 33 feet wide with grades as high as 10% copper. Total estimated potential is about 1.1 million tons of 5% copper.

Mineral Development Potential:

Moderate mineral development potential exists at Evelyn Lee. Extensive (though not complete) investigation concluded with significant inferred copper resources. Several gold anomalies remain unexplained.

Recommendations: Systematic sampling of skarns could determine extent of gold mineralization.

References:

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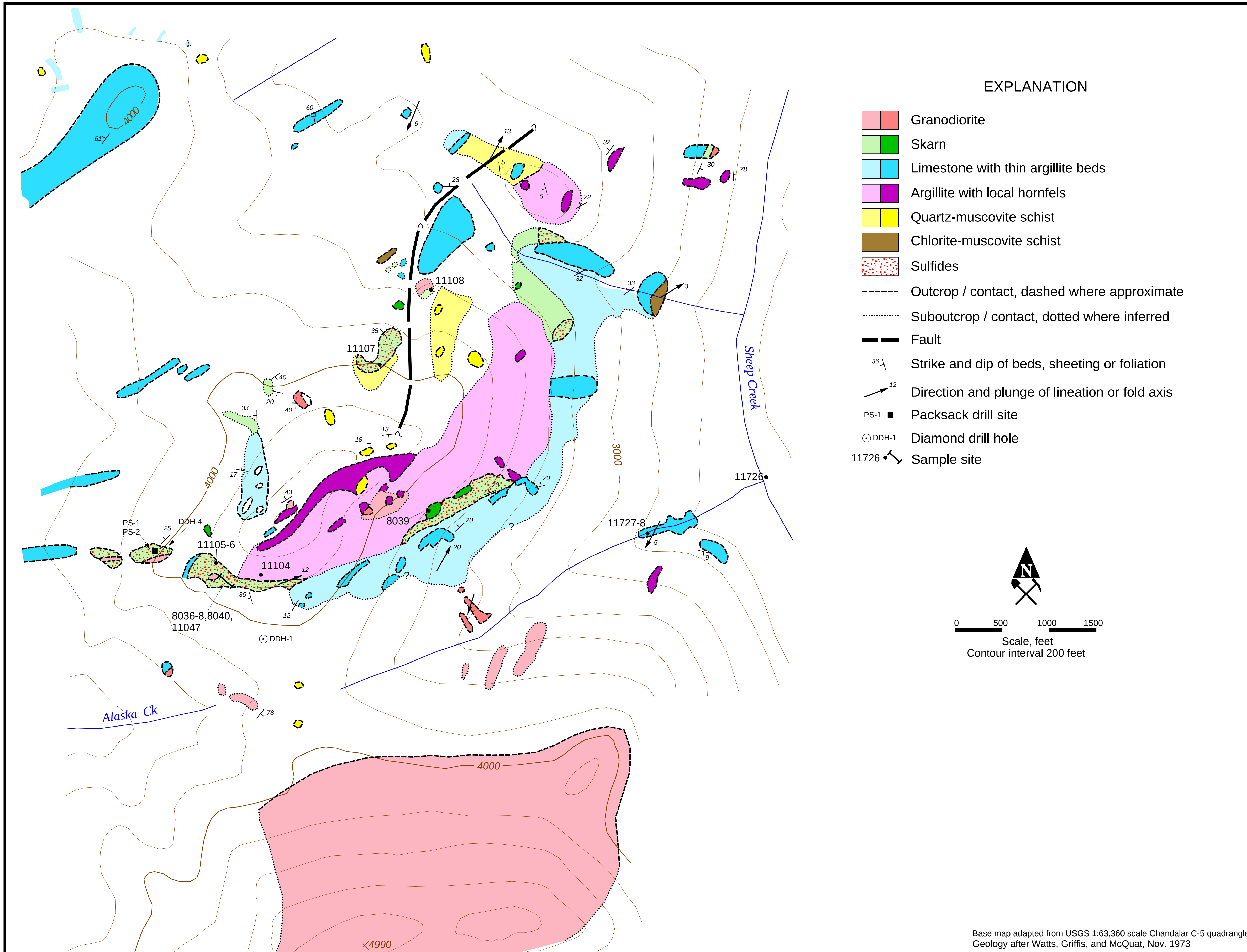

Figure C-3. Geology and sample location map of the Evelyn Lee Prospect.

____1974, Chandalar district progress report 1974: unpublished report for AMOCO Minerals, 37 p. [available from BLM Anchorage, Alaska]

____1978, 1977 Annual progress report, Doyon Ltd. project, v. II, Luna area: unpublished report 78-04 for Doyon Ltd., 15 p. [available from Doyon Ltd., Fairbanks, Alaska]

____1979, 1978 Doyon Ltd. annual progress report, Block 5 Luna volcanogenic massive sulfide and associated base-metal deposits and anomalies of the Chandalar Copper Belt: unpublished report 79-21 for Doyon Ltd., p. 1-35. [available from Doyon Ltd., Fairbanks, Alaska]

____1980, 1979 Annual progress report, Block 5- Wiseman Chandalar Copper Belt: unpublished report 80-06 for Doyon Ltd., 28 p. [available from Doyon Ltd., Fairbanks, Alaska]

Ventures Resource Corporation, 1999, 1999 Annual report: Ventures Resource Corporation, 36 p.

Property Summary

Name(s): Sheep Creek - Robert Creek tributary

Map No: C15
MAS No: 0020310045
Alaska Kardex 031-038
ARDF CH058

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar C-5
NW¼ sec. 30, T. 33 N., R. 7 W.
Meridian: Fairbanks
Elevation: 2,780 feet
Latitude: 67° 39.512' N.
Longitude: 149° 14.114' W.
Geographic: On a tributary that drains from Evelyn Lee to Sheep Creek. The site is on Doyon Ltd. land.

History:

~1909 - Prospects discovered on Sheep Creek, particularly where the schist underlying the massive limestone is exposed (Maddren 1910).

1957 - Some placer mining reported (Heiner and Wolf, 1968).

Production: No recorded production.

Workings and Facilities: No observed workings.

Geologic Setting:

Bedrock along lower Sheep Creek consists of Devonian granite and granodiorite gneiss and middle Ordivician marble (Dillon and others, 1996). Garnet-epidote skarn with massive sulfides are located on the Evelyn Lee prospect (map no. C14), immediately west of the Sheep Creek placer occurrence.

Bureau Investigation:

Several miles of Sheep Creek were traversed. The creek has a gentle gradient and is approximately 40 feet wide at the mouth. The drainage area is large (at least 20 square miles). Observed float includes schist, marble, and meta-intrusive.

Stream sediment, pan concentrate, and rock samples were collected on Sheep Creek. A pan concentrate sample collected from bedrock just above the mouth (11224, table C-1) contained 678 ppb gold and 130 ppm arsenic. What was thought to be a very fine gold piece was observed in the pan, as well as abundant pyrite and magnetite.

A stream sediment and a pan concentrate (11727-11728) were also collected from the unnamed tributary adjacent to Evelyn Lee, approximately 2 miles upstream from the mouth of Sheep Creek. The pan was collected from a bedrock plunge pool. Moderate amounts of pyrite were observed in the pan, but no visible gold. Both samples were anomalous in gold with 111 ppb and 2,795 ppb, respectively.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential exists at Sheep Creek - Robert tributary. The placer gold occurrence drains a highly mineralized area and several gold anomalies have been found on and near the site; however, the sample results do not suggest an economically viable amount of gold could be mined.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N.,1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 61.

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Heiner, L.E., and Wolff, E.N., 1968, Final report, mineral resources of northern Alaska: Mineral Industry Research Laboratory, University of Alaska, Report 16, p. 51.

Maddren, A.G., 1910, The Koyukuk-Chandalar Gold Region. Chapter in Mineral Resources of Alaska, Report on Progress of Investigations in 1909: U.S. Geological Survey Bulletin 442, p. 310.

____1913, The Koyukuk-Chandalar region, Alaska: U.S. Geological Survey Bulletin 532, p. 105.

Maddren, A.G., 1910, The Koyukuk-Chandalar gold region *in* Brooks, A.E., Mineral resources of Alaska, report on progress of investigations in 1909: U.S. Geological Survey Bulletin 442, p. 310.

____1913, The Koyukuk-Chandalar region, Alaska: U.S. Geological Survey Bulletin 532, p. 105.

Mulligan, J.J., 1974, Mineral resources of the Trans-Alaska Pipeline corridor: U.S. Bureau of Mines Information Circular 8626, p. 16.

Property Summary

Name(s): Horace Mountain

Map No: C16
MAS No: 0020310141

Deposit Type: Meta-intrusive

Commodities: Cu, Ag, Au(?), Pb, Zn

Location:

Quadrangle: Chandalar C-5
S½ sec. 29, T. 33 N., R. 7 W.
Meridian: Fairbanks
Elevation: 3,060 feet
Latitude: 67° 39.174' N.
Longitude: 149° 10.663' W.
Geographic: Located on the southwestern flank of Horace Mountain, north of the confluence of Robert and Sheep Creeks. The site is on Doyon Ltd. land.

History:

1983 - Nicol (1983) identified a color and geochemical anomaly on the southwestern flank of Horace Mountain.

1990s - Central Alaska Gold Company (1992) collected stream sediment and rock samples at Horace Mountain that contained anomalous amounts of gold and base metals.

Production: None.

Workings and Facilities: None.

Geologic Setting:

Horace Mountain is located at the southwestern portion of the Chandalar copper belt. The belt is composed of porphyry and skarn occurrences along a 15-mile-long, northeastern trend. The plutons are relatively small (0.5 to 7 square miles) and outcrop adjacent to many known skarns, north of Bettles River. The plutons are characterized as Early Devonian, metaluminous granite gneiss and hornblende granodiorite gneiss. Alteration of the plutons includes widespread, weak to pervasive sericitic zones and Cu-Mo mineralization. Schistosity is well developed along the margins of the plutons, and bodies more than half a mile thick can exhibit continuous schistose fabric. Distinguishing these rocks from metavolcanic rocks is difficult in some locations. Although bedrock at Horace Mountain is mostly granite gneiss, chlorite calcareous schist, felsic schist, and thinly bedded marble also outcrop along a northeastern trend on the south-facing slopes (Newberry and others, 1986; Dillon, 1989; Dillon and others, 1996).

Nicol (1983) reported a red color anomaly along the southwest flank of Horace Mountain. It was interpreted as a narrow shear zone in the intrusive. A stream sediment sample collected from the area was anomalous in copper and zinc. A pan concentrate from the same site contained 470 ppb gold. The area was briefly investigated; however, no mineralized float was observed.

Central Alaska Gold Company (1992) collected float samples of highly altered intrusive similar to those found at the Venus Prospect (map no. C13). The samples contained ductilely folded mineralized quartz bands and were anomalous in gold, silver, copper, lead, zinc, arsenic, and antimony. They concluded more work is needed in the area.

Bureau Investigation:

Conspicuous red-yellow staining on the west and east flanks of Horace Mountain were investigated. Quartz-sericite schist was observed on both flanks at 3,500 feet elevation between calcareous schist and meta-intrusive outcrops. The quartz-sericite schist contains zones of 2-5% pyrite and has abundant red-yellow limonite staining. The unit strikes roughly northeast and dips to the west. The schist extends for at least 0.6 mile along strike in one location and probably outcrops discontinuously along the entire southern face of Horace Mountain. The unit is believed to be a highly altered version of the meta-intrusive.

On the west flank, below peak 5440, an outcrop sample of muscovite-quartz-sericite schist with 4% pyrite and minor arsenopyrite (12349) and a similar float sample of siliceous mica schist (12350) average 127.5 ppb gold, 15.7 ppm silver, 1,119 ppm copper, 510 ppm lead, 291 ppm zinc, and 1.16% arsenic.

On the eastern flank, below peak 5192, a 75- to 100-foot-thick outcrop of sericite-quartz schist contains zones of pyrite up to 1-foot thick. The schist strikes northeast and dips 35° W. Select outcrop samples with 2-5% pyrite (12480-12481) contain up to 62 ppb gold, 1.4 ppm silver, 116 ppm molybdenum, and 134 ppm arsenic.

Resource Estimate: None.

Mineral Development Potential:

Moderate mineral development potential for gold and base metals exists at Horace Mountain. Several anomalous samples of quartz-sericite schist indicate the possibility of mineralized zones within the meta-intrusive.

Recommendations:

Conduct rigorous stream sediment, pan concentrate, and rock sampling around Horace Mountain in order to define and delineate mineralized areas.

References:

Brosge, W.P., and Reiser, H.N.,1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Central Alaska Gold Company, 1990, 1989 Annual report to Doyon Ltd., Alaska field operations, v. I: unpublished report 90-06A for Doyon Ltd. [available from Doyon Ltd., Fairbanks, Alaska]

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Newberry, R.J., Allegro, G.L., Cutler, S.E., Hagen-Levelle, D.D., Adams, D.D., Nicholson, L.C., Weglarz, T.B., Bakke, A.A., Clautice, K.H., Coulter, G.A., Ford, M.J., Myers, G.L., and Szumigala, D.J., 1997, Skarn deposits of Alaska, *in* Goldfarb, R.J., and Miller, L.D., eds., Mineral deposits of Alaska: Economic Geology Monograph 9, 482 p.

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Nicol, D. L., 1983, Evaluation of the mineral potential of Doyon Ltd.'s Blocks 5 and 22: unpublished report 83-04, 78 p. [available from Doyon Ltd., Fairbanks, Alaska]

Property Summary

Name(s): Ginger
Middle Sheep Creek

Map No: C17
MAS No: 0020310059
Alaksa Kardex 031-053G
ARDF CH060

Deposit Type: Skarn

Commodities: Au, Cu, Ag

Location:

Quadrangle: Chandalar C-5
SW¼ sec. 1, T. 33 N., R. 8 W.
Meridian: Fairbanks
Elevation: 4,300 feet
Latitude: 67° 42.571' N.
Longitude: 149° 16.265' W.
Geographic: Located on the western ridge of Sheep Creek, approximately 0.5 miles southeast of peak 5147. The site is on Doyon Ltd. land.

History:

1967-70 - Bear Creek Mining Company (BCMC) initiated investigation and staked 8 claims at Ginger and other sites in the area, which was collectively designated the "Chandalar copper belt" (WGM Inc., 1979).

1970-80s - WGM Inc. (1980) made detailed investigation of Ginger and other Chandalar copper belt sites

Production: None.

Workings and Facilities: None.

Geologic Setting:

Ginger is a skarn occurrence in the middle of the Chandalar copper belt. The belt is composed of porphyry and skarn along a 15-mile-long, northeastern trend. The skarns exhibit both prograde and retrograde mineral assemblages. They also exhibit what appears to be regional zoning: Cu-Ag skarns occur along the southern portion of the belt, and Pb-Zn-Ag mineralization is common in the north. The plutonic rocks within the belt are characterized as relatively small (0.5 to 7 square miles), Early Devonian, metaluminous granite gneiss and hornblende granodiorite gneiss of the Horace Mountain plutons. Alteration of the plutons includes widespread, weak to pervasive sericitic zones. Schistosity is well developed along the margins of the plutons, and bodies more than half a mile thick can exhibit continuous schistose fabric. Distinguishing these rocks from metavolcanic rocks is difficult in some locations (Newberry and others, 1986; Dillon, 1989; Dillon and others, 1996).

Ginger lies at the end of a 1.2-mile-long zone of calc-silicate rocks. Bedrock is Devonian Skajit Limestone that structurally overlies Ordovician phyllite, marble, and calcareous schist. Skarn and intrusive rocks are mapped locally along a northeast trend (Dillon and others, 1996).

Nicol (1983) reported pyrite and chalcopyrite pods associated with epidote-calc-silicate rock. Quartz-sericite schist is a minor unit at Ginger and did not host sulfides. He also noted a narrow zone of hornblende-rich intrusive - possibly a dike formation.

Bureau Investigation:

Skarn outcrops discontinuously along the ridge between peaks 4109 and 5147. The Ginger site includes a 1,000- by 3,000-foot area of skarn located about 2,000 feet southeast of peak 5147. The skarn contains small zones (up to 50 by 100 feet) of rubblecrop and float with chalcopyrite, pyrite, and malachite staining. Eight samples of skarn and calc-silicate rocks average 1.8% copper and 12.2 ppm silver (table C-1). Three of the samples (8041, 11251, 11751) are anomalous in gold, ranging from 548 ppb to 1,201 ppb.

Gray chlorite phyllite and tan quartz-sericite schist outcrop adjacent to the skarn. Small amounts of disseminated pyrite and chalcopyrite were observed in the quartz-sericite schist. Three samples averaged 5,467 ppm copper and 3.3 ppm silver.

Under a west-facing cliff, a 10-foot-thick diabase sill is exposed for 50 feet along strike. The sill strikes N. 15° W. and dips 20° E. It appears to have been injected within a limestone bed; it is abruptly terminated by a nearly vertical fault that strikes N. 75° W. An outcrop sample of the diabase (11047) does not contain any significant results, but the unit could be responsible for a magnetic anomaly in the area (Sial Geosciences Inc., and On-Line Exploration Services Inc., 1998a, 1998b).

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential: the site contains strongly anomalous assay results for gold, silver, and copper; however, the mineralization appears to be relatively small in extent.

Recommendations: Anomalous gold assay values in skarn samples should be investigated further.

References:

Brosge, W.P., and Reiser, H.N.,1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 29.

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Dillon, J.T., 1989, Structure and Stratigraphy of the southern Brooks Range and Northern Koyukuk basin near the Dalton Highway *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 2, p. 157-187.

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Grybeck, D., 1977, Known mineral deposits of the Brooks Range, Alaska: U.S. Geological Survey Open-File Report 77-166C, p. 35.

Newberry, R.J., Allegro, G.L., Cutler, S.E., Hagen-Levelle, D.D., Adams, D.D., Nicholson, L.C., Weglarz, T.B., Bakke, A.A., Clautice, K.H., Coulter, G.A., Ford, M.J., Myers, G.L., and Szumigala, D.J., 1997, Skarn deposits of Alaska, *in* Goldfarb, R.J., and Miller, L.D., eds., Mineral deposits of Alaska: Economic Geology Monograph 9, 482 p.

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Sial Geosciences Inc., and On-Line Exploration Services Inc., 1998a, Project report for the airborne geophysical survey for the northeastern portion of the Koyukuk Mining District eastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Public Data File 98-25, 139 p. and two maps.

____1998b, Total field magnetics for the northeast portion of the Koyukuk Mining District, eastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys RI 98-8.

WGM Inc., 1979, 1978 Doyon Ltd. annual progress report, Block 5 Luna volcanogenic massive sulfide and associated base-metal deposits and anomalies of the Chandalar Copper Belt: unpublished report 79-21 for Doyon Ltd., p. 1-35. [available from Doyon Ltd., Fairbanks, Alaska]

____1980, 1979 Annual progress report, Block 5- Wiseman Chandalar Copper Belt: unpublished report 80-06 for Doyon Ltd., 28 p. [available from Doyon Ltd., Fairbanks, Alaska]

Property Summary

Name(s): Deimos
Demos

Map No: C18
MAS No: 0020310142
Alaksa Kardex 031-053x
ARDF CH061

Deposit Type: Skarn

Commodities: Cu, Ag, Au(?)

Location:

Quadrangle: Chandalar C-5
SW¼ sec. 31, T. 34 N., R. 7 W.
Meridian: Fairbanks
Elevation: 3,800 feet
Latitude: 67° 43.624' N.
Longitude: 149° 13.864' W.
Geographic: Located 1.25 miles east of peak 6031, between Ginger (map no. C17) and Hurricane (map no. C19). The site is located on Doyon Ltd. land.

History:

1967-70 - Bear Creek Mining Company (BCMC) initiated investigation and staked many sites in the area, which was collectively designated the "Chandalar copper belt" (WGM Inc., 1978).

1970-80s - WGM Inc. (1980) conducted soil sampling, mapping, and geophysical surveys at Deimos.

Production: None.

Workings and Facilities: None.

Geologic Setting:

Deimos is a skarn occurrence in the middle of the Chandalar copper belt. The belt is composed of porphyry and skarn along a 15-mile-long, northeastern trend. The skarns exhibit both prograde and retrograde mineral assemblages. They also exhibit what appears to be regional zoning: Cu-Ag skarns occur along the southern portion of the belt, and Pb-Zn-Ag mineralization is common in the north. The plutonic rocks within the belt are characterized as relatively small (0.5 to 7 square miles), Early Devonian, metaluminous granite gneiss and hornblende granodiorite gneiss of the Horace Mountain plutons (Newberry and others, 1986; Dillon, 1989; Dillon and others, 1996).

Bedrock at Deimos consists of Devonian Skajit Limestone that structurally overlies Ordovician phyllite, marble, and calcareous schist. Felsic schist, skarn, and intrusive rocks are mapped locally along a northeast trend (Dillon and others, 1996).

Nicol (1983) reported a 50- by 100-foot area of skarn outcrop with pyrite, chalcopyrite, and occasional massive magnetite. The skarn is cut with quartz veins and contains iron-oxide- and malachite-staining. One sample of skarn with 10% pyrite and chalcopyrite contained 1 ppm gold, 46 ppm silver, and 2.64% copper. Most samples at Deimos, however, were in the range of 0.5% to 0.9% copper, and no other samples contained significant gold. Results of the soil sampling and geophysical survey indicate that the extent of mineralization was not any bigger than could be seen at the surface.

Bureau Investigation:

Approximately 1.5 miles of the area were examined. Rubblecrop of quartz-sericite schist weathering to whitish tan occurs on the south side of the east-flowing tributary that drains peak 6031. Pyrite was observed in some of the schist, but a sample (11204) did not contain anomalous metal values. An area that is similar to the skarn described by Nicol (1983) occurs on the north side of the tributary. The skarn outcrops along a 100-foot-long northeast trend. A select outcrop sample (11243, table C-1) contained 3,871 ppm copper, 4 ppm silver, and 56 ppb gold.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential for lode copper, silver, and gold. Although the skarn contains anomalous metal values, data suggest the mineralized area is limited to approximately 50 by 100 feet of outcrop on the surface.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N.,1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

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Dashevsky, S.S., 1986, Mines, prospects, and geochemical anomalies on Doyon Ltd. regional overselection lands Alaska, Blocks 1 - 8, v. I of II: unpublished report 86-01A for Doyon Ltd., v. 1, 42 p. [available from Doyon Ltd., Fairbanks, Alaska]

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Dillon, J.T., 1989, Structure and Stratigraphy of the southern Brooks Range and Northern Koyukuk basin near the Dalton Highway *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 2, p. 157-187.

Dillon, J.T., Reifenstuhl, R.R., and Harris, G.W., 1996, Geologic map of the Chandalar C-5 quadrangle, southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 104, 2 sheets, scale 1:63,360.

Grybeck, D., 1977, Known mineral deposits of the Brooks Range, Alaska: U.S. Geological Survey Open-File Report 77-166C, p. 35.

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WGM Inc., 1979, 1978 Doyon Ltd. annual progress report, Block 5 Luna volcanogenic massive sulfide and associated base-metal deposits and anomalies of the Chandalar Copper Belt: unpublished report 79-21 for Doyon Ltd., p. 1-35. [available from Doyon Ltd., Fairbanks, Alaska]

____1980, 1979 Annual progress report, Block 5- Wiseman Chandalar Copper Belt: unpublished report 80-06 for Doyon Ltd., 28 p. [available from Doyon Ltd., Fairbanks, Alaska]

Property Summary

Name(s): Hurricane-Diane
Upper Sheep Creek

Map No: C19
MAS No: 0020310058
Alaska Kardex 031-053F
ARDF CH062

Deposit Type: Skarn

Commodities: Au, Cu, Ag

Location:

Quadrangle: Chandalar C-5
N½ sec. 32, T. 34 N., R. 7 W.
Meridian: Fairbanks
Elevation: 4,500 feet
Latitude: 67° 44.007' N.
Longitude: 149° 10.952' W.
Geographic: Located about 1.5 miles southeast of peak 5105, between Robert Creek and the headwaters of Sheep Creek. The site is on Doyon Ltd. land.

History:

1967-70 - Bear Creek Mining Company (BCMC) initiated investigation and staked about 20 claims at Hurricane-Diane and other sites in the area, which was collectively designated the "Chandalar copper belt" (Grybeck, 1977; WGM Inc., 1979).

1970-80s - WGM Inc. made detailed investigation of Deimos.

Production: None.

Workings and Facilities:

WGM Inc. (1979) reported that soil sampling was conducted by BCMC, but no evidence was observed.

Geologic Setting:

Hurricane-Diane is a skarn occurrence in the middle of the Chandalar copper belt. The belt is comprised of porphyry and skarn along a 15-mile-long, northeastern trend. The skarns exhibit both prograde and retrograde mineral assemblages. They also exhibit what appears to be regional zoning: Cu-Ag skarns occur along the southern portion of the belt, and Pb-Zn-Ag mineralization is common in the north. The plutonic rocks within the belt are characterized as relatively small (0.5 to 7 square miles), Early Devonian, metaluminous granite gneiss and hornblende granodiorite gneiss of the Horace Mountain plutons. Alteration of the plutons includes widespread, weak to pervasive sericitic zones. Schistosity is well developed along the margins of the plutons, and bodies more than half a mile thick can exhibit continuous schistose fabric. Distinguishing these rocks from metavolcanic rocks is difficult in some locations (Newberry and others, 1986; Dillon, 1989; Dillon and others, 1996).

Bedrock at the Ginger occurrence is Devonian Skajit Limestone and Ordovician phyllite, marble, and calcareous schist. Skarn and meta-intrusive rocks are mapped locally (Brosge and Reiser, 1964; Dillon and others, 1996).

WGM Inc. (1979) reported that soil sampling was conducted by BCMC, and a large soil anomaly was identified. The anomaly is about 10,000 feet long by 500 feet wide and contains copper values that range from 1,000 ppm to over 20,000 ppm. WGM Inc. (1979) felt that this could suggest more or less continuous mineralized horizon(s) under the tundra/soil cover.

Nicol (1983) reported epidote calc-silicate outcrop with several percent of pyrite, pyrrhotite, and chalcopyrite. Two 3- to 5-foot-wide mineralized zones were observed. Samples contained up to 930 ppb gold, 8.3 ppm silver, 3.76% copper, 187 ppm zinc, and 200 ppm arsenic.

Bureau Investigation:

Tundra covers much of the area that surrounds Hurricane-Diane. Resistant skarn knobs outcrop along a northeastern trend, forming discontinuous exposure approximately 1.5 miles long by 40 feet wide. The skarn contained variable amounts of garnet, epidote, pyrite, chalcopyrite, pyrrhotite, and magnetite. Six skarn samples collected at the site average 2.54% copper and 20.15 ppm silver (table C-1). Also, two chip samples (11748-11749) were anomalous in gold, averaging 1,286 ppb gold. Unfortunately, samples anomalous in gold did not have a unique mineralogy that would differentiate them from other mineralized skarn samples.

At the southwest portion of the site, quartz-sericite schist contacted the skarn. A sample of the schist (11658) contained 1.3% copper and 19.7 ppm silver. The schist is a minor unit at Hurricane-Diane.

Resource Estimate: None.

Mineral Development Potential:

Low to moderate mineral development potential: the site contains anomalous assay results for gold, silver, and copper; however, the mineralization appears to be relatively limited in extent.

Recommendations: Anomalous gold assay values found in skarn samples should be investigated further.

References:

Brosge, W.P., and Reiser, H.N.,1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

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Dillon, J.T., Reifenstuhl, R.R., and Harris, G.W., 1996, Geologic map of the Chandalar C-5 quadrangle, southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 104, 2 sheets, scale 1:63,360.

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Newberry, R.J., Dillon, J.T., and Adams, D.D., 1986, Regionally metamorphosed, calc-silicate-host deposits of the Brooks Range, northern Alaska: Economic Geology, v. 81, p. 1728-1752.

Nicol, D. L., 1983, Evaluation of the mineral potential of Doyon Ltd.'s Blocks 5 and 22: unpublished report 83-04, 78 p. [available from Doyon Ltd., Fairbanks, Alaska]

WGM Inc., 1978, 1977 Annual progress report, Doyon Ltd. project, v. II, Luna area: unpublished report 78-04 for Doyon Ltd., 15 p. [available from Doyon Ltd., Fairbanks, Alaska]

____1979, 1978 Doyon Ltd. annual progress report, Block 5 Luna volcanogenic massive sulfide and associated base-metal deposits and anomalies of the Chandalar Copper Belt: unpublished report 79-21 for Doyon Ltd., p. 1-35. [available from Doyon Ltd., Fairbanks, Alaska]

____1980, 1979 Annual progress report, Block 5- Wiseman Chandalar Copper Belt: unpublished report 80-06 for Doyon Ltd., 28 p. [available from Doyon Ltd., Fairbanks, Alaska]

Property Summary

Name(s): Luna Prospect

Map No: C20
MAS No: 0020310109
Alaska Kardex 031-105
Alaska Kardex 031-053
ARDF CH101

Deposit Type: Skarn

Commodities: Au, Ag, Cu, Zn

Location:
Quadrangle: Chandalar D-5
NW¼ sec. 20, T. 34 N., R. 7 W.
Meridian: Fairbanks
Elevation: 4,460 feet
Latitude: 67° 45.625' N.
Longitude: 149° 09.859' W.
Geographic: Located at the western headwaters of Robert Creek, approximately 2 miles east of peak 6270. The site is on Doyon Ltd. land.

History:

1968 - Luna discovered by Bear Creek Mining Company (BCMC).

1969-73 - BCMC initiated investigation and staked claims at Luna and other sites to the south, which was collectively designated the "Chandalar copper belt." Activities included detailed geologic mapping; soil and rock sampling; blasting and trenching; IP and magnetic geophysical surveying; and general prospecting (WGM Inc., 1979).

1973 - BCMC optioned its claims to Midwest Oil Company, a subsidiary of AMOCO. WGM Inc. supervised subsequent mapping and core drilling. The targets consisted of low-grade, bulk tonnage copper in altered intrusive rock and high-grade copper in adjacent calc-silicate rocks (WGM Inc., 1980).

1977 - WGM Inc. staked 32 lode claims at Luna and collected samples (Kardex).

1978-79 - WGM Inc. mapped the area and conducted detailed magnetometer and scintillometer surveys. They also diamond core drilled 5 locations, totaling 1,500 feet (WGM Inc., 1980).

1981 - Arctic Resources Inc. examined area, concluding further work should be done (Nicol, 1983).

1997 - Ventures Resource Alaska conducted investigation at Luna (Swainbank and others, 1997).

Production: None.

Workings and Facilities:

Remnants of a base camp are located near the confluence of Robert and Luna Creeks. Drill pads are also visible on several ridge locations above Luna and South Creeks.

Geologic Setting:

Luna is located near the northeastern corner of the Chandalar copper belt. The belt is composed of porphyry and skarn along a 15-mile-long, northeastern trend. The skarns exhibit both prograde and retrograde mineral assemblages. They also exhibit what appears to be regional zoning: Cu-Ag skarns occur along the southern portion of the belt, and Pb-Zn-Ag mineralization is common in the north. The plutonic rocks within the belt are characterized as relatively small (0.5 to 7 square miles), Early Devonian, metaluminous granite gneiss and hornblende granodiorite gneiss of the Horace Mountain plutons. Alteration of the plutons includes widespread, weak to pervasive sericitic zones. Schistosity is well developed along the margins of the plutons, and bodies more than half a mile thick can exhibit continuous schistose fabric. Distinguishing these rocks from metavolcanic rocks is difficult in some locations (Newberry and others, 1986; Dillon, 1989; Dillon and others, 1996).

Bedrock at Luna consists of interbedded schists, marble, meta-intrusive, and skarns that directly underlie the Skajit formation. A unit of quartz-sericite schist occurs in lesser amounts than the other units, and is thought to represent a highly sheared margin of the meta-intrusive. Mapping indicates at least two episodes of folding and high-angle thrust faulting at the site (WGM Inc., 1980). Massive, stringer, and disseminated sulfides are found in calc-silicate rocks and schist. Sulfides consist of pyrite, pyrrhotite, chalcopyrite, and sphalerite. The sulfides often occur with magnetite, as seen at Venus (map no. C13). However, the presence of sphalerite in addition to the other minerals differentiates Luna from other Chandalar copper belt prospects.

Because Luna exhibits different mineralogy than other Chandalar skarn occurrences, it has been interpreted by some to be a volcanogenic massive sulfide deposit (figure C-4) (Nicol, 1983; Nicholson, 1990; Ventures Resource Corporation, 1999).

Extensive soil and rock sampling have been conducted at Luna by WGM Inc. In 1978, five coreholes (DDH-1 to DDH-5) were drilled within a 1-mile radius of the confluence of Luna and Roberts Creeks. These cores intercepted zones of massive sulfides. DDH-1 intercepted a 6.1-foot interval (from 173.7 to 179.8 feet below ground surface) that contained 6.3% copper, 0.5% zinc, and 1.0 oz/ton silver. DDH-5 was drilled at the same location, at 60° from horizontal. A 2.2-foot interval (from 148.8 to 151.0 feet of the core) contained 1.9% copper and 1.0% zinc. Finally, hole DDH-3 intercepted a 3.6-foot interval (from 135.0 to 138.6 feet below ground surface) that contained 2.0% copper and 7.0% zinc (WGM Inc., 1979).

A hand specimen of skarn with garnet, pyroxene, epidote, actinolite, chalcopyrite, pyrite, sphalerite, and magnetite contained 6.3% copper, 0.57% zinc, and 32 ppm silver (Newberry and others, 1986). Ventures Resource Alaska reported anomalous copper values (3 plus percent) over widths of 20 to 30 feet (Swainbank and others, 1997).

Bureau Investigation:

Sulfide-bearing quartz-sericite schist float with sphalerite, chalcopyrite, and pyrite was found near DDH-3, which reportedly marks the southern extent of the mineralization (Nicholson, 1990, p. 78). Samples contain up to 1,129 ppb gold, 98.4 ppm silver, 10.2% copper, and 8,447 ppm zinc (10698-10700, table C-1). The three schist samples average 689 ppb gold, 54 ppm silver, 5.2% copper, and 5,714 ppm zinc.

Approximately 0.3 mile to the northeast, at a similar elevation, samples of massive sulfide (11756-11757) were collected at a 10- by 100-foot-wide talus field. The site is just uphill of DDH-1 and DDH-5 and is reportedly the northern extent of mineralization (Nicholson, 1990, p. 78). The two samples average 811 ppb gold, 46.1 ppm silver, 5.6% copper, and 15.0% zinc.

A third site, 0.3 mile northwest of DDH-3, contains schist and massive sulfides in outcrop. Two samples were collected. A pyrite-rich massive sulfide (11754) collected from adjacent rubblecrop contain 141 ppb gold, 24.9 ppm silver, and 5.3% copper.

The samples collected at Luna also contain elevated concentrations of gold, cobalt, cadmium, arsenic, and mercury. The gold values for all rock samples range from 13 ppb to 1,402 ppb. Samples of schist and massive sulfide rocks contain the highest gold results; however, no unique mineralogy appeared to differentiate these anomalous samples from others.

Resource Estimate:

Nicholson (1990, p. 78-79) used two different models to estimate the resources at the Luna Prospect. Assuming a strike length of 350 meters (distance between DDH-1 and DDH-3) and a depth of 175 meters (half the strike length), the resources tonnage was estimated to be 1.8 million tons. A second model, which used more conservative dimensions, produced an estimate of 70,000 tons of resource. The average grades for the estimates are 0.9% copper, 0.03% zinc, and 0.25 oz/ton (8 ppm) silver.

Mineral Development Potential:

Moderate mineral development potential exists at Luna for base metals and gold. The massive sulfides are high grade (up to 10% copper, 98.4 ppm silver, and 29.9% zinc); however, more sampling is needed on the extent of the mineralization. Gold anomalies remain unexplained.

Recommendations:

Several gold anomalies (up to 1,402 ppb gold) in schist and massive sulfide samples have not been thoroughly investigated. Attempts should be made to find the source of the gold mineralization.

A coincident IP, EM, and magnetic anomaly near the valley bottom remains unexplained and could be followed up (Dashevsky, 1986).

References:

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Brosge, W.P., and Reiser, H.N.,1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

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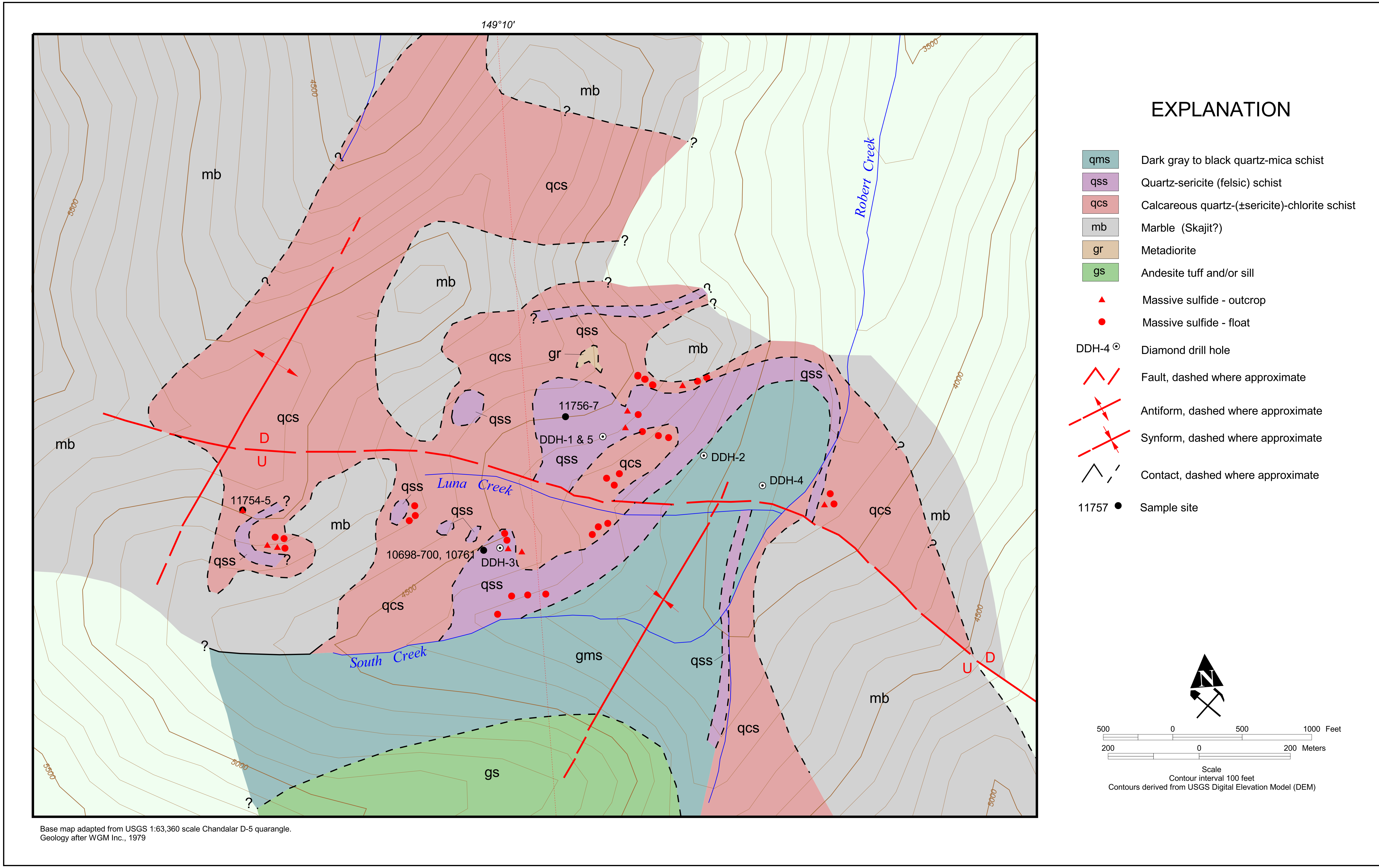

Base map adapted from USGS 1:63,360 scale Chandalar D-5 quarangle.
Geology after WGM Inc., 1979

Figure C-4. Geology and sample loaction map for the Luna prospect.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

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Nicholson, L., 1990, Porphyry copper, copper skarn and volcanogenic massive sulfide occurrences in the Chandalar copper district, Alaska: University of Alaska Fairbanks, Masters thesis, 96 p.

Nicol, D. L., 1983, Evaluation of the mineral potential of Doyon Ltd.'s Blocks 5 and 22: unpublished report 83-04, 78 p. [available from Doyon Ltd., Fairbanks, Alaska]

Swainbank, R.C., Clautice, K.H., and Nauman, J.L., 1998, Alaska's mineral industry 1997: Alaska Division of Geological and Geophysical Surveys Special Report 52, p. 6.

WGM Inc., 1978, 1977 Annual progress report, Doyon Ltd. project, v. II, Luna area: unpublished report 78-04 for Doyon Ltd., 15 p. [available from Doyon Ltd., Fairbanks, Alaska]

____1979, 1978 Doyon Ltd. annual progress report, Block 5 Luna volcanogenic massive sulfide and associated base-metal deposits and anomalies of the Chandalar Copper Belt: unpublished report 79-21 for Doyon Ltd., p. 1-35. [available from Doyon Ltd., Fairbanks, Alaska]

____1980b, 1979 Annual progress report, Block 5- Wiseman Chandalar Copper Belt: unpublished report 80-06 for Doyon Ltd., 28 p. [available from Doyon Ltd., Fairbanks, Alaska]

Ventures Resource Corporation, 1999, 1999 Annual report: Ventures Resource Corporation, 36 p.

Property Summary

Name(s): Mike

Map No: C21
MAS No: 0020310101
Alaska Kardex 031-059
ARDF CH100

Deposit Type: Skarn

Commodities: Cu

Location:

Quadrangle: Chandalar D-5
SE¼ sec. 14, T. 34 N., R. 7 W.
Meridian: Fairbanks
Elevation: 4,290 feet
Latitude: 67° 46.304' N.
Longitude: 149° 03.064' W.
Geographic: Located approximately 0.5 mile east of Robert Creek and 1.5 miles northwest of the Pilgrim occurrence (map no. C22). The site is on Doyon Ltd. land.

History:

1972-77 - Placid Oil Company staked 5 lode claims at the site and a total of 239 in the area (Kardex).

Production: None.

Workings and Facilities: None.

Geologic Setting:

Mike is located in the northeastern corner of the Chandalar copper belt. The belt is composed of porphyry and skarn occurrences along a 15-mile-long, northeastern trend. The skarns exhibit both prograde and retrograde mineral assemblages. They also exhibit what appears to be regional zoning: Cu-Ag skarns occur along the southern portion of the belt, and Pb-Zn-Ag mineralization is common in the north. The plutonic rocks within the belt are characterized as relatively small (0.5 to 7 square miles), Early Devonian, metaluminous granite gneiss and hornblende granodiorite gneiss of the Horace Mountain plutons (Newberry and others, 1986; Dillon, 1989; Dillon and others, 1996).

Bedrock at the Mike occurrence is predominantly Devonian calcareous schist and marble in thrust contact with Devonian Hunt Fork Shale, Skajit Limestone, and greenschist (Brosge and Reiser, 1964; DeYoung, 1978).

Bureau Investigation:

The Mike occurrence consists of a 20- by 50-foot area of quartz epidote skarn outcrop. Pyrite was the only sulfide observed at the site. A select sample (11769, table C-1) contained 29 ppb gold, 0.8 ppm silver, and 167 ppm copper. These values are considered only slightly anomalous.

The BLM investigated a 1.5-mile long area between the Mike and Pilgrim occurrences. They observed little outcrop exposure between the sites and no skarn.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential because no copper minerals were observed and the samples contained low metal values.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N.,1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Dillon, J.T., 1989, Structure and Stratigraphy of the southern Brooks Range and Northern Koyukuk basin near the Dalton Highway *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of eastern Koyukuk basin, central Brooks Range, and eastcentral Arctic Slope: Alaska Division of Geological and Geophysical Surveys Guidebook 7, v. 2, p. 157-187.

Newberry, R.J., Allegro, G.L., Cutler, S.E., Hagen-Levelle, D.D., Adams, D.D., Nicholson, L.C., Weglarz, T.B., Bakke, A.A., Claútice, K.H., Coulter, G.A., Ford, M.J., Myers, G.L., and Szumigala, D.J., 1997, Skarn deposits of Alaska, *in* Goldfarb, R.J., and Miller, L.D., eds., Mineral deposits of Alaska: Economic Geology Monograph 9, 482 p.

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Property Summary

Name(s): Pilgrim

Map No: C22
MAS No: 0020310143
Alaska Kardex 031-059
ARDF CH099

Deposit Type: Skarn

Commodities: Cu, Ag(?)

Location:

Quadrangle: Chandalar D-5
SE¼ sec. 24, T. 34 N., R. 7 W.
Meridian: Fairbanks
Elevation: 5,090 feet
Latitude: 67° 45.310' N.
Longitude: 149° 01.053' W.
Geographic: Located approximately 1.5 miles east of Robert Creek, at peak 5150. The site is on Doyon Ltd. land.

History:

1972-77 - Placid Oil Company staked 5 lode claims at the site and a total of 239 in the area (Kardex).

Production: None.

Workings and Facilities: None.

Geologic Setting:

Pilgrim is located in the northeastern corner of the Chandalar copper belt. The belt is composed of porphyry and skarn occurrences along a 15-mile-long, northeastern trend. The skarns exhibit both prograde and retrograde mineral assemblages. They also exhibit what appears to be regional zoning: Cu-Ag skarns occur along the southern portion of the belt, and Pb-Zn-Ag mineralization is common in the north. The plutonic rocks within the belt are characterized as relatively small (0.5 to 7 square miles), Early Devonian, metaluminous granite gneiss and hornblende granodiorite gneiss of the Horace Mountain plutons. Alteration of the plutons includes widespread, weak to pervasive sericitic zones. Schistosity is well developed along the margins of the plutons, and bodies more than half a mile thick can exhibit continuous schistose fabric. Distinguishing these rocks from metavolcanic rocks is difficult in some locations (Newberry and others, 1986; Dillon, 1989; Dillon and others, 1996).

Bedrock at the Pilgrim occurrence is predominantly early Paleozoic (or older) greenschist, calcareous schist, and marble with smaller amounts of Devonian Hunt Fork Shale and Skajit Limestone. Several thrust faults are mapped near Pilgrim: the early Paleozoic units have been thrust over the Devonian units (Brosge and Reiser, 1964; DeYoung, 1978).

A rock grab sample with garnet, epidote, actinolite, pyrtie, sphalerite, and chalcopyrite assayed 12.4% copper, 0.24% zinc, and 71 ppm silver (Newberry and others, 1986). WGM Inc. (1980) reported locally massive coarse-grained pyrite and chalcopyrite hosted in a quartz-sericite schist and chlorite schist. Grab samples contained up to 3.08% copper.

Bureau Investigation:

Disseminated chalcopyrite and pyrite occur in a steeply dipping sericite-quartz schist. A rubblecrop sample (11768, table C-1) contains 332 ppm copper. Steeply dipping calc-silicate rocks also contain disseminated chalcopyrite and pyrite, but in lesser amounts.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential because no copper minerals were observed and the samples contained low metal values.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N.,1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

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WGM Inc., 1980, 1979 Annual progress report, Block 5- Wiseman Chandalar Copper Belt: unpublished report 80-06 for Doyon Ltd., 28 p. [available from Doyon Ltd., Fairbanks, Alaska]

Property Summary

Name(s): Cindy

Map No: C23
MAS No: 0020310144
Alaska Kardex 031-059
ARDF CH098

Deposit Type: Skarn

Commodities: Au, Ag, Cu, Pb, Zn

Location:

Quadrangle: Chandalar D-4
Center sec. 18, T. 34 N., R. 6 W.
Meridian: Fairbanks
Elevation: 5,100 feet
Latitude: 67° 46.200' N.
Longitude: 148° 59.400' W.
Geographic: Located approximately 2.5 miles east of Robert Creek, and 1.5 miles east of the Mike occurrence (map no. C21). The site is on Doyon Ltd. land.

History:

1972-77 - Placid Oil Company staked 5 lode claims at the site and a total of 239 in the district (Kardex).

Production: None.

Workings and Facilities: None.

Geologic Setting:

Cindy is located in the northeastern corner of the Chandalar copper belt. The belt is comprised of porphyry and skarn occurrences along a 15-mile-long, northeastern trend. The skarns exhibit both prograde and retrograde mineral assemblages. They also exhibit what appears to be regional zoning: Cu-Ag skarns occur along the southern portion of the belt, and Pb-Zn-Ag mineralization is common in the north. The plutonic rocks within the belt are characterized as relatively small (0.5 to 7 square miles), Early Devonian, metaluminous granite gneiss and hornblende granodiorite gneiss of the Horace Mountain plutons. Alteration of the plutons includes widespread, weak to pervasive sericitic zones. Schistosity is well developed along the margins of the plutons, and bodies more than half a mile thick can exhibit continuous schistose fabric. Distinguishing these rocks from metavolcanic rocks is difficult in some locations (Newberry and others, 1986; Dillon, 1989; Dillon and others, 1996).

Bedrock at the Cindy occurrence is predominantly Devonian calcareous schist and marble in thrust contact with Devonian Hunt Fork Shale, Skajit Limestone, and greenschist (Brosge and Reiser, 1964; DeYoung, 1978).

Bureau Investigation:

The BLM investigated 2 miles from peak 5387 south to the Cindy occurrence. Bedrock at peak 5387 is Skajit Limestone. The area to the south is composed of chlorite schist and greenschist. This unit contains crosscutting quartz veinlets with trace amounts of pyrite.

Bedrock at Cindy consisted of silicified marble and minor sericite schist that structurally overlies the greenschist unit. Massive pyrite, galena, and chalcopyrite occur in veins and pods within the silicified marble. Two outcrop samples (12345, 12382, table C-1) averaged 955.5 ppb gold, 48.5 ppm silver, 225 ppm copper, 809.5 ppm lead, and 14,514 ppm arsenic. The sulfides occur within quartz veins and siliceous zones that postdate the emplacement of the marble. These zones appear to be limited to an area of about 500 square feet of outcrop and talus.

A select sample of massive hematite with 5% galena (12383) that was found in float above the other samples contained 144 ppb gold, 151.6 ppm silver, 1,591 ppm copper, 4.24% lead, 21.01% zinc, and 1,038 ppm arsenic.

Resource Estimate: None.

Mineral Development Potential:

Moderate mineral development potential exists at Cindy. Although the area of sulfide mineralization appears small, there are significant gold and base metal anomalies.

Recommendations:

Re-visit site in order to map the extent of sulfide exposure and attempt to find the source for the gold mineralization.

References:

Brosge, W.P., and Reiser, H.N.,1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

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Newberry, R.J., Dillon, J.T., and Adams, D.D., 1986, Regionally metamorphosed, calc-silicate-host deposits of the Brooks Range, northern Alaska: Economic Geology, v. 81, p. 1728-1752.

Property Summary

Name(s): Arsine

Map No: C24
MAS No: 0020310024
Alaska Kardex 031-067
ARDF CH052

Deposit Type: Porphyry

Commodities: Cu, Mo, As

Location:

Quadrangle: Chandalar C-4
SE¼ sec. 21, T. 33 N., R. 5 W.
Meridian: Fairbanks
Elevation: 5,000 feet
Latitude: 67° 39.925' N.
Longitude: 148° 41.436' W.
Geographic: Located on the ridge bounded by Baby, Anderson, and Geroe Creeks, just north of peak 6010.

History:

1964 - Brosge and Reiser (1964) obtain anomalous copper, arsenic, and stibnite values from a stream sediment sample at the headwaters of Geroe Creek.

1975 - Oil Development Company of Texas staked six lode claims and named the site Arsine (Kardex).

Production: No recorded production.

Workings and Facilities: Claim marker found.

Geologic Setting:

The Arsine occurrence is on the margin of a northeast-trending belt of Devonian metaplutonic rocks consist of peraluminous biotite-muscovite granites of the Baby Creek batholith and the Early Devonian metaluminous biotite-hornblende granites and granodiorites of the Horace Mountain plutons (Newberry and others, 1986). Several quartz stockwork and altered zones of the belt have been described. Veinlets in the stockworks are reported to contain disseminated molybdenite, chalcopyrite, and pyrite along with intense quartz-sericite-chlorite plus or minus epidote alteration. Samples from Geroe Creek reportedly contain up to 0.1% molybdenum (Eakins and others, 1983; Nokleberg and others, 1987). The metaplutonic rocks contact Paleozoic calcareous schist and marble along a west-northwest trend at the headwaters of Geroe Creek (Brosge and Reiser, 1964).

Bureau Investigation:

The site is composed of conspicuous iron-oxide-stained granite gneiss, which contained 2% fine-grained disseminated pyrite, pyrrhotite, and magnetite(?). The iron-stained granite gneiss contacts a quartz-mica schist unit along a northeastern trend for approximately 2 miles. Two samples of the bedrock (11881-11882) average 97 ppm copper and 52 ppm arsenic. Neither sample contained detectable gold. A pan concentrate sample collected from the site (11883) contained only 8 ppb gold.

Another area of conspicuous iron-oxide staining situated halfway between Arsine and the Geroe Creek lode (C25) occurrence was investigated. A sample of siliceous meta-intrusive with pyrite and magnetite stringers (11885) contained 138 ppm copper and 135 ppm molybdenum, but no detectable gold or arsenic.

These sites may be metamorphosed porphyry-type deposits in which weak copper-molybdenum mineralization was remobilized during regional metamorphism and concentrated near the sheared margins of the Baby Creek batholith. The alteration zone appears to outcrop discontinuously in the area between Arsine and Geroe Creek lode occurrence (map no. C25). It is similar to the copper-bearing quartz stockwork zones that are described by Newberry (1986) as occurring within in the Horace Mountain plutons and Baby Creek batholith.

Resource Estimate: None

Mineral Development Potential:

Low development mineral development potential due to low values of gold, copper, molybdenum, and arsenic.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N.,1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Dillon, J.T., 1982, Source of lode and placer gold deposits of the Chandalar and upper Koyukuk districts, Alaska: Alaska Division of Geological and Geophysical Surveys Open-File Report 158, 22 p.

Eakins, G.R., Bundtzen, T.K., Robinson, M.S., Clough, J.G., Green, C.B., Clautice, K.H., and Albanese, M.A., 1983, Alaska's mineral industry 1982: Alaska Division of Geological and Geophysical Surveys Special Report 31, p. 41.

Grybeck, D., 1977, Known mineral deposits of the Brooks Range, Alaska: U.S. Geological Survey Open-File Report 77-166C, p. 36.

Newberry, R.J., Dillon, J.T., and Adams, D.D., 1986, Regionally metamorphosed, calc-silicate-host deposits of the Brooks Range, northern Alaska: Economic Geology, v. 81, p. 1728-1752.

Nokleberg, W.J., Bundtzen, T.K., Berg, H.C., Brew, D.A., Grybeck, D., Robinson, M.S., Smith, T.E., and Yeend, W., 1987, Significant metalliferous lode deposits and placer districts in Alaska: U.S. Geological Survey Bulletin 1786, p. 15.

Property Summary

Name(s): Geroe Creek Lode
Placid Oil Company

Map No: C25
MAS No: 0020310026
Alaska Kardex 031-068
ARDF CH053

Deposit Type: Porphyry

Commodities: Cu, Mo

Location:

Quadrangle: Chandalar C-4
Meridian: Fairbanks
Latitude: 67° 40.876' N.

SW¼ sec. 13, T. 33 N., R. 6 W.
Elevation: 5,000 feet
Longitude: 148° 48.790' W.

Geographic: Located on the west side of a cirque at the headwaters of Geroe Creek, a southern tributary of North Fork Chandalar River.

History:

1959-60 - Brosge and Reiser (1964) obtained anomalous lead and zinc values in stream sediment sample.
1975-76 - Placid Oil Company staked 239 lode claims in the area (Grybeck, 1977; Kardex).

Production: No recorded production.

Workings and Facilities: None observed.

Geologic Setting:

The Geroe Creek occurrence is within a northeast-trending belt of Devonian metaplutonic rocks consist of peraluminous biotite-muscovite granites of the Baby Creek batholith and the Devonian metaluminous biotite-hornblende granites and granodiorites of the Horace Mountain plutons (Newberry and others, 1986). Several quartz stockwork and altered zones within this belt have been described. Veinlets in the stockworks are reported to contain disseminated molybdenite, chalcopyrite, and pyrite along with intense quartz-sericite-chlorite plus or minus epidote alteration. Samples from Geroe Creek are reported to contain up to 0.1% molybdenum (Eakins and others, 1983; Nokleberg and others, 1987). The metaplutonic rocks contact Paleozoic calcareous schist and marble on the ridge north of Geroe Creek (Brosge and Reiser, 1964).

Bureau Investigation:

A conspicuous, 0.25-mile-long area of limonite-stained cliffs is on the west side of a cirque in the reported vicinity of the occurrence. Access was difficult due to the steepness of the terrain, so most of the examination focused on talus along the base of the cliffs. The stained rocks appear to represent an intensely altered zone within metagranite. This zone consists mostly of quartz and sericite along with abundant disseminated and stringer pyrite. A sample of the altered rock (11864, table C-1) contained 5,212 ppm molybdenum and 106 ppm lead. The high molybdenum content would indicate that gray metallic specks observed in the rock are probably molybdenite.

The intensely altered rocks grade into slightly altered metagranite with gneissic textures. Occasionally, pieces of the metagranite contained minor chalcopyrite with associated malachite and azurite stain. A float sample (11863) contained 1,457 ppm copper and 37 ppb gold. Limonite staining would indicate that the pyrite-bearing zone is at least 2,000 feet wide; however, the copper-molybdenum mineralization is spotty and occurs as small zones.

This occurrence may be a metamorphosed porphyry-type deposit in which weak copper-molybdenum mineralization was remobilized during regional metamorphism and concentrated near the sheared margins of the Baby Creek batholith. It may also be an extension of a similar alteration zone found at the Arsine occurrence (map no. C24), 3 miles to the southeast. It is similar to the copper-bearing quartz stockwork zones that are described by Newberry (1986) as occurring within in the Horace Mountain plutons and Baby Creek batholith.

Stream sediment samples collected in upper Geroe Creek are reported to be anomalous in tin (Newberry, 1986). Stream sediment and pan concentrate samples collected by the BLM at the major fork, 2 miles downstream from the Geroe Creek occurrence (11866-11867) contained up to 34 ppb gold, but no detectable tin.

Resource Estimate: None.

Mineral Development Potential:

Low development potential due to low copper, molybdenum, and gold values.

Recommendations: Walk ridgetop above stained cliffs.

References:

Brosge, W.P., and Reiser, H.N.,1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 28.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Eakins, G.R., Bundtzen, T.K., Robinson, M.S., Clough, J.G., Green, C.B., Clautice, K.H., and Albanese, M.A., 1983, Alaska's mineral industry 1982: Alaska Division of Geological and Geophysical Surveys Special Report 31, p. 41.

Grybeck, D., 1977, Known mineral deposits of the Brooks Range, Alaska: U.S. Geological Survey Open-File Report 77-166C, p. 36.

Newberry, R.J., Dillon, J.T., and Adams, D.D., 1986, Regionally metamorphosed, calc-silicate-host deposits of the Brooks Range, northern Alaska: Economic Geology, v. 81, p. 1728-1752.

Nokleberg, W.J., Bundtzen, T.K., Berg, H.C., Brew, D.A., Grybeck, D., Robinson, M.S., Smith, T.E., and Yeend, W., 1987, Significant metalliferous lode deposits and placer districts in Alaska: U.S. Geological Survey Bulletin 1786, p. 15.

Property Summary

Name(s): Upper Willow Creek Lode

Map No: C26
MAS No: 0020310074
ARDF CH055, CH109(?)

Deposit Type: Contact metasomatic

Commodities: Zn, Sb

Location:

Quadrangle: Chandalar C-4
NW¼ sec. 34, T. 33 N., R. 6 W.
Meridian: Fairbanks
Elevation: 4,000 feet
Latitude: 67° 38.644' N.
Longitude: 148° 53.532' W.
Geographic: Located on a ridge about 1.5 miles southeast of the confluence of Willow and Little Spruce Creeks.

History:

1910(?) - J. Kelley and G. Eaton reportedly found very good placer prospects (Reed, 1938; Cobb and Cruz, 1983).

1959-60 - Brosge and Reiser (1964) reported a copper anomaly in a stream sediment sample and a zinc anomaly in a rock sample from upper Willow Creek.

1982-86 - Twenty-eight placer claims are staked in Willow Creek and the immediate area (Kardex).

Production: None.

Workings and Facilities: None.

Geologic Setting:

Bedrock at the site is mapped as Devonian chlorite-muscovite schist, calcareous schist, and marble. About 1 mile to the west, the bedrock is gneissic chloritized biotite granite, part of the Early Devonian Baby Creek batholith (Brosge and Reiser, 1964; Dillon and others, 1996).

Bureau Investigation:

The site consists of resistant marble and hornfels outcrop knobs between chlorite-muscovite schist rubblecrop. The schist weathers yellow-red, but does not contain sulfides. The hornfels contains small amounts of disseminated sphalerite, pyrite, and pyrrhotite. Zinc values in the hornfels samples (11710, 12337, 12338, 12344, 12381, table C-1) varied widely, ranging from 36 ppm to 3.09%. The highest value was from a 1.8-foot-long continuous chip sample of siliceous hornfels (12337). The hornfels contacts a layer of marble along a N. 10° W. strike and 50° W. dip. The sample also contained 348.8 ppm cadmium.

Two rock samples were anomalous in antimony. A select sample of hornfels found in float (11710) contained 1.56% antimony and 153 ppb gold. A random chip sample of iron-oxide-stained quartz-mica schist collected nearby (11711) contained 229 ppm antimony and only 8 ppb gold.

Figure C-5. Sample locations at the upper Willow Creek lode occurrence. Bedrock consists of red-stained chlorite-muscovite schist rubblecrop and resistant skarn and hornfels outcrop knobs. Photo faces southeast towards peak 6740.

Resource Estimate: None.

Mineral Development Potential:

The lode occurrence has low mineral development potential due to relatively low zinc, antimony, and gold values.

Recommendations:

Additional sampling of the hornfels unit in order to determine extent of mineralization.

References:

Brosge, W.P., and Reiser, H.N.,1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 73.

Dillon, J.T., Reifenstuhl, R.R., and Harris, G.W., 1996, Geologic map of the Chandalar C-5 quadrangle, southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 104, 2 sheets, scale 1:63,360.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 47.

Property Summary

Name(s): Lower Willow Creek Lode
M and W Assoc. claims

Map No: C27
MAS No: 0020310145
Alaska Kardex 31-217
Alaska Kardex 31-219

Deposit Type: Metamorphosed sulfide

Commodities: Zn, Cu

Location:

Quadrangle: Chandalar C-4
NW¼ sec. 30, T. 33 N., R. 6 W.
Meridian: Fairbanks
Elevation: 2,800 feet
Latitude: 67° 39.691' N.
Longitude: 148° 59.811' W.
Geographic: Bedrock exposures in Willow Creek, 1.5 miles downstream from Little Willow Creek.

History:

1938 - J. Kelley and G. Eaton reportedly found good prospects on Willow Creek (Reed, 1938).

1982-86 - F. Wilkes and R. Boyd staked up to 46 placer claims on Willow Creek and the immediate area (Kardex).

Production: None.

Workings and Facilities: None observed.

Geologic Setting:

In the vicinity of the occurrence, a thrust-fault contact between chlorite-muscovite schist and quartz muscovite-chlorite schist has been mapped with the latter unit comprising the upper plate. Both rock types are Devonian. The schist is locally sericitic and iron stained, containing concentrations of pyrite, arsenopyrite with trace amounts of chalcopyrite and sphalerite. The Early Devonian Baby Creek batholith, a stock of gneissic chloritized biotite granite, is located 1.5 miles to the southeast (Brosge and Reiser, 1964; Dillon and others, 1996).

Bureau Investigation:

About 1.5 miles upstream from Robert Creek, Willow Creek flows through a rocky gorge. Two iron-stained exposures of sericitic(?) schist up to 25 feet wide, occurring near the upper end of the gorge, were examined. The stained zones are related to pyritic bands, which average 0.8 feet thick, parallel schistosity, and are exposed up to 20 feet along a N. 40° E. strike. The bands also contain arsenopyrite and trace amounts of chalcopyrite and malachite. Samples did not contain significant amounts of base or precious metals. Similar iron-stained rocks were found exposed in a tributary of Willow Creek, 0.3 mile to the south. A 7-foot-long spaced chip sample (12372, table C-1) across pyritic bands up to 0.5 feet wide contained 1,679 ppm copper and 367 ppm zinc. None of the samples contained significant precious metal values.

A piece of garnet-epidote skarn (12296) picked up in the bed of Willow Creek, near the top of the gorge, contained 3,295 ppm zinc. A bedrock source for the skarn was not located. The skarn may be related to other contact metamorphic rocks found upstream near a granitic stock (see map no. C26). A pan concentrate (12294) collected from bedrock crevices nearby contained 21.12 ppm gold. This is highly anomalous.

Results of a ground-magnetometer survey of the area between the two sites were inconclusive.

Resource Estimate: Unknown.

Mineral Development Potential:

Low development potential for volcanic-hosted base metal deposits due to low assay values. The source of the gold in the pan concentrate could be a contact aurole around the granitic stock to the southeast.

Recommendations:

Follow up anomalous gold values in pan concentrates for both placer and lode deposits.

References:

Brosge, W.P., and Reiser, H.N.,1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Dillon, J.T., Reifenstuhl, R.R., and Harris, G.W., 1996, Geologic map of the Chandalar C-5 quadrangle, southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 104, 2 sheets, scale 1:63,360.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 47.

Property Summary

Name(s): Willow Creek
M and W Assoc. claims

Map No: C28
MAS No: 0020310146
Alaska Kardex 31-217
Alaska Kardex 31-219
ARDF CH109

Deposit Type: Placer

Commodities: Au

Location:
Quadrangle: Chandalar C-4
S½ sec. 24, T. 3 N., R. 7 W.
Meridian: Fairbanks
Elevation: 2,310 feet
Latitude: 67° 39.899' N.
Longitude: 149° 02.849' W.
Geographic: An 8.3-mile-long eastern tributary of Robert Creek, east of Horace Mountain.

History:

1910(?) - J. Kelley and G. Eaton reportedly found very good placer prospects (Reed, 1938; Cobb and Cruz, 1983).

1982-86 - F. Wilkes and R. Boyd staked up to 46 placer claims on Willow Creek and the immediate area (Kardex).

Production: Unknown.

Workings and Facilities:

Remains of two cabins and suction dredging equipment are visible near the mouth of the creek. It is assumed that this equipment was used to work bedrock potholes in the Willow Creek gorge.

Geologic Setting:

The majority of the bedrock in Willow Creek consists of chlorite-muscovite schist. This unit is in thrust-fault contact with quartz-muscovite-chlorite schist with the latter unit comprising the upper plate. Both rock types are Devonian in age. The schist is locally sericitic and iron stained. It contains concentrations of pyrite and arsenopyrite and trace amounts of chalcopyrite and sphalerite. The Early Devonian Baby Creek batholith, a stock of gneissic chloritized biotite granite, is exposed 3.0 miles up Willow Creek. Mineralized hornfels is associated with this stock (Brosge and Reiser, 1964; Dillon and others, 1996).

The lower part of Willow Creek runs through a 1-mile-long gorge before spilling onto an alluvial fan near Robert Creek. This gorge probably formed as the result of rapid downcutting by Willow Creek due to ice retreat up the Robert Creek valley in the late Pleistocene. This event left that portion of Willow Creek above the gorge as a hanging valley.

Bureau Investigation:

A series of three test pans taken from around boulders in the creek near the cabins produced 2 fine and 2 very fine gold flakes (table C-1). A pan concentrate sample (12291) contained 9,322 ppb gold and 326 ppm arsenic. The lower part of the gorge contains gravel-filled bedrock potholes. No gold was found in test pans taken around boulders in this area. A pan concentrate sample (12294), collected from bedrock crevices above the gorge and 1.5 miles upstream from Robert Creek, contained 21.12 ppm gold. This result is highly anomalous.

Resource Estimate: Unknown.

Mineral Development Potential:

Lack of gold in test pans indicates that the Willow Creek gorge has low potential for placer gold. However, the sampling did not adequately assess bedrock potholes. Moderate potential may exist for placer gold in bedrock crevices at the upper end of the gorge.

Recommendations:

Test bedrock potholes at the lower end of Willow Creek gorge using a suction dredge. Test cracks and crevices in bedrock at upper end of the gorge using a suction dredge.

References:

Brosge, W.P., and Reiser, H.N.,1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Dillon, J.T., Reifenstuhl, R.R., and Harris, G.W., 1996, Geologic map of the Chandalar C-5 quadrangle, southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 104, 2 sheets, scale 1:63,360.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 47.

Property Summary

Name(s): Big Jim (Suklak) Creek

Map No: C29
MAS No: 0020310090
ARDF CH056

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar C-4
SW¼ sec. 2, T. 31 N., R. 7 W.
Meridian: Fairbanks
Elevation: 2,220 feet
Latitude: 67° 32.226' N.
Longitude: 148° 58.042' W.
Geographic: Located on a west-flowing tributary, between the Twin Lakes.

History:

1938 - Reed (1938) reported that "Big Jim" Edwards was mining near the mouth.
1985 - Dillon (1987) reported a mining claim near the creek mouth.

Production: None recorded.

Workings and Facilities:

A cabin remains at the mouth of the creek, but no evidence of mining was visible.

Geologic Setting:

The bedrock at Big Jim Creek is gneissic chloritized biotite granite, part of the Early Devonian Baby Creek batholith (Brosge and Reiser, 1964; Dillon and others, 1996).

Reed (1938) reported that although the placer gold recovery was not known, "It cannot amount to much as the mining is mostly by rocker and panning."

Bureau Investigation:

The creek has a broad valley and an extremely gentle gradient. A stream sediment and a pan concentrate sample (11194-11195, table C-1) were collected off bedrock, near the headwaters of Big Jim Creek; however, assay results were not anomalous.

Resource Estimate: None.

Mineral Development Potential: Low mineral development potential due to lack of gold in samples.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N.,1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 11.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Dillon, J.T., 1987, Upper Koyukuk district land and mining claim status current to 1985: Alaska Division of Geological and Geophysical Surveys Public Data File 87-11, 25 p., 1 sheet, scale 1:125,000.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 49.

Property Summary

Name(s): Phoebe Creek

Map No: C30
MAS No: 0020310040
Alaska Kardex 031-036
Alaska Kardex 031-270
ARDF CH057

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar C-5
NE¼ sec. 29, T. 32 N., R. 7 W.
Meridian: Fairbanks
Elevation: 2,180 feet
Latitude: 67° 34.536' N.
Longitude: 149° 08.534' W.
Geographic: Located about 3.5 miles downstream of the confluence of Phoebe Creek and Bettles River, near Mellow Creek. The site is on Doyon Ltd. land.

History:

1909 - Activity reported on Phoebe Creek (Maddren, 1910)

pre-1938 - Very good prospects were reportedly found on a northern tributary of Phoebe Creek by M. Mello (Reed, 1938; Heiner and Wolf, 1968; Kardex).

1984 - D. Johnson staked two claims on Mellow Creek (Kardex).

Production: No recorded production.

Workings and Facilities:

There are cabin remains on the north side of Phoebe Creek, 1.1 miles upstream of the confluence with Bettles River. Sluice and shaft-digging equipment along with the burned remains of another cabin are located 3.5 miles upstream from Robert Creek on a northern tributary of Phoebe Creek, opposite Mellow Creek.

Geologic Setting:

Phoebe Creek is a slow, meandering creek draining from Twin Lakes into Bettles River. The bedrock consists primarily of Devonian albite-chlorite-mica schist. North of Mellow Creek this unit is in contact with Devonian quartz-muscovite schist, which weathers orange. It is locally pyritic and includes sills of quartz diorite. A belt of calc-silicate hornfels follows the contact between the two types of schist, starting about 1 mile north of Mellow Creek. Gneissic chloritized biotite granite, comprising the Devonian Baby Creek batholite, is located about 3 miles north of Mellow Creek (Brosge and Reiser, 1964; Newberry and others, 1986).

Bureau Investigation:

Samples were collected at two locations on Phoebe Creek. Stream sediment and pan concentrate samples

(11235-11236, table C-1) were collected on the tributary opposite Mellow Creek. The pan concentrate (11236) sample contained 319 ppb gold, which is anomalous. Although shaft-digging equipment was found on site, no shaft was located.

Approximately 2.5 miles downstream, several test pans were collected near a 150-foot-high morainal bluff. No visible gold was found. Stream sediment and pan concentrate samples (11232-11233) were collected off a gravel bar about 300 feet downstream of the bluff. The samples contained no gold. A float sample of chlorite-biotite-quartz schist with disseminated pyrite and pyrrhotite (11234) was also collected at the site. None of the results were significant.

Resource Estimate: None.

Mineral Development Potential: Low mineral development potential exists due to lack of placer gold.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N.,1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 54.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Dillon, J.T., Reifenstuhl, R.R., and Harris, G.W., 1996, Geologic map of the Chandalar C-5 quadrangle, southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 104, 2 sheets, scale 1:63,360.

Heiner, L.E., and Wolff, E.N., 1968, Final report, mineral resources of northern Alaska: Mineral Industry Research Laboratory, University of Alaska, Report 16, p. 50.

Maddren, A.G., 1910, The Koyukuk-Chandalar gold region *in* Brooks, A.E., Mineral resources of Alaska, report on progress of investigations in 1909: U.S. Geological Survey Bulletin 442, p. 310.

____1913, The Koyukuk-Chandalar region, Alaska: U.S. Geological Survey Bulletin 532, p. 105.

Newberry, R.J., Allegro, G.L., Cutler, S.E., Hagen-Levelle, D.D., Adams, D.D., Nicholson, L.C., Weglarz, T.B., Bakke, A.A., Clautice, K.H., Coulter, G.A., Ford, M.J., Myers, G.L., and Szumigala, D.J., 1997, Skarn deposits of Alaska, *in* Goldfarb, R.J., and Miller, L.D., eds., Mineral deposits of Alaska: Economic Geology Monograph 9, 482 p.

Newberry, R.J., Dillon, J.T., and Adams, D.D., 1986, Regionally metamorphosed, calc-silicate-host deposits of the Brooks Range, northern Alaska: Economic Geology, v. 81, p. 1728-1752.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 47-48.

Property Summary

Name(s): Robert Creek

Map No: C31
MAS No: 0020310053
Alaska Kardex 031-037
Alaska Kardex 031-073
ARDF CH058

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar C-5
Center sec. 12, T. 32 N., R. 8 W.
Meridian: Fairbanks
Elevation: 1,970 feet
Latitude: 67° 35.743' N.
Longitude: 149° 14.584' W.
Geographic: Robert Creek is a 17.6-mile-long drainage. Reported areas of placer activity are concentrated along 3.5 miles of the lower creek between Sheep Creek and the Bettles River. The site is on land owned by Doyon Ltd.

History:

1900 - Placer claim(s) staked on Robert Creek.

1909 - Prospects are reported on lower Robert Creek, particularly where the schist that underlies the massive limestone is exposed (Maddren 1910, 1913).

1976 - W. Denman staked three placer claims on Robert Creek, below the confluence with Sheep Creek (Kardex).

Production: No recorded production.

Workings and Facilities: None observed.

Geologic Setting:

The Robert Creek drainage contains wide, braided flood plains interspersed with shallow bedrock gorges. The bedrock consists of Cambrian to Ordovician chlorite-quartz schist and quartzite. The schist locally contains disseminated pyrrhotite and pyrite(?), the weathering of which produces iron staining on some outcrops. Early Devonian granite and granodiorite gneiss related to the Horace Mountain pluton outcrop on the west side of the creek. Early Devonian biotite-granite gneiss (related to the Baby Creek Batholith) and dikes and sills of aplite are exposed on the east side of the creek. Calc-silicate hornfels borders the intrusive outcrops locally on the pluton margins. In addition, zones of intense quartz-sericite alteration on the margins of the Horace Mountain pluton contain copper mineralization (map no. C16). Prospects of placer gold have been found in tributaries which erode into the schist (Maddren, 1913; Brosge and Reiser, 1964; DeYoung, 1978; Cobb and Cruz, 1983; Dillon and others, 1996).

Bureau Investigation:

A traverse was made along Robert Creek between Sheep Creek and the Bettles River. Test pans were taken from gravel lying on bedrock, but no gold was observed. Stream sediment, pan concentrate, and rock samples were collected from an area just above the confluence with Bettles River. The pan concentrate (11228, table C-1) contains 1,219 ppb gold and 40 ppm arsenic. No other anomalies are noted. A sample of pyrrhotite-bearing quartz segregations in the schist (11227) is not anomalous in any metals.

Samples were also collected just above the confluence with Sheep Creek. The pan concentrate from Robert Creek (11226) contains 259 ppb gold and 35 ppm arsenic. No other anomalies are noted. No visible gold was observed in any of the test pans taken on Robert Creek. The lack of visible gold and anomalous analytical results would indicate that the creek carries extremely fine flood gold.

Resource Estimate: None.

Mineral Development Potential:

Low development potential for placer gold exists on lower Robert Creek due to a lack of visible gold.

Recommendations: Bedrock potholes could be prospected for coarse gold with a suction dredge.

References:

Brosge, W.P., and Reiser, H.N.,1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 57.

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Dillon, J.T., Reifenstuhl, R.R., and Harris, G.W., 1996, Geologic map of the Chandalar C-5 quadrangle, southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 104, 2 sheets, scale 1:63,360.

Heiner, L.E., and Wolff, E.N., 1968, Final report, mineral resources of northern Alaska: Mineral Industry Research Laboratory, University of Alaska, Report 16, p. 50.

Maddren, A.G., 1910, The Koyukuk-Chandalar gold region *in* Brooks, A.E., Mineral resources of Alaska, report on progress of investigations in 1909: U.S. Geological Survey Bulletin 442, p. 310.

____1913, The Koyukuk-Chandalar region, Alaska: U.S. Geological Survey Bulletin 532, p. 105.

Nicholson, L., 1990, Porphyry copper, copper skarn and volcanogenic massive sulfide occurrences in the Chandalar copper district, Alaska: University of Alaska Fairbanks, Masters thesis, 96 p.

Schrader, F.C., 1900, Preliminary report on a reconnaissance along the Chandalar and Koyukuk Rivers, Alaska in 1899: Twenty-first annual report of the U.S. Geological Survey Part 2, p. 480-481.

Property Summary

Name(s): Big Spruce Creek
Spruce Creek

Map No: C32
MAS No: 0020310029
Alaska Kardex 031-005
ARDF CH068

Deposit Type: Placer

Commodities: Au

Location:
Quadrangle: Chandalar C-5
SE¼ sec. 15, T. 32 N., R. 8 W.
Meridian: Fairbanks
Elevation: 1,930 feet
Latitude: 67° 35.459' N.
Longitude: 149° 17.851' W.
Geographic: Big Spruce Creek is a 20-mile-long, south-flowing tributary of Bettles River. The placer site is near the confluence with Bettles River, on Doyon Ltd. land.

History:

1900s - Limited prospecting occurred (Maddren, 1910, 1913).

1930s - Two shafts were sunk near the confluence with the Bettles River. The results were not encouraging (Reed, 1938).

1985 - Dillon (1987) reported an inactive claim approximately 1 mile upstream of the creek mouth.

Production: No recorded production.

Workings and Facilities:

Two shafts approximately 45 feet deep were reportedly sunk on the west side of Big Spruce Creek, near the confluence with Bettles River (Reed, 1938). Remains of the shafts were not located during the BLM investigation. Trees have been cleared immediately northwest of the confluence - possibly for an airstrip.

Geologic Setting:

The bedrock in the Big Spruce Creek drainage consists of Ordovician to Devonian marble, phyllite, chlorite-calcareous schist, quartz schist, and quartzite. The metasediments are intruded by Early Devonian granite gneiss and hornblende granodiorite gneiss, known as the Horace Mountain plutons. Calc-silicate hornfels and skarns border the intrusive outcrops and contain variable copper-silver-gold mineralization (map nos. C11-C12). In addition, zones of intense quartz-sericite alteration on the margins of the Horace Mountain plutons contain copper-molybdenum mineralization (map nos. C13-C14 and C16) (Newberry and others, 1986; Dillon and others, 1996; Newberry and others, 1997).

Bureau Investigation:

The lower two miles of Big Spruce Creek are in a gorge-like bedrock canyon with walls approximately 100 feet high. Two pan concentrate samples (12347-12348, table C-1) were collected within the canyon.

Both samples contained moderate amounts of pyrite, but no visible gold. One of the samples (12348) contains 485 ppb gold and the two samples averaged 139 copper. Both results are anomalous.

Two pan concentrate samples were also collected near the Venus Creek (map no. C13) tributary, approximately 3 miles upstream from the creek mouth. The samples average 712 ppb gold and 255 ppm copper.

Resource Estimate: None.

Mineral Development Potential:

Low development potential for placer gold at lower Big Spruce Creek due to a lack of visible gold.

Recommendations: Prospect the potholes in gorge with a suction dredge.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 65.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF 878-B, 2 sheets, scale 1:250,000.

Dillon, J.T., 1987, Upper Koyukuk district land and mining claim status current to 1985: Alaska Division of Geological and Geophysical Surveys Public Data File 87-11, 25 p., 1 sheet, scale 1:125,000.

Dillon, J.T., Reifenstuhl, R.R., and Harris, G.W., 1996, Geologic map of the Chandalar C-5 quadrangle, southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 104, 2 sheets, scale 1:63,360.

Heiner, L.E., and Wolff, E.N., 1968, Final report, mineral resources of northern Alaska: Mineral Industry Research Laboratory, University of Alaska, Report 16, p. 51.

Maddren, A.G., 1910, The Koyukuk-Chandalar gold region *in* Brooks, A.E., Mineral resources of Alaska, report on progress of investigations in 1909: U.S. Geological Survey Bulletin 442, p. 310.

____1913, The Koyukuk-Chandalar region, Alaska: U.S. Geological Survey Bulletin 532, p. 105.

Newberry, R.J., Allegro, G.L., Cutler, S.E., Hagen-Levelle, D.D., Adams, D.D., Nicholson, L.C., Weglarz, T.B., Bakke, A.A., Clautice, K.H., Coulter, G.A., Ford, M.J., Myers, G.L., and Szumigala, D.J., 1997, Skarn deposits of Alaska, *in* Goldfarb, R.J., and Miller, L.D., eds., Mineral deposits of Alaska: Economic Geology Monograph 9, 482 p.

Newberry, R.J., Dillon, J.T., and Adams, D.D., 1986, Regionally metamorphosed, calc-silicate-host deposits of the Brooks Range, northern Alaska: Economic Geology, v. 81, p. 1728-1752.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 46-47.

Property Summary

Name(s): Shady Creek
Gus Creek

Map No: C33
MAS No: 0020310147
ARDF CH069

Deposit Type: Placer

Commodities: Au, Ag, Sb

Location:

Quadrangle: Chandalar C-5
C½ sec. 23, T. 32 N., R. 8 W.
Meridian: Fairbanks
Elevation: 2,200 feet
Latitude: 67° 35.164' N.
Longitude: 149° 16.192' W.
Geographic: A north-flowing tributary of Bettles River, 1 mile west of the confluence of Robert and Phoebe Creeks. The site is on Doyon Ltd. land.

History:

Early 1900s - Reed (1938) reported S.G. Larson may have found fair prospects at "Gus Creek."
1959-60 - Brosge and Reiser (1964) reported an arsenic anomaly in a stream sediment sample.
Early 1990s - Central Alaska Gold Company (1992) reported gold anomalies in stream sediment samples taken at the head of Shady Creek, near the western ridge.

Production: None recorded.

Workings and Facilities: None observed.

Geologic Setting:

The bedrock at Shady Creek is predominantly Ordovician to Cambrian(?) marble, calcareous-chlorite-quartz schist, feldspar-quartz schist, and quartzite. Relatively small outcrops of Devonian biotite granite gneiss are surrounded by calcareous hornfels approximately ¾ mile upstream from the creek mouth and at the eastern tributary headwaters (Dillon and others, 1996).

Central Alaska Gold Company (1992) collected two stream sediment samples from the headwaters on Shady and Limestone Creeks. The samples averaged 37.5 ppb gold. After investigating the ridge between the two creeks, they concluded that some gold-antimony-quartz veins and possibly some low-grade skarn mineralization is responsible for the weak gold anomalies in the creeks.

Brosge and Reiser (1964) reported that the arsenic anomaly near the creek mouth is at the contact of Devonian Skajit Limestone with calcite-muscovite-quartz-chlorite schist, quartz-muscovite schist, and schistose marble.

Bureau Investigation:

Shady Creek was investigated near the mouth and in the headwaters. A pan concentrate collected at the canyon about 0.3 mile upstream from the creek mouth (11723, table C-1) contains 11.67 ppm gold. Three garnet pieces and 1 fine gold flake were observed in the sample. The sample was collected from small amounts of gravel on the numerous large boulders. No bedrock exposures suitable for panning were observed.

Two samples of Skajit Limestone with minor pyrite and pyrrhotite (11719-11720) were slightly anomalous in silver and antimony, averaging 1.45 ppm and 105 ppm respectively. However, during investigation of the canyon and the headwaters area, no sulfides were observed in outcrop.

Resource Estimate: None.

Mineral Development Potential:

Although fine gold was panned at the site, the lack of bedrock (and potential gravel resources) suggests low mineral development potential for placer gold.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Central Alaska Gold Company, 1992, 1991 Annual report, Alaska field operations- Doyon Ltd. option, v. I: unpublished report 92-70 for Doyon Ltd, 39 p. [available from Doyon Ltd., Fairbanks, Alaska]

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 73.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Dillon, J.T., Reifenstuhl, R.R., and Harris, G.W., 1996, Geologic map of the Chandalar C-5 quadrangle, southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 104, 2 sheets, scale 1:63,360.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 46.

Property Summary

Name(s): Mule Creek
Mule 1-10 claims
Jimmy 1-5 claims

Map No: C34
MAS No: 0020310043
Alaska Kardex 031-035
ARDF CH067

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar C-5
W½ sec. 21, T. 32 N., R. 8 W.
Meridian: Fairbanks
Elevation: 1,900 feet
Latitude: 67° 34.805' N.
Longitude: 149° 20.860' W.
Geographic: A north-flowing tributary of the Bettles River, opposite Eightmile Creek. The site is on Doyon Ltd. land.

History:

1901-09 - Mule Creek mined intermittently. Nuggets of native silver and copper (up to 7 pounds) were reportedly found on the creek (Maddren, 1913).

1930s - G. Eaton and J. Kelly sank shafts in alluvial fan near mouth of creek. No prospects were reported (Reed, 1938).

1938 - S.G. Larson mined placer gold using booming and shoveling techniques (Reed, 1938).

1985 - Dillon (1987) reported active claims on Mule Creek.

Production: (oz Au) (Maddren, 1913; U.S. Bureau of Mines PIMRs, 1906-1938)

1906 - 15
1937 - 10
1938 - 25
Total: 50 (Records incomplete.)
Average fineness: 908 (Reed, 1938)

Workings and Facilities:

Several shafts were sunk on the alluvial fan at the confluence of Mule Creek and Bettles River. Two or three of the shafts were located at the mouth, below Larson's cabin, and another was about 1,000 feet upstream at an elevation of 1,900 feet. Remains of an old sluice box were found between the canyon and creek mouth (Reed, 1938).

Geologic Setting:

At the headwaters of Mule Creek, bedrock consists of Devonian limestone, dolomite, and marble. These units are bounded by several east-west-trending faults. To the south of the faults, bedrock is composed of Ordovician black phyllite, marble, and chlorite-calcareous schist (Dillon and others, 1996).

Placer gold has been mined at several locations relative to the creek mouth: a low bench 2.5 miles upstream, a gravel bar 1.5 miles upstream, and the canyon 0.5 mile upstream. The depth to bedrock ranges from 3 to 8 feet, and the gradient is about 5%. The ground was reported to produce 10 cents (0.002 oz) per bedrock foot. The gold is medium fine, well worn, and lies between the lowest foot of gravel and the top of bedrock. Also, copper and silver nuggets have been reportedly found in Mule Creek (Maddren, 1913; Reed, 1938).

A deep channel, underneath the large alluvial fan at the mouth of Mule Creek, was also prospected. Several shafts were sunk ranging from 75 to 80 feet deep. All of the shafts flooded before reaching bedrock; no gold was recovered (Reed, 1938).

Bureau Investigation:

One piece of fine gold was observed in a pan concentrate sample (11075) collected from a cutbank approximately 2 miles upstream from the mouth. (It assayed >10,000 ppb gold, but there was insufficient sample material for a re-analysis.) However, no bedrock was exposed in the present channel, and two other test pans collected nearby did not contain gold. Approximately 6 more test pans were collected between the headwaters the creek mouth. No gold was observed in any of the samples. A pan concentrate sample (11077) collected from bedrock 0.4 mile upstream of the mouth contains 235 ppb gold. Trace pyrite was observed in the pan, but no visible gold. Depth to bedrock on the lower three quarters of a mile of the creek is about 8 feet.

A piece of fine-grained quartzite with 5% combined pyrrhotite, chalcopyrite, and pyrite (11073) was found in float at midstream and contained 217 ppm copper. Copper mineralization was also noted in a float sample on Limestone Creek (map no. C35). The ridge between Mule and Limestone Creeks was investigated; however, no indications of copper mineralization were noted.

Resource Estimate: None.

Mineral Development Potential:

Mule Creek appears to have small amounts of fine gold; however, sample results suggest low mineral development potential for placer gold.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

____1972, Geochemical reconnaissance in the Wiseman and Chandalar districts and adjacent region, southern Brooks Range, Alaska: U.S. Geological Survey Professional Paper 709, p. 20.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

____1973, Placer deposits of Alaska: U.S. Geological Survey Bulletin 1374, 213 p.

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 50.

Dillon, J.T., 1987, Upper Koyukuk district land and mining claim status current to 1985: Alaska Division of Geological and Geophysical Surveys Public Data File 87-11, 25 p., 1 sheet, scale 1:125,000.

Dillon, J.T., Reifenstuhl, R.R., and Harris, G.W., 1996, Geologic map of the Chandalar C-5 quadrangle, southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 104, 2 sheets, scale 1:63,360.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Heiner, L.E., and Wolff, E.N., 1968, Final report, Mineral resources of northern Alaska: University of Alaska Mineral Industry Research Lab, Report 16, p. 50.

Maddren, A.G., 1910, The Koyukuk-Chandalar gold region *in* Brooks, A.E., Mineral resources of Alaska, report on progress of investigations in 1909: U.S. Geological Survey Bulletin 442, p. 292, 310.

____1913, The Koyukuk-Chandalar region, Alaska: U.S. Geological Survey Bulletin 532, p. 69, 104-105.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 45.

U.S. Bureau of Mines, 1906-1938, Permanent Individual Mine Records (PIMR) for placer mines in Alaska: U.S. Bureau of Mines unpublished reports.

Property Summary

Name(s): Limestone Creek Lode

Map No: C35
MAS No: 0020310139

Deposit Type: Carbonate-hosted

Commodities: Cu, Zn

Location:

Quadrangle: Chandalar C-5
NW¼ sec. 17, T. 32 N., R. 8 W.
Meridian: Fairbanks
Elevation: 3,900 feet
Latitude: 67° 36.146' N.
Longitude: 149° 23.547' W.
Geographic: Headlands of Limestone Creek, a 3-mile-long, northern tributary of Bettles River. The site is on Doyon Ltd. land.

History:

1959-60 - Brosge and Reiser (1964) reported that nickel, silver, and palladium were identified by X-ray analysis of marble samples from the headlands of Limestone Creek.

Production: None.

Workings and Facilities: None.

Geologic Setting:

The bedrock at the headwaters of Limestone Creek consists of Devonian marble and dolomitic marble. Downstream, the creek cuts the underlying Ordovician calcareous schist which contains lenses of graphitic schist. The contacts between the units trend northeast (Dillon and others, 1996). Native copper has been reportedly found in nearby Mule Creek (Maddren, 1913).

Bureau Investigation:

The marble formation near the headwaters was investigated. An outcrop sample of the marble with 1-2% disseminated sulfides (11092, table C-1) contained 1.3 ppm silver and 142 ppm arsenic. The buff-colored marble was adjacent to the conspicuous red-stained areas that dot the cliff walls. A pan concentrate and a stream sediment sample collected below the rock sample did not contain any anomalous results. Mulligan (unpublished notes, 1974) stated the hematite-stained marble contains trace zinc, titanium, and antimony.

About 1.5 miles upstream from the creek mouth, a sample of marble float with massive chalcopyrite (11095) contained 77 ppb gold, 3.3 ppm silver, 1.41% copper, 109 ppm antimony, and 0.2% titanium. A pan concentrate (11096) collected at the same location contained 108 ppm copper, 270 ppm zinc, and 94 ppm arsenic. Dillon and others (1996) reported a contact between an intrusive and calc-hornfels at this location; however, neither unit was found in place. The ridge between Mule and Limestone Creeks was also investigated; however, no indications of mineralization were noted.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential for copper-zinc. Although one anomalous sample was found in float, the site does not appear to have significant lode mineralization.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Dillon, J.T., Reifenstuhl, R.R., and Harris, G.W., 1996, Geologic map of the Chandalar C-5 quadrangle, southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 104, 2 sheets, scale 1:63,360.

Maddren, A.G., 1913, The Koyukuk-Chandalar region, Alaska: U.S. Geological Survey Bulletin 532, p. 104-105.

Property Summary

Name(s): Limestone Creek

Map No: C36
MAS No: 0020310027
Alaska Kardex 031-003
Alaska Kardex 031-046

Deposit Type: Placer

Commodities: Au

Location:
Quadrangle: Chandalar C-5
SE¼ sec. 29, T. 32 N., R. 8 W.
Meridian: Fairbanks
Elevation: 1,800 feet
Latitude: 67° 34.235' N.
Longitude: 149° 22.976' W.
Geographic: A 3-mile-long, south-flowing tributary of the Bettles River, opposite Eightmile Creek. The site is on Doyon Ltd. land.

History:

1901-09 - Limestone Creek was prospected intermittently.
1954 - E. and L. Bott staked a placer claim (Kardex).

Production: No recorded production.

Workings and Facilities:

Remnants of a boom dam and a cabin are near the confluence of Limestone Creek and Bettles River. Reed (1938) reported that James Kelly and Victor Neck sank a shaft at an elevation of 1,820 feet. The shaft went 18 feet to bedrock; only light prospects were reported.

Geology:

Bedrock at the headwaters of Limestone Creek consists of Devonian marble and dolomitic marble. Downstream, the creek cuts the underlying Ordovician calcareous schist which contains lenses of graphitic schist. The contacts between the units trend northeast (Dillon and others, 1996). Native copper was reportedly found in nearby Mule Creek (Reed, 1938).

Bureau Investigation:

Pan concentrate samples were collected from Limestone Creek at three locations: the headwaters (11094, table C-1), 1.5 miles upstream from the creek mouth (11096), and the creek mouth (11097). No visible gold was found in the samples; they averaged only 16 ppb gold.

One piece of fine gold was found in a pan concentrate collected from a gravel bar on the right limit of Bettles River (map no. C39) immediately north of its confluence with Limestone Creek. The pan concentrate sample (11098) contained 2,247 ppb gold.

Resource Estimate: None.

Mineral Development Potential:

Limestone Creek has low mineral development potential for placer gold due to lack of visible gold in samples.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Dillon, J.T., Reifenstuhl, R.R., and Harris, G.W., 1996, Geologic map of the Chandalar C-5 quadrangle, southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 104, 2 sheets, scale 1:63,360.

Heiner, L.E., and Wolff, E.N., 1968, Final report, mineral resources of northern Alaska: Mineral Industry Research Laboratory, University of Alaska, Report 16, p. 50.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 45.

Property Summary

Name(s): Eightmile Creek
Eightmile Creek Discovery
B&B Discovery Association

Map No: C37
MAS No: 0020310028
Alaska Kardex 031-004
Alaska Kardex 031-043
ARDF CH070

Deposit Type: Placer

Commodities: Au

Location:
Quadrangle: Chandalar C-5
S½ sec. 29, T. 32 N., R. 8 W.
Meridian: Fairbanks
Elevation: 2,000 feet
Latitude: 67° 34.037' N.
Longitude: 149° 22.646' W.
Geographic: A north-flowing tributary of the Bettles River, directly opposite Limestone Creek. The site is on Doyon Ltd. land.

History:

1900-09 - Prospects reported on Eightmile Creek, as well as several other Bettles River tributaries (Maddren 1910, 1913).

1938 - E. and L. Moore placer mined for a year, then sold their outfit to S. G. Larson, who was mining on nearby Mule Creek (Fairbanks Daily News-Miner, 1938).

~1943 - Placer cinnabar reported by local placer miner A. Schwaesdall (Joesting, 1943).

1949-53 - D. and L. Blott held 14 claims, and placer mined in the narrow schist canyon. They reported the gravel was not rich, but they were making expenses (Roehm, 1949; Williams, 1950).

1967 - Two claims staked (Heiner and Wolff, 1968).

1985 - Dillon (1987) reported active placer claims near creek mouth.

Production: (oz Au) (U.S. Bureau of Mines PIMRs, 1939-1948)

1939 - 5
1940 - 18
1941 - 21
1948 - 24
Total: 68

Average gold fineness: 891 (Metz and Hawkins, 1981); 895.3 (Mosier and Lewis, 1986).

Workings and Facilities:

Remnants of several generations of placer mining are still visible at Eightmile Creek. A cabin, lean-to, steam points, and several caches that contain suction dredge equipment are located within a mile of the mouth. Also, an overgrown airstrip (circa 1950s?) is located on the east side of the confluence with Bettles River.

Geologic Setting:

The bedrock at Eightmile Creek consists primarily of Ordovician to Cambrian calcareous schist with lesser amounts of marble, quartz-muscovite schist, graphitic schist, feldspar-quartz schist, and black phyllite. Near the headwaters, a Devonian biotite-granite gneiss and felsic schist are also mapped (Dillon and others, 1996).

Eightmile Creek consists of a schist canyon, which extends approximately 1 mile upstream from the mouth. The canyon walls rise up about 70 feet above the creek level. The pay is confined to the schist bedrock on the creek floor, which ranges from 30 to 40 feet in width. The gravel bed is 2 feet thick, and the first 3 feet of soft schist bedrock contain placer gold (Roehm, 1949).

Bureau Investigation:

A stream sediment sample and two pan concentrate samples were collected from bedrock 0.7 mile upstream of the creek mouth. One of the samples (11101, table C-1) contained 1,434 ppb gold and 80 ppm arsenic, but no visible gold. The two pan samples averaged 140 ppm zinc. No other anomalies were noted.

Resource Estimate:

Eightmile Creek has low mineral potential for placer gold. The creek has been mined extensively for placer gold and apparently little resource remains.

Mineral Development Potential:

Low potential for placer gold due to extensive past mining activity and limited gravel resources.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 54.

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Williams, J.A., 1950, Mining operations in Fairbanks district and Innoko and Koyukuk precincts (Chandalar) Alaska: Alaska Territorial Department of Mines Miscellaneous Report MR-194-13, p. 2.

Property Summary

Name(s): Garnet Creek
Garnet Creek 1-10 claims

Map No: C38
MAS No: 0020310042
Alaska Kardex 031-033
Alaska Kardex 031-034
ARDF CH071

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar C-5
SE¼ sec. 30, T. 32 N., R. 8 W.
Meridian: Fairbanks
Elevation: 1,690 feet
Latitude: 67° 33.675' N.
Longitude: 149° 24.670' W.
Geographic: A 5-mile-long, north-flowing tributary of the Bettles River, adjacent to Eightmile Creek. The site is on Doyon Ltd. land.

History:

1900-09 - Reported to have earned $7 to $9 per man per day (Maddren, 1913).

1922 - C.F. Moon staked placer claims.

1927 - Just before freeze-up, while water was at an exceptionally low stage, a considerable quantity of gold was panned from a channel of the Bettles River (Smith, 1930).

1938 - C. F. Moon used boom and shovel methods about 0.5 mile above the mouth (Reed, 1938).

1950 - F. Terrel was groundsluicing with poor returns (Williams, 1950).

1959 - Claims staked (Heiner, 1968).

1980-86 - Claims staked (Kardex).

Production: (oz Au) (Maddren, 1913; U.S. Bureau of Mines PIMRs, 1906-1940)

1901-09 - 48
1938 - 42
1939 - 12
1940 - 16
Total: 118 (Records incomplete.)

Average gold fineness: 872 (Reed, 1938) and 894 (Metz and Hawkins, 1981). Mosier and Lewis (1986) reported an average gold fineness of 856.3 for minus-35-mesh and 586.7 for plus-35-mesh. The coarse gold had elevated silver and mercury values.

Workings and Facilities:

The lower half a mile of Garnet Creek has been placer mined since the early 1900s. A plywood A-frame cabin, which postdates the 1974 U.S. Geological Survey topographic map, is located at the southeast corner of the confluence with Bettles River. Also, an old hauling system is located on the southwest side of the confluence.

Geologic Setting:

The bedrock at the mouth of Garnet Creek is Ordovician black phyllite and marble. Farther upstream it is Ordovician to Cambrian chloritic calcareous schist with minor marble and quartzite. A Devonian mafic metavolcanic unit has been mapped near the headwaters, on the ridge adjacent to Billy Glen Creek (Dillon and others, 1996).

The lower half a mile of the present creek channel has been placer mined in the past. The ground was reportedly valued between 20 to 77 cents (0.006-0.022 oz) per bedrock foot. The depth to bedrock ranges from 3 to 8 feet, and the gravel is waterworn with many large boulders. Gold is found in the lower 4 feet of gravel, but is concentrated mostly on top of bedrock. The gradient averages 3.5% with several short, sharp drops. Above the mined area, the creek flows through a narrow canyon with walls 50 to 100 feet high (Reed, 1938).

Reed (1938) also reported a high channel on Bettles River (map no. C39) quarter of a mile downstream of the confluence with Garnet Creek.

Bureau Investigation:

Stream sediment and pan concentrate samples (11102-11103) were collected from bedrock, near the mouth. Several test pans were also collected nearby. No gold was noted in any of the pans. None of the sample results were considered anomalous.

Resource Estimate: None.

Mineral Development Potential:

Low potential for placer gold due to lack of visible gold in samples.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 26.

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Smith, P.S., 1930, Mineral industry of Alaska in 1928, *in* Smith, P.S. and others, 1930, Mineral resources of Alaska, report on progress of investigations in 1928: U.S. Geological Survey Bulletin 813, p. 33.

U.S. Bureau of Mines, 1906-1940, Permanent Individual Mine Records (PIMR) for placer mines in Alaska: U.S. Bureau of Mines unpublished reports.

Williams, J.A., 1950, Mining operations in Fairbanks district and Innoko and Koyukuk precincts (Chandalar) Alaska: Alaska Territorial Department of Mines Miscellaneous Report MR-194-13, p. 3.

Property Summary

Name(s): Bettles River

Map No: C39
MAS No: 0020310131
Alaska Kardex 031-014
ARDF CH072

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar C-5
NE¼ sec. 31, T. 32 N., R. 8 W.
Meridian: Fairbanks
Elevation: 2,780 feet
Latitude: 67° 33.750' N.
Longitude: 149° 25.333' W.
Geographic: The discovery claim is about one quarter of a mile downstream from Garnet Creek, on Doyon Ltd. land.

History:

1901 - Prospecting on many of Bettles' River tributaries opened the drainage to mining.

1919 - J. Kelley, F. Howard, and J. Holzer sunk three holes to bedrock near the discovery claim (Fairbanks Daily News-Miner, 1919).

1927 - Just before freeze-up, while water was at an exceptionally low stage, a considerable quantity of gold was panned from a channel of the Bettles River (Smith, 1930).

1935 - Hiltner prospected the left limit (south side) flood plain of Bettles River about one quarter of a mile below the canyon (Reed, 1938).

1936-37 - C. F. Moon drift mined just upstream of the discovery claim (Reed, 1938).

1937-38 - The Terrel brothers drift mined a bench on the southern side of Bettles River, opposite the discovery claim (Reed, 1938).

1985 - Dillon (1987) reported active placer claims on Bettles River near the confluence with Mule and Garnet Creeks.

Production:

Almost all of the major tributaries of Bettles River have been prospected. Production has been recorded on Eightmile, Garnet, Mule, and Emory Creeks. Bettles River has no recorded production.

Workings and Facilities:

A substantial amount of drift mining has occurred on Bettles River downstream of Garnet Creek. C.F. Moon drift mined immediately south of the confluence. Also, the Terrel brothers sank shafts in the south-side benches, at elevations of 2240, 1905, 1870, and 1930 feet. Drift mining has been reported on benches on both sides of Bettles River (Reed, 1938).

An old airstrip (circa 1950s) is located at the confluence of Bettles River and Eightmile Creek. Approximately 3 miles downstream, at the Bob Johnson Lake outlet, an airstrip was used to service mining operations circa 1930.

Geologic Setting:

The bedrock along the Bettles River, from Mule Creek to Mathews River, is Ordovician black phyllite and marble, with lesser amounts of Ordovician to Cambrian(?) calcareous-quartz-chlorite schist and quartzite (Dillon and others, 1996).

The discovery claim on Bettles River is about one quarter of a mile below the mouth of Garnet Creek. Three holes to bedrock were sunk with depths of 7 feet, 14 feet, and 18 feet. Each hole reportedly had 4.5 feet of pay that averaged 15 cents to the pan. A 2-oz copper nugget was found in pay gravel (Fairbanks Daily News-Miner, 1919). The area was also drift mined. The reported depth to bedrock was from 14 to 16 feet, and the ground ran 50 cents per bedrock foot (Reed, 1938).

The Bettles River runs through 100-foot-high vertical schist walls. On the north side of the canyon, the schist walls are capped by vertical bluffs of cross-bedded sands and gravels about 100 feet high. On top of these deposits is a flat bench which extends downstream about a mile below Mathews River. Similar benches slope towards the canyon on the south side of Bettles River as well. The Terrel brothers sank several shafts into the south side upper benches (Reed, 1938).

Bureau Investigation:

Five samples were collected along Bettles River (table C-1). Pan concentrate samples collected from gravel bars near the confluence of Mule (11078) and Limestone Creeks (11098) contained 718 ppb and 2,247 ppb gold respectively. One very fine piece of gold was noted in sample 11098. Both results are considered anomalous and indicate that the river carries extremely fine flood gold

An unnamed tributary south of the schist canyon on the right limit was also investigated. A pan concentrate sample collected from gravel (12499) was not anomalous in gold.

Resource Estimate: None.

Mineral Development Potential:

Only extremely fine gold was detected during the investigation, which indicates low mineral development potential exists along the Bettles River.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250,000.

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Heiner, L.E., and Wolff, E.N., 1968, Final report, Mineral resources of northern Alaska: University of Alaska Mineral Industry Research Lab, Report 16, p. 47.

Maddren, A.G., 1910, The Koyukuk-Chandalar gold region *in* Brooks, A.E., Mineral resources of Alaska, report on progress of investigations in 1909: U.S. Geological Survey Bulletin 442, p. 310.

____1913, The Koyukuk-Chandalar region, Alaska: U.S. Geological Survey Bulletin 532, p. 104.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 44-45.

Smith, P.S., 1930, Mineral industry of Alaska in 1928, *in* Smith, P.S. and others, 1930, Mineral resources of Alaska, report on progress of investigations in 1928: U.S. Geological Survey Bulletin 813, p. 33.

____1938, Mineral resources of Alaska, report on progress of investigations in 1936: U.S. Geological Survey Bulletin 897A, p. 53-54.

____1942, Mineral resources of Alaska, report on progress of investigations in 1940: U.S. Geological Survey Bulletin, 933A, p. 47.

Property Summary

Name(s): Ready Bullion Creek

Map No: C40
MAS No: 0020310104
Alaska Kardex 031-113
Alaska Kardex 031-114
Alaska Kardex 031-115
Alaska Kardex 031-116
Alaska Kardex 031-117

Deposit Type: Placer

Commodities: Unknown

Location:

Quadrangle: Chandalar C-6
SW¼ sec. 5, T. 31 N., R. 9 W.
Meridian: Fairbanks
Elevation: 2100 feet
Latitude: 67° 32.324' N.
Longitude: 149° 36.398' W.
Geographic: A southern tributary of Bettles River, adjacent and parallel to Emery Creek. Access is via an all-terrain-vehicle (ATV) trail from the Dalton Highway, near the mouth of Gold Creek.

History:

1937 - No evidence of mining found (Reed, 1938).
1978 - Claims owned in area by several people (Kardex).

Production: No recorded production.

Workings and Facilities: None observed.

Geologic Setting:

Ready Bullion Creek does not cut bedrock, but bedrock units mapped nearby include Ordovician black phyllite and marble. The headwaters of Ready Bullion drain an area with bedrock that consists of Ordovician to Cambrian(?) marble, calcareous-chlorite schist, and quartzite (Dillon and Reifenstuhl, 1995).

Bureau Investigation:

A brief examination was made of the creek. A stream sediment and pan concentrate sample (11779, 11802, table C-1) were collected about 2.5 miles upstream, at elevation 2,100 feet. No gold or magnetite was noted in the pan. The analytical results are not considered anomalous.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential for placer gold due to lack of gold in creek.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Dillon, J.T., and Reifenstuhl, R.R., 1995, Geologic map of the Chandalar C-6 quadrangle southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 105, 1 sheet, scale 1:63,360.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 30-31.

Property Summary

Name(s): Emery Creek
Emory Creek
Sourdough Group

Map No: C41
MAS No: 0020310050
Alaska Kardex 031-032
ARDF CH078

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar C-6
NE¼ sec. 6, T. 31 N., R. 9 W.
Meridian: Fairbanks
Elevation: 1,900 feet
Latitude: 67° 32.146' N.
Longitude: 149° 38.787' W.
Geographic: Emery Creek is a tributary to Bettles River, 4 miles southeast of Sukakpak Mountain. Access is via an all-terrain-vehicle (ATV) trail from the Dalton Highway, near the mouth of Gold Creek.

History:

1900-09 - Maddren (1910) reported that $10,000 worth of gold was produced by 1909.

1936 - S. Rychlew staked 8 placer claims and prospected (Reed, 1938; Fairbanks Daily News-Miner, 1937).

1938 - Reed (1938) visited creek, but was unable to see evidence of previous mining.

1993-98 - C. Bell placer mined on Emery Creek.

Production: (oz Au) (Maddren, 1910; C. Bell written communication, 1997)

1900-09 - 484
1993-98 - 40
Total: 524

Workings and Facilities:

In 1937, S. Rychlew built a boom dam at the junction of an east-flowing tributary to Emery Creek at elevation 1,855 feet Emory Creek and was ready for a cleanup this spring. But runoff was too rapid, and he ran out of water (Fairbanks Daily News-Miner, 1937). Also, a cabin and mining equipment (circa 1990s) are located at upper Emery Creek.

Geologic Setting:

The bedrock at Emery Creek is Ordovician black to dark gray, pyritic and graphitic pelitic phyllite and schist with minor marble interlayers (Dillon and Reifenstuhl, 1995). Lacustrine clay also outcrops in upper benches along Emery Creek.

Bureau Investigation:

A stream sediment and pan concentrate sample (11079-11080, table C-1) were collected off bedrock about 2.5 miles above the creek mouth. Although minor pyrite was noted in the sample, there was no visible gold. Another pan concentrate sample (11081) was collected off a clay bench, slightly above the present stream. None of the analytical results were anomalous.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential exists at Emery Creek due to lack of gold in samples.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 23.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Dillon, J.T., and Reifenstuhl, R.R., 1995, Geologic map of the Chandalar C-6 quadrangle southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 105, 1 sheet, scale 1:63,360.

Fairbanks Daily News-Miner newspaper, Fairbanks, Alaska, July, 16, 1937.

Heiner, L.E., and Wolff, E.N., 1968, Final report, mineral resources of northern Alaska: Mineral Industry Research Laboratory, University of Alaska, Report 16, p. 48.

Maddren, A.G., 1910, The Koyukuk-Chandalar gold region *in* Brooks, A.E., Mineral resources of Alaska, report on progress of investigations in 1909: U.S. Geological Survey Bulletin 442, p. 292, 310.

____1913, The Koyukuk-Chandalar region, Alaska: U.S. Geological Survey Bulletin 532, p. 69, 104.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 30.

Property Summary

Name(s): Sukakpak Mountain Prospect
No Name Creek
Discovery Creek

Map No: C42
MAS No: 0020310071
ARDF No: CH076
Alaska Kardex 031-082
Alaska Kardex 031-083
Alaska Kardex 031-084
Alaska Kardex 031-085
Alaska Kardex 031-086

Deposit Type: Stibnite-gold veins

Commodities: Au, Sb

Location:
Quadrangle: Chandalar C-6
SE¼ sec. 15, T. 32 N., R. 10 W.
Meridian: Fairbanks
Elevation: 3,500 feet
Latitude: 67° 35.743' N.
Longitude: 149° 44.048' W.
Geographic: 0.7 mile south of the summit of Sukakpak Mountain (4,459 feet) and 1.4 miles east of the Dalton Highway. There is no road access to the prospect which lies within the inner Trans-Alaska Pipeline corridor and closed to mineral entry.

History:

1971 - Inner Trans-Alaska Pipeline corridor closed to mineral entry by Public Land Order 5150 as modified or amended.

1977 - Lode claims staked over veins on Sukakpak Mountain (Kardex). Claims invalid due to pipeline corridor closure.

Production: None.

Workings and Facilities:

A 2- by 6-foot prospect pit is located at 3,375 feet near the southwestern end of the upper vein exposure and there are indications of trenching on the lower vein at 2,550 feet.

Geologic Setting:

Rocks in the Sukakpak Mountain area are contained within the Hammond subterrane, one of a series of panels bounded by thrust faults of Late Jurassic to Early Cretaceous age. The thrust faulting is related to the Late Jurassic Brooks Range Orogeny and resulted in deformation and metamorphism of the Hammond terrane rocks. The core of Sukakpak Mountain is composed of marble of the Devonian Skajit Limestone which has been deformed into a nearly recumbent overturned syncline. On the south side of the mountain, post-Cretaceous high-angle faulting has placed the marble in faulted contact with Cambrian(?) muscovite-chlorite-quartz schist. Stibnite-gold-bearing quartz veins occur along the fault and in the adjacent marble (Dillon, 1982; Huber, 1988).

The veins contain two generations of quartz: an early, nearly barren quartz with traces of tetrahedrite and a later stibnite-gold-bearing quartz. In the later veins, gangue minerals consist of quartz and calcite. Metallic minerals consist of stibnite (coarsely crystalline at times), trace arsenopyrite, and gold. In places stibnite can comprise up to 50% of the vein. Gold occurs within both the quartz and stibnite as well as graphite-filled fractures within the veins. The gold occurs as cubes, wire, and flakes, which are very difficult to detect in hand specimens. Antimony oxides consisting of yellow stibiconite and red kermesite occur on weathered surfaces along with trace copper stain. The kermesite may have been previously reported as cinnabar (Dillon, 1982, p. 17). There are no indications of wallrock alteration. Banding in the veins indicates that fluids were emplaced through open-space filling during repeated periods of dilation. Slickensides and boudinage forms indicate post-emplacement movement along the fault. Stibnite blades are locally bent and brecciated which also indicates post-emplacement movement (Dillon, 1982; Huber, 1988).

Veins occur at two sites on the west side of Sukakpak Mountain. The main occurrence or "upper vein" is exposed at an elevation of 3,500 feet, just west of the ridge that extends south from the summit. The vein trends approximately N. 55° E. with dips ranging from steeply south to vertical. The longest continuous vein exposure is 120 feet with an average width of 2.2 feet. It is intermittently exposed for 570 feet along strike with widths varying from 1.7-7.5 feet. The vein is contained entirely within the marble, but parallel to the schist contact (figure C-6) (Huber, 1988).

A "lower mineralization" is 0.5 mile to the southwest along strike with the upper vein at an elevation of 2,550 feet. Here a 50-foot-long mineralized zone containing a quartz vein and veinlets is contained within a 350-foot-long quartz-rich zone that follows the same faulted contact as the main vein. Vein widths range from less than 1 inch to almost 2 feet. The mineralized quartz occurs within marble, but is probably within a few feet of the schist contact. Stibnite occurs sporadically in a quartz-carbonate gangue. The vein margins contain slickenslides. This indicates post-emplacement movement on the fault, which resulted in vein deformation. Strikes range from N. 70° E. to N. 70° W. and have a wide range of dips (Huber, 1988).

According to Dillon (1982, p. 14), the probable emplacement age of the veins is Albian (middle Cretaceous). Huber states that the age of the mineralization is unknown, but it can be no older than the end of the Brooks Range Orogeny metamorphic event in the Neocomian (Early Cretaceous). The veins were emplaced at temperatures from 150°C to 300°C (Huber, 1988, p. 69).

Huber (1988, p. 41-42) collected 11 samples at varying intervals along the strike length of the upper vein. These averaged 15.52 ppm (0.48 oz/ton) gold and 20.8% antimony. Vein width at the sample sites was not stated.

Bureau Investigation:

The geology of the upper vein was mapped, and samples were collected wherever possible (figure C-6). Due to the steep terrain, access to the vein for sampling was difficult in some places. Intermittent exposures make it difficult to determine vein continuity. Vein exposures measure up to 7.5 feet wide and are continuously exposed for up to 120 feet along strike. The western extension of the vein is covered by talus. Vein quartz float occurs up to and just over the top of the ridge to the east. The vein has an intermittent exposure length of 570 feet along strike. The occurrence may include one vein that was dismembered into a series of boudin-like lenses by post-emplacement deformation. The other possibility is that there may be a series of subparallel veins lying along the same fault.

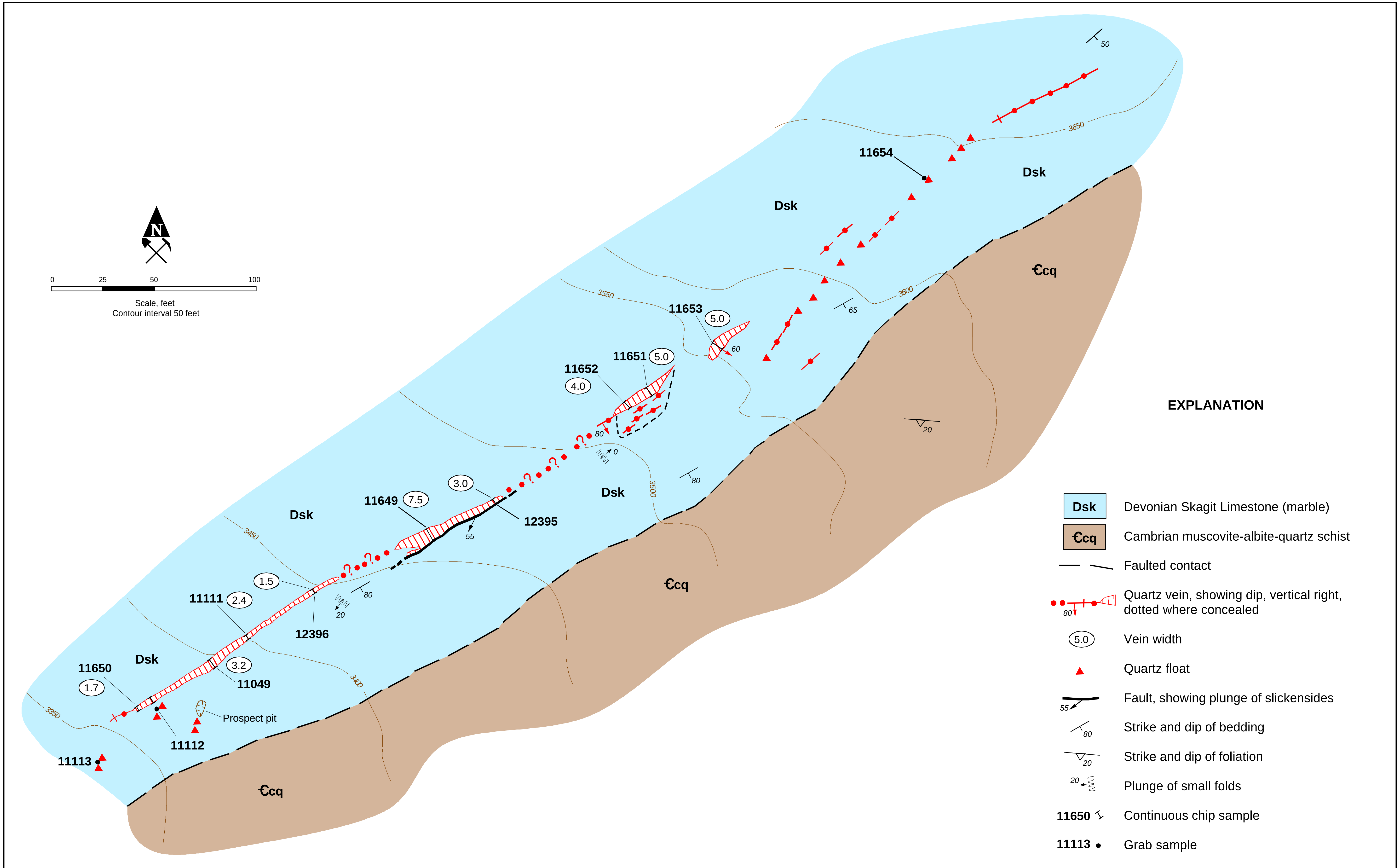

Figure C-6. Geology and sample location map of the Sukakpak Mountain Prospect.

A total of 9 continuous chip and 3 float samples were collected from the upper vein (11049, 11111, 11649-11653, 12395, 12396, table C-1). The chip samples average 39.59 ppm gold and 22.74% antimony. No visible gold was observed in any of the samples or hand specimens. Visible gold was detected in some specimens that were cut with a diamond saw. The gold was mostly associated with quartz.

The mineralization at the lower site was very spotty with little consistency along strike. A spaced-chip sample from a dismembered vein (12319) contains 25.13 ppm gold and 21.22% antimony. Geologists walked the faulted contact between the upper and lower veins, but saw no indications of mineralization.

Visible gold was associated with stibnite-bearing quartz float in the creek that drains the west end of the upper vein. A pan concentrate sample (12288) contains 2,396 ppb gold and 334 ppm antimony. This drainage has been worked for placer gold (map no. C43). An investigation of the drainage on the east side of the ridge resulted in the discovery of one piece of stibnite-bearing quartz float a short distance from the ridge crest. A stream sediment sample collected from the drainage (12424) contains 15 ppb gold and 54 ppm antimony.

Dillon (1982, p. 17) reported the veins are enriched in mercury and molybdenum. The highest values detected in BLM samples were 2.9 ppm mercury (11651) and 8 ppm molybdenum (11649).

Northwest-trending faults on Wiehl Mountain, 4.5 miles east of Sukakpak Mountain, are reported to be an eastward extension of the Sukakpak Mountain mineralized faults. These are also reported to contain stibnite-bearing quartz veinlets (Dillon, 1982; Huber, 1988). An aerial reconnaissance was made of the area, but no obvious quartz veining was spotted. A follow up ground search did not locate any veins. A ground traverse along the ridge south of Sukakpak Mountain did not result in the location of any mineralization.

Resource Estimate:

Inferred resource: 31,000 tons with weighted average grades of 39.35 ppm (1.22 oz/ton) gold and 18.44% antimony.

Mineral Development Potential:

Moderate development potential for lode gold as the site is currently closed to mineral entry. A small operation mining a few tons a day by underground or trenching may prove economic. The veins may be boudinaged, resulting in inconsistent widths and continuity.

Recommendations:

Continue prospecting in the Wiehl Mountain area outside the inner Pipeline corridor where mineral entry is open.

References:

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Property Summary

Name(s): Discovery Creek - Sukakpak Mountain
No Name Creek

Map No: C43
MAS No: 0020310072
ARDF CH077
Alaska Kardex 031-089
Alaska Kardex 031-090

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar C-6
SW¼ sec. 22, T. 32 N., R. 10 W.
Meridian: Fairbanks
Elevation: 1,650 feet
Latitude: 67° 35.343' N.
Longitude: 149° 44.706' W.
Geographic: A tributary of the Middle Fork Koyukuk River, located on the southwest side of Sukakpak Mountain. This site is within the inner Pipeline corridor and closed to mineral entry.

History:

1971 - Inner Trans-Alaska Pipeline corridor closed to mineral entry by Public Land Order 5150 as modified or amended.

1982 - Reports of suction dredging on creek (Dillon, 1982, p. 17-18).

Production: Unknown.

Workings and Facilities:

Sawn logs, probably remnants of an old boom dam, are located at the 2,060-foot level.

Geologic Setting:

Rocks in the Sukakpak Mountain area are contained within the Hammond subterrane, one of a series of panels, bounded by thrust faults of Late Jurassic to Early Cretaceous age. The thrust faulting is related to the Late Jurassic Brooks Range Orogeny and resulted in deformation and metamorphism of the Hammond Terrane rocks. The core of Sukakpak Mountain is composed of marble of the Devonian Skajit Limestone which has been deformed into a nearly recumbent overturned syncline. On the south side of the mountain, post-Cretaceous high-angle faulting has placed the marble in faulted contact with Cambrian(?) muscovite-chlorite-quartz schist. Stibnite-gold-bearing quartz veins occur along the fault and in the adjacent marble (map no. C42). The majority of these veins are at the headwaters of Discovery Creek and are the source of the placer gold found there. It is reported that a suction dredge was used to establish the presence of recoverable gold on the creek (Dillon, 1982, p. 17-18; Huber, 1988).

Bureau Investigation:

BLM geologists investigated the length of Discovery Creek. A pan concentrate (12288, table C-1) taken where the creek flows on muscovite-chlorite-quartz schist bedrock contains 2,396 ppb gold and 334 ppm antimony . Vein quartz float containing stibnite and visible gold was found at this same site. Old sawn logs found in a bedrock narrows at an elevation of 2,060 feet are probably the remains of a boom dam. A pan concentrate (12289) from this site contains 154 ppb gold.

Resource Estimate: None.

Mineral Development Potential:

Low development potential for placer gold in bedrock traps on the creek. The stream has a steep gradient and the gravel resource is small. The site is located within the inner Pipeline corridor and withdrawn from mineral entry.

Recommendations: None.

References:

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Property Summary

Name(s): Vi Creek
Dorothy 1-2 claims

Map No: C44
MAS No: 0020310113
Alaska Kardex 031-074

Deposit Type: Placer

Commodities: Au(?)

Location:
Quadrangle: Chandalar C-6
SE¼ sec. 1, T. 31 N., R. 11 W.
Meridian: Fairbanks
Elevation: 1,350 feet
Latitude: 67° 32.384' N.
Longitude: 149° 53.740' W.
Geographic: Located between the Middle Fork Koyukuk River and Jennie Creek Lake. The upper part of Vi Creek is within Gates of the Arctic National Park.

History:

1977 - R. Oberwitte staked one placer claim near the mouth of Vi Creek (Kardex).

Production: None.

Workings and Facilities: None observed.

Geologic Setting:

Vi Creek is a 9.5-mile-long drainage. About 1 mile upstream from the Koyukuk River, the creek runs through a bedrock narrows composed of Middle to Upper Devonian black slate and phyllite with lesser amounts of calcareous schist (Brosge and Reiser, 1964; Dillon and Reifenstuhl,1995).

Bureau Investigation:

Test pans were collected from bedrock and from underneath a boulder at the upper end of the narrows. No visible gold was observed in any of the four pans. Stream sediment and pan concentrate samples (11817, 11835, table C-1) contained no anomalous assay values. A piece of pyrite-bearing quartz float (11836) collected at the same site contained 130 ppm zinc and 173 ppm antimony. Sulfides were found in quartz veins near the headwaters of Vi Creek (map no. C8).

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential for placer gold due to lack of visible gold in samples.

Recommendations: None

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Dillon, J.T., and Reifenstuhl, R.R., 1995, Geologic map of the Chandalar C-6 quadrangle southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 105, 1 sheet, scale 1:63,360.

Property Summary

Name(s): Linda Creek
Compass Mining

Map No: C45
MAS No: 0020310003
ARDF CH081
Alaska Kardex 031-008
Alaska Kardex 031-050
Alaska Kardex 031-075 through -081
Alaska Kardex 031-123
Alaska Kardex 031-133 through -135
Alaska Kardex 031-137
Alaska Kardex 031-143

Deposit Type: Placer

Commodities: Au, Ag

Location:

Quadrangle: Chandalar C-6 — NE¼ sec. 17, T. 31 N., R. 10 W.
Meridian: Fairbanks — Elevation: 1,500 feet
Latitude: 67° 31.084' N. — Longitude: 149° 49.292' W.
Geographic: A 4-mile-long eastern tributary of the Middle Fork Koyukuk River, 1 mile north of Gold Creek. Mine workings and camp are accessible by road from the Dalton Highway.

History:

1901 - Gold discovered about half a mile upstream from mouth of creek (Maddren, 1913).
1903 - Approximately $18,000 mined by 1903 - operations were concentrated near discovery claim (Maddren, 1913).
1915 - Mining in winter as well as summer (Heiner and Wolff, 1968).
1934 - Placer claims staked by H. Christenson (Kardex).
1938 - A. Wilcox and F. Miller mined using simple hydraulic and hand methods. Placer claims staked by J. and F. Jonas (Reed, 1938; Heiner and Wolff, 1968).
1957 - Claims staked (Heiner and Wolff, 1968).
1962 - Claims staked and mining done by E. and M. Boese.
1975 - Hydraulic and bulldozer operations by E. Boese (Carnes, 1976).
1978-present - Surface and underground drift mining by J. and E. Hall.

Production: (oz Au)

1902 - 387	1937 - 117
1903 - 484	1938 - 140
1907 - 19	1965 - 42
1908 - 15	1966 - 16
1914 - 97	1967 - 27
1915 - 138	1998 - 125
1916 - 136	1999 - 326

Total: 2,069 (Records incomplete.)

Average gold fineness: 945 (Reed, 1938; J. Hall personal communication, 1997)

Workings and Facilities:

Early mining, consisting primarily of simple hydraulic and hand methods, concentrated on shallow bedrock below a major bend in Linda Creek. Underground drifting commenced at an unknown time and workings are extensive. At least five old shafts exist in the area.

Recent drift mining consists of two adits which connect underground and follow the buried channel for 360 feet upstream from the major bend in Linda Creek. A jackleg-type drill and explosives are used to drive headings forward along the pay channel in permanently frozen ground. Each round of drilling and blasting pulls about 5 feet of material. The channel is prospected mostly by test panning and with a metal detector. In addition further testing is done by running known volumes of muck obtained from drift headings through a sluice. The gold is recovered and an oz/cy value determined for that section of drift.

A load-haul diesel (LHD) and small underground dump truck are used to move the gold-bearing gravel to the surface via an 8- by 10-foot haulage way. The gravel is then run through a sluice near the adit portal. A camp with several log cabins is on the bluff on the north side of the creek.

Geologic Setting:

Where exposed, bedrock on lower Linda Creek consists of limonitic, partly calcareous, banded quartz siltstone and dull gray phyllite of the Middle and Upper Devonian Beaucoup Formation. The bedrock is mostly phyllite at the Linda Creek mine site, 0.8 mile upstream from the Koyukuk River. The remainder of the valley is filled with tundra-covered glacial deposits (Dillon and Reifensthul, 1995). Just below the mine, the stream changes abruptly from a roughly north-south to an east-west flow. This is probably the result of capture of the modern stream by an east-west-oriented deep, buried channel of ancestral Gold Creek.

Placer gold in the modern stream channel is limited to a 0.25-mile-long section of Linda Creek, beginning at and running downstream from the major creek bend. Here the depth to bedrock was about 8 feet, with gold occurring in the lower 3 feet of gravel and upper 2 feet of bedrock. The gold was reported to be fairly fine and averaging about 0.027 oz/cy. At about a quarter of a mile below the bend, the phyllite bedrock on which the creek flows reportedly drops off very steeply to an unknown depth. No gold values are reported below this point (Reed, 1938).

Early miners following pay up Linda Creek saw that the gold values dropped off above the major creek bend. Through prospecting efforts, they discovered that the source of the gold was a deep buried channel intersected by lower Linda Creek. Consequently, miners sank shafts into the deep channel and drift mined up to 800 feet above the bend (Reed, 1938).

Gravel deposits on the north wall of Gold Creek, 1.2 miles east, occupy a 50- by 300-foot bedrock depression. This may be the upper end of an ancestral high channel, before the creek was diverted into its present canyon. The strip of ground between the canyon rim and the gold-bearing deep channel (cut by Linda Creek) could be the same channel, previously cut by ancestral Gold Creek. There are no surface indications of this channel, other than a timberless strip of tundra lying between the two points. This could be a reflection of the frozen gravels beneath, which inhibited the growth of evergreens. The gold on Linda Creek is similar in character to that of Gold Creek (Madden, 1913).

The source of the gold on lower Linda Creek is probably a buried ancestral deep channel of Gold Creek that lies east of where Linda Creek makes an abrupt bend to the north. Above this point there are no reports of gold in payable quantities on Linda Creek. Consequently, the placer gold that currently exists at the site is believed to have been deposited from ancestral Gold Creek (Reed, 1938).

Drift mining since 1982 has followed the deep channel for about 300 feet east of the bend in Linda Creek Drifts from the main haulage way have explored the channel for a width of about 100 feet. Drifts to the north have intersected what appears to be the north rim of the channel while those to the south have not intersected a definite rim. The channel is filled with mostly poorly sorted cobble-boulder gravel with numerous 6-inch cobbles and rarely 4-foot boulders. Silty layers up to a few inches thick occur locally within the gravel and form the back of some of the underground workings. All the gravel in the channel is permanently frozen (J. Hall, personal communication, 2000).

Gold is concentrated in the lower 2.5 to 3.0 feet of gravel and 1.5 feet into the underlying phyllite bedrock. It appears that the pay is not confined to a single channel, but may actually be distributed throughout a system of shallow braided channels. Pay zones running as high as 1.0 oz/cy have been encountered (J. Hall, personal communication, 1998). Much of the gold occurs as flattened , smooth, rounded nuggets, which indicates that the gold has traveled some distance. Some sheet-like nuggets are as thin as 1 mm and appear to have been folded and doubled in thickness.

The largest nugget recovered by recent mining weighed 0.99 oz. Most of the gold is about the size of a match head with some the size of a fingernail. In 1999 mine production averaged 0.18 oz/cy gold (J. Hall, personal communication, 1998). The head of the underground workings are about 90 feet below the ground surface. Old shafts presumably intersected the same channel as far as 800 feet above the bend and the modern workings have intersected underground drifts related to these shafts (figure C-7).

Bureau Investigation:

The surface and underground workings were mapped and show advances through 2000 (figure C-7). A sluice concentrate (10697, table C-1) from the underground mine is anomalous in lead (>10,000 ppm), arsenic (6,366 ppm), tungsten (979 ppm), and tin (247 ppm). The high lead value is probably due to contamination from mining. The sample contained no magnetite.

In 1998 the underground workings of Linda Creek were surveyed using ground penetrating radar (GPR). The objective of the survey was to test GPR's ability to determine depth to bedrock in a controlled environment and possibly detect underground mine workings. The survey was started approximately midway between the two adit portals and runs uphill for 341 feet on a bearing of S. 87° E. Depth to bedrock varies from 29 feet on the west end to 107 feet at the east end of the profile.

A strong continuous reflector is evident across the entire profile starting at a depth of 82 feet at the east end of the line and at 56 feet at the west end. At the east end of the profile, the reflector appears too shallow to be bedrock and the presence of weaker reflectors at greater depth suggest more unconsolidated deposits underneath. The reflector is most likely one of the prevalent silt layers in the underground workings. No indications of underground workings were evident on the GPR profile, even though the survey line passed over an 8- by 10-foot drift at a depth of approximately 40 feet (Kurtak and others, 1999, p. 140-141).

Resource Estimate:

The potential for a large resource of gold-bearing gravel exists in the deep buried channel at Linda Creek. If the deep channel currently being followed by underground drifting is indeed an abandoned channel of Gold Creek, it has the potential to extend almost 1 mile east to the northern rim of Gold Creek. If a pay channel width of 100 feet is assumed to have a 4.5-foot-thick pay layer, then potential exists for an inferred resource of 2.4 million cubic yards of gold-bearing gravel. An average grade is difficult to determine as gold values are quite spotty. In addition, the extent of previous underground drifting upstream from the present workings will be a major factor in determining resources.

Mineral Development Potential:

Moderate development potential for placer gold in the deep buried channel of ancestral Gold Creek.

Recommendations:

Systematic drilling of the buried channel in advance of mining. Fences of rotary drill holes placed at intervals of about 100 feet could be used to determine the channel width and locate pay zones within it. An alternative would be to extend the present haulage way up the middle of the channel and drive crosscuts out to the channel rims at regular intervals. Testing of the gravel in the crosscuts would outline the pay streaks on the channel floor. The pay channels could then be mined by drifting between the crosscuts.

References:

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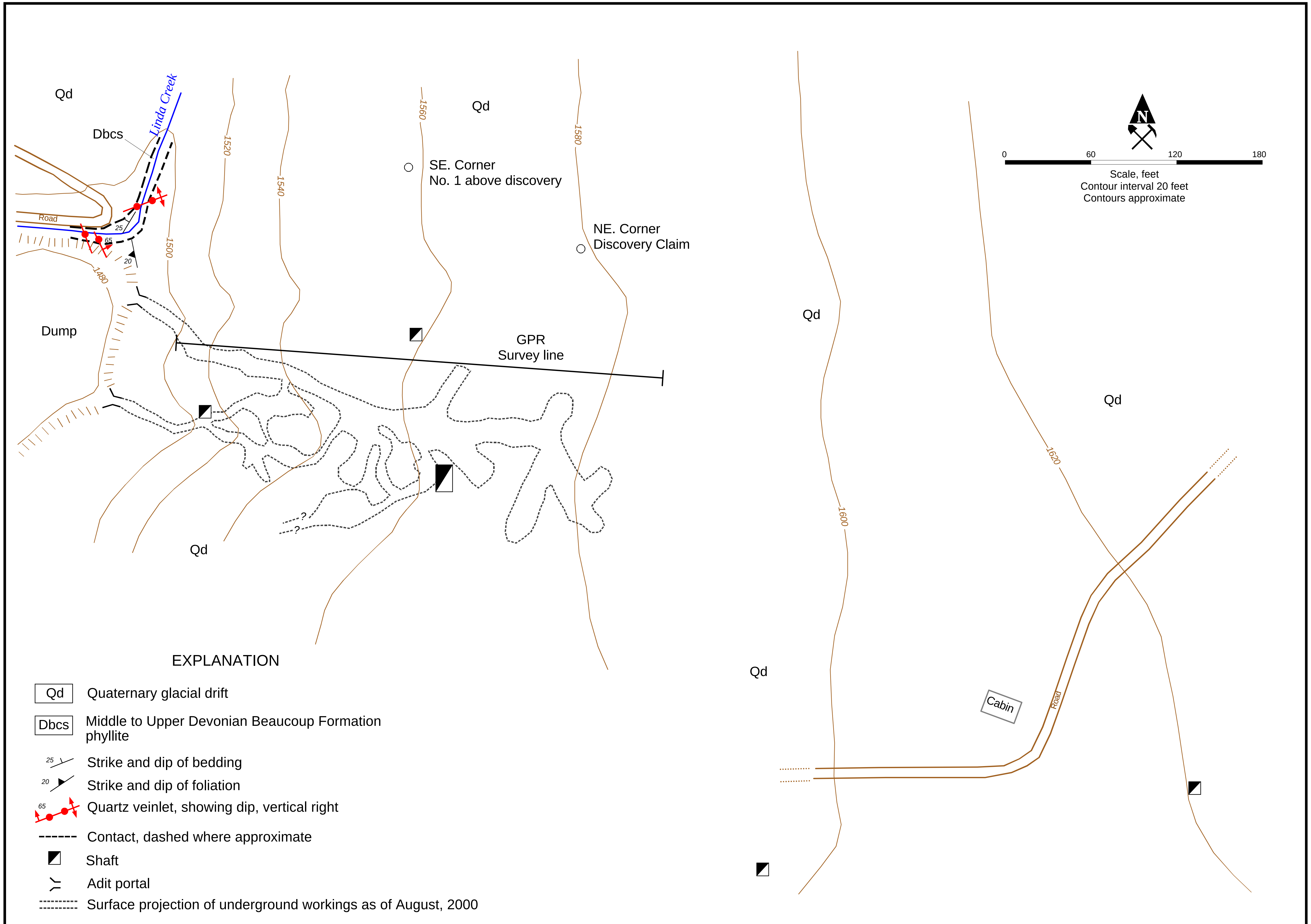

Figure C-7. Geology map of Linda Creek underground placer mine.

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Property Summary

Name(s): Sheep Creek - Middle Fork tributary
Small Change 1-2 claims

Map No: C46
MAS No: 0020310044
Alaska Kardex 031-029
ARDF CH029

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar B-6
S½ sec. 21, T. 31 N., R. 10 W.
Meridian: Fairbanks
Elevation: 2,100 feet
Latitude: 67° 29.543' N.
Longitude: 149° 47.556' W.
Geographic: A west-flowing tributary of the Middle Fork Koyukuk River, south of Gold Creek. Access is provided via an unpaved road off the Dalton Highway.

History:

1907 - Placer production is first recorded on Sheep Creek.

1933 - F. Miller found a 51-oz gold nugget on Sheep Creek. The nugget had some quartz attached. The origin of the nugget was later debated. Peter Dow and Denny O'Keefe testified that it came from Archibald Creek (map no. W94); however, Judge E. Coke Hill awarded the nugget to Miller (Fairbanks Dailey News-Miner, 1933).

1934-36 - F. Miller and associates drift mined at Sheep Creek (Reed, 1938; Smith, 1936).

1936 - F. Miller started booming and shoveling in the present channel, 1,000 feet above the confluence with the Middle Fork Koyukuk River (Reed, 1938).

1949 - F. Miller and sons mined the present channel, on the left limit, above the old drift workings, where the bedrock forms a hanging valley (Roehm, 1949).

2000 - Evidence of recent placer mining was observed.

Production: (oz Au) (Maddren, 1910; U.S. Bureau of Mines PIMRs)

1907 - 24	1936 - 42
1908 - 48	1939 - 25
1909 - 24	1940 - 84
1914 - 97	1941 - 81
1933 - 60	1942 - 141
1935 - 110	1948 - 44

Total: 780 (Records incomplete.)

Metz and Hawkins (1964) reported a gold fineness of 965. Mosier and Lewis (1986) reported an average fineness of 897.6 for minus-35-mesh and 909.8 for plus-35-mesh gold.

Workings and Facilities:

Several generations of mine workings and equipment exist at Sheep Creek. An old airstrip and two cabins are located in the flats, where Sheep Creek enters the Middle Fork Koyukuk River valley. Tailings piles are up to 30 feet high near elevation 1,500 feet; smaller tailings can be seen up to elevation 2,100 feet. Remains of boom dams, steam points, sluice boxes, bulldozers, and other mining equipment are concentrated near the canyon at 1,500 feet. In 2000, BLM geologists observed evidence of recent, small-scale placer mining.

Geologic Setting:

The headwaters of Sheep Creek is bisected by the Wiseman thrust fault, a regional fault system that trends roughly east-northeast. It juxtaposes Proterozoic(?) or Paleozoic(?) interbanded quartzite and graphitic schist over Devonian metasediments of the Beaucoup Formation. North of the fault, the bedrock includes chloritic siltstone, black slate, and phyllite. South of the fault, it consists mostly of interbanded quartzite and graphitic albite-chlorite-muscovite-quartz schist (Dillon and Reifenstuhl, 1995).

Mining was conducted along the modern creek channel and deep channels of Sheep Creek. The gradient for the mined portion of Sheep Creek averages 4% with steep canyon walls on both sides. Depth to bedrock is approximately 6 feet. The gravel in the modern channel is very coarse with many large boulders, including conglomerate glacial erratics. The estimated returns were 50 cents (0.015 oz) per bedrock foot; however, one select area payed $4 (0.12 oz) per bedrock foot (Maddren, 1913; Reed, 1938).

The deep channel lies on the right limit (north side) from the place where Sheep Creek opens into the Middle Fork Koyukuk River valley and extends upstream approximately 7,000 feet. Above this distance the deep channel gradually grades into the modern channel. It is probable that the deep channel extended into the Middle Fork valley for about another half a mile. At this place it may be cut off, as was the deep channel of Gold Creek, by a former glacier that occupied the Middle Fork valley. The value of the deep channel was reported to be $1 (0.03 oz) per bedrock foot (Reed, 1938).

Bureau Investigation:

Limited amounts of fine and coarse gold were found near the upper portion of the tailings. At this point, the creek runs over phyllite bedrock which strikes N. 30° E. and dips of 20° W. The schistosity of the phyllite forms perfect natural riffles. Coarse gold was panned off a 40-foot by 2-foot section of exposed bedrock. The pans were filled with broken bedrock, as limited gravel was available. A 2-pan composite sample (12440, table C-1) contained 257 ppm gold and 9.1 ppm silver. The gold was generally rounded, but some angular pieces were observed. Three other test pans collected near the area all contained fine gold: the best pan contained 6 very fine, 5 fine, and 2 coarse gold pieces.

Two other pan concentrates, collected at the upper (12439) and lower limits of the tailings (11258), averaged 328 ppm gold.

Resource Estimate: None.

Mineral Development Potential:

Moderate mineral development potential for placer gold exists at Sheep Creek, although the amount of undisturbed gravel resources is very limited.

Recommendations:

Investigate the possibility of the deep channel extending out into the Middle Fork Koyukuk River valley. A ground penetrating radar (GPR) survey could potentially reveal ancestral channel locations.

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Smith, P.S., 1936, Mineral industry of Alaska in 1934, *in* Smith, P.S., and others, Mineral resources of Alaska, report on progress of investigations in 1934: U.S. Geological Survey Bulletin 868A, p. 42.

____1937, Mineral resources of Alaska in 1935: U.S. Geological Survey Bulletin 880A, p. 45-46.

____1938, Mineral resources of Alaska in 1936: U.S. Geological Survey Bulletin 897A, p. 54.

U.S. Bureau of Mines, 1908-1945, Permanent Individual Mine Records (PIMR) for placer mines in Alaska: U.S. Bureau of Mines unpublished reports.

Property Summary

Name(s): Wolf Pup

Map No: C47
MAS No: 0020310093
Alaska Kardex 031-151

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar B-6
NW¼ sec. 28, T. 31 N., R. 10 W.
Meridian: Fairbanks
Elevation: 2,000 feet
Latitude: 67° 29.280' N.
Longitude: 149° 48.769' W.
Geographic: An eastern tributary to the Middle Fork Koyukuk River, 10 miles north of Wiseman.

History:

1979 - Two placer claims staked on Wolf Pup (Kardex).

Production: No recorded production.

Workings and Facilities:

Claim marker (circa 1970s) found near sample site. No evidence of previous mining observed.

Geologic Setting:

Wolf Pup is bisected by the Wiseman thrust fault, a regional fault system that trends roughly east-northeast. It juxtaposes Proterozoic(?) or Paleozoic(?) interbanded quartzite and graphitic schist over Devonian metasediments of the Beaucoup Formation. North of the fault, the bedrock is mapped as chloritic siltstone, black slate, and phyllite. South of the fault, it consists mostly of interbanded quartzite and graphitic albite-chlorite-muscovite-quartz schist (Dillon and Reifenstuhl, 1995).

Bureau Investigation:

Wolf Pup has limited amounts of gravel in the creek channel and does not appear to cut bedrock. Stream sediment and pan concentrate samples (11803-11804, table C-1) were not considered anomalous.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential due to lack of visible gold.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Dillon, J.T., and Reifenstuhl, R.R., 1995, Geologic map of the Chandalar B-6 quadrangle southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 103, 1 sheet, scale 1:63,360.

Property Summary

Name(s): Nugget Creek
BJ Association
Forgotten claims

Map No: C48
MAS No: 0020310148
Kardex 031-195
Kardex 031-208
Kardex 031-229

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar B-5
SW¼ sec. 32, T. 31 N., R. 10 W.
Meridian: Fairbanks
Elevation: 1,915 feet
Latitude: 67° 27.957' N.
Longitude: 149° 48.799' W.
Geographic: Nugget Creek is a 5-mile-long tributary of the Middle Fork Koyukuk River. It drains the northwest flanks of Poss Mountain. Its principal tributary is Victor Gulch. The site can be accessed from the Dalton Highway: a dirt road extends for almost 2 miles up Nugget Creek.

History:

Early 1900s - Reed (1938) reported fair prospects had been found and little mining had been conducted.
1981 - J. Christiansen and S. Jones staked 3 placer claims on Nugget Creek (Kardex).
1982 - L Brown staked 3 placer claims (Kardex).
1983 - J. Jolly staked 7 claims (Kardex).
1994-present - B. Dykes and J. Czerski own and operate placer claims.

Production:

No recorded production; however, there has been intermittent prospecting and mining for almost 100 years. Gravels in the present channel have produced up to $24 (~0.09 oz) per yard by suction dredging methods (B. Dykes, personal communication, 2000).

Workings and Facilities:

There is ample evidence of placer mining below the confluence of Victor Gulch and Nugget Creek, including a trench, tailings, sluice boxes, suction dredging equipment, and several cabins.

Geologic Setting:

Nugget Creek is bisected by the Wiseman thrust fault, a regional fault system that trends roughly east-northeast. It juxtaposes Proterozoic(?) or Paleozoic(?) interbanded quartzite and graphitic schist over Devonian metasediments of the Beaucoup Formation. The fault cuts through Nugget Creek about 2 miles above the mouth. The bedrock from this area up to the headwaters mostly consists of interbanded quartzite and graphitic albite-chlorite-muscovite-quartz schist (Dillon and Reifenstuhl, 1995). The formation forms steep canyons in both creeks.

Bureau Investigation:

The length of Nugget Creek was investigated. Depth to bedrock is extremely shallow (less than 3 feet) for much of the creek length. Just above the confluence with Victor Gulch, pan samples from bedrock (11777, 11778, 12310, table C-1) contained up to 84.77 ppm gold and 33.8 ppm silver. A 0.1-cubic-yard placer sample (11805) collected at the same site contained 0.224 oz/cy gold, 0.3 ppm silver, and 180 ppm arsenic. Well-rounded gold pieces, moderate pyrite, and trace magnetite were observed in the pan samples.

A pan concentrate sample collected from bedrock approximately 1.5 miles farther upstream (12306) contained 357 ppb gold. Pyrite was observed in the pan, but no gold. At the same site, a float sample of calcareous-quartz rock with pyrrhotite stringers (12307) contained 0.67% arsenic, but only 18 ppb gold.

Stream sediment and pan concentrate samples were also collected from Victor Gulch, just downstream of the canyon. The pan concentrate sample (11775) contained minor rusty pyrite, but no visible gold. Analytical results from the samples were not anomalous.

Resource Estimate: None.

Mineral Development Potential:

Moderate mineral development potential exists at Nugget Creek due to the presence of coarse placer gold and gravel resources.

Recommendations: None.

References:

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 53.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Dillon, J.T., and Reifenstuhl, R.R., 1995, Geologic map of the Chandalar B-6 quadrangle southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 103, 1 sheet, scale 1:63,360.

Mulligan, J.J., 1974, Mineral resources of the Trans-Alaska Pipeline corridor: U.S. Bureau of Mines Information Circular 8626, p. 6.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 30.

Property Summary

Name(s): Magnet Creek
Magnet claims

Map No: C49
MAS No: 0020310052
Alaska Kardex 031-028
Alaska Kardex 031-065
ARDF CH079

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar C-6
SW¼ sec. 14, T. 31 N., R. 10 W.
Meridian: Fairbanks
Elevation: 2,560 feet
Latitude: 67° 29.680' N.
Longitude: 149° 43.916' W.
Geographic: A 2.5-mile-long southern tributary to Gold Creek, accessible via an all-terrain-vehicle (ATV) trail from the Dalton Highway.

History:

1900 - Gold discovered on Gold Creek upstream of Magnet Creek (Reed, 1938).
Pre-1938 - High channel between Gold and Magnet Creeks worked (Reed, 1938).
1973-77 - H. Leonard owned claims on creek (Kardex).
1975-79 - Crown Mining and Minerals owned 83 placer claims on creek (Kardex).
1998-99- R. Wright filed mining plan under RTD Mining (R. Wright, written communication, 1998).

Production: No recorded production.

Workings and Facilities:

Opencut mining was reportedly done at the mouth of this creek, but no indications of old workings or tailings were observed. These may have been wiped out by flooding. There is a camp with cabin, cache, and other buildings near the mouth of the creek. A high channel about 50 feet above the modern channel was reportedly mined for about 500 or 600 feet between Gold and Magnet Creeks (Reed, 1938).

Geologic Setting:

Bedrock on lower Magnet Creek is predominantly phyllite and siltstone These rocks are in thrust-fault contact with schist and schistose quartzite that underlies the upper portion of the creek. A sliver of quartzite conglomerate lies along the fault contact. These rocks have been described as part of the Middle Devonian Beaucoup Formation (Brosge and Reiser, 1964; Dillon and others, 1995a,b). The upper portion of the west fork of Magnet Creek flows on bedrock that becomes less frequent downstream near the forks.

Bureau Investigation:

Geologists walked the lower portion of Magnet Creek and where possible took test pans off bedrock. A pan concentrate sample (12313, table C-1) collected a quarter of a mile above the confluence of Magnet and Gold Creeks contains 318 ppb gold. Stream sediment and pan concentrate samples were collected from both the east fork (12314-12315) and the west fork (12316-12317) about half a mile upstream from the creek mouth. The concentrate sample from the east fork (12315) contains 5.57 ppm gold. Bedrock was not seen on this fork. On the west fork, the creek flows sporadically over bedrock, and some large boulders are present. A pan concentrate sample (12317) collected from behind a boulder contained 245 ppb gold. At a point 1.6 miles upstream from the mouth and on the west fork, vertically fractured quartz-muscovite schist bedrock contained small flakes of placer gold. Some flakes could be plucked from the bedrock by hand (11341-11342). A pan concentrate sample (11342) contains 267.41 ppm gold with visible coarse flakes of gold in the pan. A barren vertical quartz vein at this site trends S. 80° W.

Resource Estimate: Unknown.

Mineral Development Potential:

This creek has moderate development potential. Even though placer gold was found at several locations, it was mostly confined to bedrock fractures and not found in the overlying gravels. Thus mineable resources may be limited.

Recommendations:

Dig small-scale test pits to evaluate the bedrock and overlying gravels, especially on the east fork. Suction dredging could possibly be used to mine gold from fractured bedrock.

References:

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 45.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Grybeck, D., 1977a, Known mineral deposits of the Brooks Range, Alaska: U.S. Geological Survey Open-File Report 77-166C, p. 33.

Mulligan, J.J., 1974, Mineral resources of the Trans-Alaska Pipeline corridor: U.S. Bureau of Mines Information Circular 8626, p. 16.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 28.

Property Summary

Name(s): Gold Creek
Betty claims
Gold III claim
Mary Ann claims
Theodore Allen Pup
Webster claim
Wright Creek
Big Rock claim
Magnet claims

Map No: C50
MAS No: 0020310051
ARDF CH080
Alaska Kardex 031-030
Alaska Kardex 031-066
Alaska Kardex 031-088
Alaska Kardex 031-091 to 092
Alaska Kardex 031-099 to 104
Alaska Kardex 031-131 to 132
Alaska Kardex 031-398

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar C-6
NE¼ sec. 14, T. 31 N., R. 10 W.
Meridian: Fairbanks
Elevation: 1,300-2,650 feet
Latitude: 67° 31.083' N.
Longitude: 149° 42.417' W.
Geographic: A 9.5-mile-long eastern tributary to the Middle Fork Koyukuk River, 12 miles north of Wiseman. Gold Creek is accessible via an all-terrain-vehicle (ATV) trail from the Dalton Highway.

History:

1900 - Pay gravels discovered on Gold Creek. Schrader (1900) reported that the ground was "all staked."

1902 - One claim site reported washing out $12,000 worth of gold in ten days (Schrader, 1900).

1914 - Brooks (1915) reported five mines operating in the winter and four in the summer.

1921-25 - High channel above Magnet Creek mined by H. Christenson (Reed, 1938).

1925-29 - G. Maglass and A. Ness "thoroughly explored" a deep channel opposite Claim No. 3 Below Discovery (Reed, 1938).

1935-36 - H. Leonard drift mined 1 mile upstream from Magnet creek (Reed, 1938).

1937 - Reed (1938) reported C. and J. Horner, R. Creecy, and H. Leonard mining at three placer operations in the present channel of Gold Creek. Miller, A. Wilcox, and E. Collins were reported to be drifting about 100 feet below the Linda Creek side of the divide.

1940 - Tractor reported to be operating on Gold Creek (Fairbanks Daily News-Miner, 1940).

1997-2001 - B. Anderson mining below Magnet Creek.

2000-01 - J. Olmsted mining below forks on upper Gold Creek.

Production: (oz Au)

1900 - 97	1909 - 145	1925 - 20	1936 - 18
1901 - 2,414	1911 - 2	1926 - 41	1937 - 14
1902 - 1,450	1912 - 450	1927 - 24	1938 - 27
1903 - 3,387	1913 - 487	1928 - 40	1939 - 18
1904 - 2,176	1916 - 386	1929 - 8	1940 - 49
1905 - 1,163	1921 - 63	1931 - 31	1941 - 33
1906 - 145	1922 - 16	1932 - 8	1942 - 588
1907 - 7	1923 - 19	1933 - 3	1948 - 806
1908 - 164	1924 - 16	1935 - 34	

Total: 14,349
(Records incomplete.)

Average gold fineness: 890 (Metz and Hawkins, 1981). Reed (1938) reported that fineness ranged from 900 to 931. B. Anderson (personal communication, 1997) reported that gold fineness near Discovery Gulch averaged 934.

Workings and Facilities:

Gold Creek was one of the first streams to be mined in the upper Koyukuk River country, and activity has continued up to the present day. Most of the mining has concentrated between 2 and 6 miles upstream from the Dalton Highway. Considerable reclaimed placer tailings are present, and cabins and mining equipment are scattered along the drainage. In 2000 there were mining operations 0.3 mile downstream of Magnet Creek and just below the major forks near the creek headwaters. Placer ground 0.4 mile downstream from Magnet Creek has been evaluated with a track-mounted drill (B. Anderson, personal communication, 2000).

Geologic Setting:

Bedrock underlying Gold Creek is predominantly phyllite, slate, siltstone and conglomerate of the Middle Devonian Beaucoup Formation. Several northeast-trending thrust faults cut across the creek. A small body of Devonian schistose diorite (metabasite) is exposed on the north side of the creek, 0.4 mile upstream of Magnet Creek. The resistant diorite causes the stream valley to narrow to a gorge for about 200 feet (Reed, 1938; Dillon and others, 1995; Brosge and Reiser, 1964).

The lower 2 miles of ancestral lower Gold Creek flowed at an elevation 200 feet higher and to the north of the present channel. Ice advance probably shifted the creek south, where it downcut its present channel. The ancestral channel, which was subsequently buried by glacial drift, is probably the source of the gold being drift mined on lower Linda Creek (map no. C45) (Maddren, 1913).

The channel of Gold Creek has been mined for nearly its entire length, except the lower 2 miles on the flood plain of the Middle Fork. The stream has cut a trench in the bedrock along the south valley wall and contains high, modern, and deeply buried channels. The modern channel is reported to have been mined for a distance of 8 miles with sporadic gold values. The best pay is on bedrock, which is exposed in the narrow portions of the creek. The depth to bedrock varies from 2 to 7 feet. The gravel is coarse and waterworn, with many boulders. Values ranged from 0.007 to 0.04 oz/bedrock foot. The richest ground was in the vicinity of the narrows where the diorite is exposed just upstream from Magnet Creek. This is also the site of the discovery claim. Highest values in the modern channel below Magnet Creek were concentrated around diorite boulders with the pay zone in the lower 1.5 feet of gravel on bedrock. Removal of the boulders slowed mining operations (Maddren, 1913; Reed, 1938; B. Anderson, personal communication, 2000).

Gold-bearing high channels appear to be confined to the north and east (right limit) sides of the creek. The high channel, 1.5 miles upstream from Magnet Creek, is about 8 feet above the modern channel. Depth to bedrock varies from 3 to 50 feet. Results of hand mining in this channel averaged 0.01 oz/bedrock foot. Below Magnet Creek, benches on the north side contained from 0.04 to 0.07 oz/cy gold, with 5 feet of overburden (Reed, 1938; B. Anderson, personal communication, 2000)

The location of the deep channel appears to vary from the right to left limit of the stream valley. It has been mined 0.3 mile below Magnet Creek where it varies from 50 to 100 feet beneath the surface. In this area the channel widths vary from 25 to 100 feet. The pay zone runs from 12 to 15 feet wide, with values of 0.04 oz/bedrock foot. The gold from this site is reported to be 90% plus-12-mesh size, and the concentrates contain very little magnetic black sand. The largest nugget recovered was 3.5 oz. It has been speculated that the bedrock source of the placer gold is the phyllite schist in the vicinity of the diorite dike. Pebbles and angular fragments of stibnite containing quartz stringers have been found in the pay gravel on Gold Creek (Maddren, 1913; Reed, 1938; B. Anderson, personal communication, 2000).

Gold on the upper portion of the creek, just below the major forks near the creek headwaters, is reported to be ragged with quartz attached. Gold values there reportedly averaged 975 fine (J. Olmsted, personal communication, 2000).

Bureau Investigation:

Geologists walked the upper 5.5 miles of Gold Creek, took numerous test pans, and collected sluice concentrate samples from miners. Sluice concentrate samples were collected from mining operations at three locations: downstream of Magnet Creek (11293, 12283, table C-1), 2.5 miles upstream of Magnet Creek (11294), and from just below the forks near the creek headwaters (11405). Sample 12283 contains 90 ppm bismuth and 407 ppm arsenic. Sample 11405 contains 2,570 ppm arsenic, 95 ppm antimony, and 1,066 ppm tungsten. Although stibnite is reported to occur in Gold Creek placers (Schrader, 1904), this is the highest antimony value obtained by the BLM. Rounded grains of scheelite up to 3 mm in size were identified in this concentrate. A pan concentrate (12427) collected from the western tributary at the forks near the Gold Creek headwaters did not contain visible gold, but analysis showed the sample contains 36.03 ppm gold. Pans taken off bedrock and behind boulders in the creek narrows, 1.2 miles upstream from Magnet Creek, contain coarse gold (12430).

A sample of the diorite dike (10740), collected upstream from Magnet Creek, contains 60 ppm copper and 71 ppm nickel.

Resource Estimate: None.

Mineral Development Potential:

Except for a few sites, Gold Creek appears to be mostly worked out. Moderate potential exists near the creek headwaters where small mechanized operations could pick up gold left on channel rims by previous hand mining operations. Moderate potential also exists on some benches on the north side of Gold Creek, downstream from Magnet Creek.

Recommendations:

Prospect western tributary above forks near Gold Creek headwaters.

References:

Brooks, A.H., and others, 1908, Mineral resources of Alaska, report on progress of investigations in 1907: U.S. Geological Survey Bulletin 345, p. 45.

____1915, Mineral resources of Alaska, report on progress of investigations in 1914: U.S. Geological Survey Bulletin 622, p. 59.

____1916a, Mineral resources of Alaska, report on progress of investigations in 1915: U.S. Geological Survey Bulletin 642, p. 64-65.

____1916b, Antimony deposits of Alaska: U.S. Geological Survey Bulletin 649, p. 64.

____1918, Mineral resources of Alaska, report on progress of investigations in 1916: U.S. Geological Survey Bulletin 662, p. 59.

Brosge, W.P., and Reiser, H.N.,1972, Geochemical reconnaissance in the Wiseman and Chandalar districts and adjacent region, southern Brooks Range, Alaska: U.S. Geological Survey Professional Paper 709, p. 12.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 30.

Dillon, J.T., and Reifenstuhl, R.R., 1995, Geologic map of the Chandalar C-6 quadrangle southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 105, 1 sheet, scale 1:63,360.

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Grybeck, D., 1977, Known mineral deposits of the Brooks Range, Alaska: U.S. Geological Survey Open-File Report 77-166C, p. 33.

Heiner, L.E., and Wolff, E.N., 1968, Final report, mineral resources of northern Alaska: Mineral Industry Research Laboratory, University of Alaska, Report 16, p. 48.

Joesting, H.R., 1942, Strategic mineral occurrences in interior Alaska: Alaska Department of Mines Pamphlet no. 1, p. 14.

Maddren, A.G., 1910, The Koyukuk-Chandalar gold region *in* Brooks, A.E., Mineral resources of Alaska, report on progress of investigations in 1909: U.S. Geological Survey Bulletin 442, p. 292, 307-308.

____1913, The Koyukuk-Chandalar region, Alaska: U.S. Geological Survey Bulletin 532, p. 69, 99-102.

Metz, P.A., and Hawkins, D.B., 1981, A summary of gold fineness values from Alaska placer deposits: Mineral Industry Research Laboratory, University of Alaska, Report 45, p. 36-37.

Mulligan, J.J., 1974, Mineral resources of the Trans-Alaska Pipeline corridor: U.S. Bureau of Mines Information Circular 8626, p. 6.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 23-26.

Schrader, F.C., 1900, Preliminary report on a reconnaissance along the Chandalar and Koyukuk Rivers, Alaska in 1899: Twenty-first annual report of the U.S. Geological Survey Part 2, p. 486.

____1904, A reconnaissance in northern Alaska across the Rocky Mountains, along the Koyukuk, John, Anaktuvuk, and Colville Rivers and the Arctic coast to Cape Lisburne, in 1901: U.S. Geological Survey Professional Paper 20, p. 102, 105.

Smith, P.S., 1934a, Mineral industry of Alaska in 1931, *in* Smith, P.S. and others, 1934, Mineral resources of Alaska, report of progress of investigations in 1931: U.S. Geological Survey Bulletin 844, p. 39.

____1934b, Mineral industry of Alaska in 1933, *in* Smith, P.S. and others, 1934, Mineral resources of Alaska, report on progress of investigations in 1933: U.S. Geological Survey Bulletin 864A, p. 39.

____1936, Mineral industry of Alaska in 1934, *in* Smith, P.S. and others, 1936, Mineral resources of Alaska, report on progress of investigations in 1934: U.S. Geological Survey Bulletin 868A, p. 42.

____1939a, Mineral resources of Alaska in 1937: U.S. Geological Survey Bulletin 910A, p. 56.

____1939b, Mineral resources of Alaska in 1938: U.S. Geological Survey Bulletin 917A, p. 55.

Property Summary

Name(s): Canyon Creek
Go for broke claims
Ursula prospect

Map No: C51
MAS No: 0020310115
Alaska Kardex 031-124
Alaska Kardex 031-130

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar C-6
NE¼ sec. 17, T. 31 N., R. 9 W.
Meridian: Fairbanks
Elevation: 2,500 feet
Latitude: 67° 31.170' N.
Longitude: 149° 36.348' W.
Geographic: Canyon Creek is a 3-mile-long western tributary of Glacier Creek, located 1 mile southwest of Glacier Lake. Access is via an all-terrain-vehicle (ATV) trail from the Dalton Highway, near the mouth Gold Creek.

History:

1938 - Reed (1938) reported no evidence of mining or prospecting.
1978 - Three placer claims staked on a Glacier Creek tributary (Kardex).
1982-83 - E. Robinson and sons staked a placer claim on Canyon Creek (Kardex).
1985 - Dillon (1987) reported active placer operation.
2000 - C. Smith mined placer gravels on Canyon Creek.

Production: No recorded production.

Workings and Facilities: Hand-sluicing equipment was found.

Geologic Setting:

The Wiseman thrust fault, a regional fault system that trends roughly east-northeast, cuts through the headwaters of Canyon Creek. The fault juxtaposes Proterozoic(?) or Paleozoic(?) interbanded quartzite and graphitic schist over Devonian metasediments of the Beaucoup Formation. Most of Canyon Creek lies north of the fault where bedrock is predominantly Devonian chloritic siltsone and phyllite with minor choritic quartzite, marble, and conglomerate (Dillon and Reifenstuhl, 1995a, 1995b).

Bureau Investigation:

A soil and pan concentrate sample were collected above the current placer operation near the narrows. The water was running high, and consequently, the pan sample could not be collected from bedrock. The pan sample (11827, table C-1) contained pyrite but no visible gold. (Unfortunately, the sample was lost at the laboratory before it could be analyzed for gold.) Other results for the two samples are not considered anomalous.

Resource Estimate: None.

Mineral Development Potential:

There is low mineral development potential for placer gold due to lack of gold in the sample.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Dillon, J.T., 1987, Upper Koyukuk district land and mining claim status current to 1985: Alaska Division of Geological and Geophysical Surveys Public Data File 87-11, 25 p., 1 sheet, scale 1:125,000.

Dillon, J.T., and Reifenstuhl, 1995a, Geologic map of the Chandalar B-6 quadrangle southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 103, 1 sheet, scale 1:63,360.

____1995b, Geologic map of the Chandalar C-6 quadrangle southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 105, 1 sheet, scale 1:63,360.

Property Summary

Name(s): Last Chance Creek
Tasseraluk

Map No: C52
MAS No: 0020310099
Alaska Kardex 031-055A
ARDF CH073

Deposit Type: Placer

Commodities: Au

Location:
Quadrangle: Chandalar C-6
SE¼ sec. 15, T. 31 N., R. 9 W.
Meridian: Fairbanks
Elevation: 2,600 feet
Latitude: 67° 30.710' N.
Longitude: 149° 30.808' W.
Geographic: An east-flowing tributary of Bob Johnson Lake, on the north end of the lake.

History:

1918 - O. Johnson and B. Redman reportedly sank a shaft (Reed, 1938).
1937 - F. Lessard prospected in the area (Reed, 1938).
1969 - S. Wright staked 11 placer claims in the area (Kardex).

Production: None.

Workings and Facilities: None.

Geologic Setting:

The bedrock at the headwaters of Last Chance Creek is lower Paleozoic calcareous-chlorite-quartz schist, with minor interlayers of marble and quartzite (Brosge and Reiser, 1964; Dillon and others, 1996). There is very little bedrock exposed in the drainage.

A shaft was sunk about 100 feet deep. It is not known if bedrock was reached, but the results were not encouraging (Reed, 1938).

Bureau Investigation:

The creek cuts bedrock only in the uppermost reaches of the basin, which was dry at the time of the investigation. A stream sediment and pan concentrate sample (11198-11199, table C-1) were collected about 1.5 miles upstream of the creek mouth - the uppermost point on the creek with running water. No sulfides or gold was observed in the pan. The sample results were not anomalous.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential for placer gold due to lack of anomalous results.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Dillon, J.T., and Reifenstuhl, R.R., 1995, Geologic map of the Chandalar C-6 quadrangle southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 105, 1 sheet, scale 1:63,360.

Dillon, J.T., Reifenstuhl, R.R., and Harris, G.W., 1996, Geologic map of the Chandalar C-5 quadrangle, southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 104, 2 sheets, scale 1:63,360.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 40.

Property Summary

Name(s): Glacier Creek Tributary
Eden Creek
Shoppy Creek

Map No: C53
MAS No: 0020310108
Alaska Kardex 031-124
Alaska Kardex 031-125
ADL 546521

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar B-6
NE¼ sec. 29, T. 31 N., R. 9 W.
Meridian: Fairbanks
Elevation: 2,500 feet
Latitude: 67° 28.790' N.
Longitude: 149° 35.213' W.
Geographic: A 3-mile-long western tributary of Glacier River, between Bore and Eider Creeks. Access is via an all-terrain-vehicle (ATV) trail from the Dalton Highway, near the mouth of Gold Creek.

History:

Pre-1938 - Several shafts were sunk by O. Stromdal and C. Youngberg; however, no prospects were reported (Reed, 1938).
1978 - Three placer claims staked on a Glacier Creek tributary (Kardex).
1985 - Dillon (1987) reported two inactive claims on the Glacier Creek tributary.
1998-present - W. Schoppenhorst placer mining on creek.

Production: None.

Workings and Facilities:

Several shafts were sunk on the Glacier Creek tributary. One was about 0.75 mile upstream from the mouth; another was 1.5 miles upstream. The upper hole was 55 feet deep, and water was reached. The depths of the other holes are unknown. No gold was reported in any of the shafts (Reed, 1938).

The current mining operation is using a suction dredge in the present creek channel.

Geologic Setting:

The Glacier River tributary is located immediately south of the Wiseman thrust fault which is a regional fault system trending roughly east-northeast. It juxtaposes Proterozoic(?) or Paleozoic(?) interbanded quartzite and graphitic schist over Devonian metasediments of the Beaucoup Formation. The bedrock on the creek mostly consists of interbanded quartzite and graphitic albite-chlorite-muscovite-quartz schist. The bands probably represent metamorphosed quartzose and pelitic sediments. Several glacial episodes have left poorly sorted silts, sand, and gravel (Dillon and Reifenstuhl, 1995).

Bureau Investigation:

A stream sediment and pan concentrate sample (11255-11256, table C-1) were collected off black quartz-mica schist bedrock, immediately upstream from the current placer operations. The sample results are not anomalous in precious metals.

Resource Estimate: None.

Mineral Development Potential:

Sampling by the BLM indicates low mineral development potential for placer gold. (Operator of the current placer operation was not present at the time of the investigation.)

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Dillon, J.T., 1987, Upper Koyukuk district land and mining claim status current to 1985: Alaska Division of Geological and Geophysical Surveys Public Data File 87-11, 25 p., 1 sheet, scale 1:125,000.

Dillon, J.T., and Reifenstuhl, R.R., 1995, Geologic map of the Chandalar B-6 quadrangle southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 103, 1 sheet, scale 1:63,360.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 31-32.

Property Summary

Name(s): Bore Creek
Boer Creek
Boar Creek
Boulder Patch no.1-5 claims

Map No: C54
MAS No: 0020310049
Alaska Kardex 031-031
Alaska Kardex 031-106
ARDF CH027

Deposit Type: Placer

Commodities: Au

Location:
Quadrangle: Chandalar B-6
NE¼ sec. 4, T. 30 N., R. 9 W.
Meridian: Fairbanks
Elevation: 2,280 feet
Latitude: 67° 27.779' N.
Longitude: 149° 34.153' W.
Geographic: A 6-mile-long western tributary of Glacier Creek, draining the eastern side of Poss Mountain.

History:

1901 - Gold discovered on California Creek and two of its larger tributaries - Jim Pup and Bore Creeks (Maddren, 1913).

1901-09 - Shovel and sluice operations reportedly carried out; however, the production never exceeded more than the prevailing wages in the Koyukuk district (Maddren, 1913).

1938 - Reed (1938) found no evidence of previous mining activities. Local miners report several shafts were sunk "in the early days," but no pay was found.

1959 - P. Carr prospected on Bore Creek, reported no discoveries of importance (Saunders, 1959).

1977-78 - E. Stovall staked eight placer claims (Kardex).

2001 - R. and L. Bell test placers on Boulder Patch claims by hand sampling.

Production: No recorded production.

Workings and Facilities:

There is a cabin in poor condition on the north side of the Bore Creek, 1.4 miles upstream from Glacier Creek, at an elevation 2,350 feet. Approximately 300 feet downstream on the same side, a 5-foot-deep test pit was found. Geologists observed a 100-foot-long area of hand-stacked placer tailings about a quarter of a mile downstream from the cabin, on the south side of the creek. Wooden pole and block riffles were found nearby.

Geologic Setting:

Bedrock at Poss Mountain is mapped primarily as lower Paleozoic to Proterozoic interbanded quartzite and graphitic schist with lesser amounts of calcareous schist (Dillon and Reifenstuhl, 1995). Numerous large boulders in Bore Creek would make placer mining difficult.

Bureau Investigation:

That portion of the creek near the cabin and placer tailings was investigated. From the position of the tailings, it would appear that mining efforts were focused on the northern bank. A pan concentrate collected from under boulders on the right limit (11843, table C-1) contains one very fine gold flake, but analysis did not show anomalous gold values. The same sample contains 123 ppm zinc.
A single quartz boulder with stibnite and boulangerite(?) found between the cabin and placer tailings (11841) contains 97 ppb gold, 1.17% lead, and 1.01% antimony. The bedrock source of the boulder was not located.

Quartz veins are exposed on the south wall of a gorge, 3.5 miles upstream from Glacier Creek. A sample (12421) of the quartz is not anomalous in any metals. A sample of calcareous sandstone float in the nearby creek (11844) contains 1% finely disseminated pyrite, 1,837 ppm strontium, 254 ppm antimony, and 138 ppm zinc. From the same area, a sample of arsenopyrite-bearing quartz in chlorite schist stream float (12422) contains 714 ppm arsenic and 2,000 ppm strontium. A stream sediment sample collected just above lake 3324 on the south fork of Bore Creek (12416) contains 424 ppm copper and 288 ppm zinc. A stream sediment sample collected from the west fork of the creek (12418) contains 338 ppm zinc.

Sulfide-bearing zones in quartz-chlorite schist were located midway up the ridge west of lake 3324, near the headwaters. Up to 10% pyrite and minor pyrrhotite occur in a 0.2-foot-thick siliceous zone within the schist. A select sample (12415) contains 758 ppm copper. The siliceous zone appears to be conformable to schistosity and can be traced for up to 500 feet along strike. However, the sulfide content of the rock is quite variable over this area.

Resource Estimate: None.

Mineral Development Potential:

Low potential for placer gold in Bore Creek due to insignificant amounts of gold in test pans. It appears that a concentration of placer gold mixed with large boulders has been mined out. Several of the rock and stream sediment samples are anomalous in copper, zinc, and strontium, indicating potential for lode deposits on upper Bore Creek.

Recommendations:

Further prospecting for placer gold on Bore Creek. The early miners may have worked out the highest concentration of gold. Numerous large boulders in the creek will hinder any attempts at mining. Prospect headwaters of Bore Creek for source of rocks producing zinc anomalies.

References:

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Heiner, L.E., and Wolff, E.N., 1968, Final report, mineral resources of northern Alaska: Mineral Industry Research Laboratory, University of Alaska, Report 16, p. 47.

Maddren, A.G., 1910, The Koyukuk-Chandalar gold region *in* Brooks, A.E., Mineral resources of Alaska, report on progress of investigations in 1909: U.S. Geological Survey Bulletin 442, p. 312.

____1913, The Koyukuk-Chandalar region, Alaska: U.S. Geological Survey Bulletin 532, p. 108.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 32.

Saunders, R.H., 1959, Itinerary report on a trip to the Chandalar District: Alaska Territorial Department of Mines Itinerary Report IR 31-3, 1959, p. 11.

Smith, S.S., 1917, The mining industry in the Territory of Alaska during the calendar year 1915: U.S. Bureau of Mines Bulletin 142, 65 p.

Property Summary

Name(s): California Creek
P & L's claims
TOR claims

Map No: C55
MAS No: 0020310031
Alaska Kardex 031-009
ARDF CH023

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar B-5
NW¼ sec. 35, T. 31 N., R. 9 W.
Meridian: Fairbanks
Elevation: 2,200 feet
Latitude: 67° 28.295' N.
Longitude: 149° 30.460' W.
Geographic: An 8-mile-long eastern tributary of Glacier Creek. Access is via an all-terrain-vehicle (ATV) trail from the Dalton Highway, near the mouth of Gold Creek.

History:

1901-09 - Shovel and sluice operations conducted by several men (Maddren, 1913).

1915-31 - P. Kelleher mined an opencut by booming and shoveling, sank 18 shafts, and drove two inclines below a high bench. The work was completed on California Creek, near its confluence with Jim Pup (Reed, 1938).

1940s-50s - Hans Christan Estate (a.k.a. Jim Pup Mining Company) held 26 claims on California, Jim Pup, and Wakeup Creeks (Roehm, 1949).

1980-86 - Claims staked (Kardex).

1985 - Dillon (1987) reported active placer operations near the confluence of Jim Pup, Wakeup, and California Creeks.

1990 - D. Even mined on Jim Pup and California Creek (Swainbank and others, 1991).

1999-present - T. O'Rourke and P. and L. Maydole placer mining on California Creek.

Production: (oz Au)

1901 - 48
1915 - 14
1916 - 25
1918 - 5
1919 - 10
Total: 102 (Records incomplete.)

Workings and Facilities:

Below the junction with Jim Pup, Pat Kelleher sank 18 shafts. At the confluence, where depth to bedrock is less than 5 feet, he mined an opencut by boom and shovel methods. Kelleher also drove an incline about 350 feet below his cabin, on the right limit (north side) (Reed, 1938). A trench, stacked rocks, and the remnants of a cabin (possibly Kelleher's?) are still visible near the confluence.

The current placer operation is using a suction dredge and backhoe about 1.5 miles upstream from creek mouth.

Geologic Setting:

The bedrock at California Creek is predominantly Devonian quartz-mica schist, schistose quartzite, and albite-chlorite-mica schist. Farther upstream, near the headwaters, the bedrock is Devonian calcareous schist, marble, and calc-silicate hornfels. The units contact one another along an east-northeast trend (Brosge and Reiser, 1964).

A deep channel on California Creek has been extensively prospected. Below the confluence with Jim Pup, 18 shafts were sunk to a depth of about 18 feet. The returns were reported to be fairly good. An incline was made on the right limit (north side). The incline was about 45°, 30 feet to bedrock. It extended 175 feet north from the adit. A 3.5-foot-thick gravel layer at the bottom of the incline and drift contained no pay. Another incline was initiated 100 feet west of the first, but it was abandoned due to flooding (Reed, 1938).

The present channel, near the confluence of Jim Pup and California Creeks, was mined in an opencut by booming and shoveling (Reed, 1938).

High benches occur on California Creek, where it runs through a gorge about 150 feet wide with high muck walls on both sides. The high benches are traceable along the left limit (south side). Two of the benches are 160 and 270 feet above the present channel, at elevations 2,100 feet and 2,300 feet (Reed, 1938).

Bureau Investigation:

California Creek was investigated above and below its confluence with Jim Pup Creek. Above the confluence, pan concentrate samples collected from bedrock (11201, table C-1) and from a cut bank (11203) did not contain anomalous gold. The quartz-mica schist bedrock is shallow and contains biotite which weathers orange-brown. Hornfels and granite with finely disseminated sulfides were observed in float along the creek. A sample of granite with pyrrhotite (11200) did not contain anomalous metal values.

Below the confluence with Jim Pup, California Creek appears to cut bedrock in only one location. A pan concentrate sample (12402) was collected from biotite-quartz schist bedrock. The bedrock had roughly horizontal schistosity and did not contain crosscutting quartz veins. The pan contained moderate fine and coarse pyrite, but no magnetite or visible gold. Analytical results were not anomalous in metals.

Resource Estimate: None.

Mineral Development Potential:

California Creek exhibits low mineral development potential for placer gold above the confluence with

Jim Pup due to lack of gold values in samples. Visible gold was panned from Jim Pup; consequently, California Creek may have moderate potential below this confluence. Unfortunately, the lack of bedrock precludes gold from concentrating in the present channel.

Recommendations:

Prospect California Creek below the confluence with Jim Pup using a suction dredge or trenching. Also, prospect high benches and deep channels that may extend from Wakeup Creek and Jim Pup.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Brooks, A.H., and others, 1916, Mineral resources of Alaska, report on progress of investigations in 1916: U.S. Geological Survey Bulletin 662, p. 59.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

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Heiner, L.E., and Wolff, E.N., 1968, Final report, mineral resources of northern Alaska: Mineral Industry Research Laboratory, University of Alaska, Report 16, p. 47.

Maddren, A.G., 1910, The Koyukuk-Chandalar gold region *in* Brooks, A.E., Mineral resources of Alaska, report on progress of investigations in 1909: U.S. Geological Survey Bulletin 442, p. 292, 312.

____1913, The Koyukuk-Chandalar region, Alaska: U.S. Geological Survey Bulletin 532, p. 70, 107-108.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 33.

Roehm, J.C., 1949, Report of investigations and itinerary of J.C. Roehm in the Koyukuk precinct, Alaska, August 15-22, 1949: Alaska Territorial Department of Mines Itinerary Report IR 31-1, p. 40.

Schrader, F.C., 1904, A reconnaissance in northern Alaska across the Rocky Mountains, along the Koyukuk, John, Anaktuvuk, and Colville Rivers and the Arctic coast to Cape Lisburne, in 1901: U.S. Geological Survey Professional Paper 20, 139 p.

Swainbank, R.C., Bundtzen, T.K., and Wood, J.M., 1991, Alaska's mineral industry 1990: Alaska Division of Geological and Geophysical Surveys Special Report 45, p. 26.

Property Summary

Name(s): Jim Pup
Jim Pup Creek
Jim Gulch

Map No: C56
MAS No: 0020310032
Alaska Kardex 031-009B
ARDF CH024

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar B-5
SE¼ sec. 26, T. 31 N., R. 9 W.
Meridian: Fairbanks
Elevation: 2,250 feet
Latitude: 67° 28.155' N.
Longitude: 149° 27.828' W.
Geographic: A 2.5-mile-long eastern tributary of California Creek (map no. C55). Access is via an all-terrain-vehicle (ATV) trail from the Dalton Highway or from Bob Johnson Lake.

History:

1901 - Gold discovered on California Creek and Jim Pup (Maddren, 1913).
1901-09 - Shovel and sluice operations conducted by several men for meager returns (Maddren, 1913).
1922 - Gilbert and Ellington reported good pay (Wimmler, 1922).
1930s - Work conducted by Creecy, Pat Kelleher, and Hans Christensen (Smith, 1936; Reed, 1938).
1940s-50s - Hans Christan Estate (aka Jim Pup Mining Company) held 26 claims on California, Jim Pup, and Wakeup Creeks. Also mined by Joe Blondel (Roehm, 1949).
1985 - Dillon (1987) reported active placer operations near the confluence of Jim Pup, Wakeup, and California Creeks.
1990 - D. Even mined on Jim Pup and California Creek (Swainbank and others, 1991).
1998 - Mined by M. Carolyn and J. Peep.

Production: (oz Au)

1901 - 24
1908 - 48
1909 - 48
1921 - 34
1922 - 133
1924 - 92
1925 - 25
1926 - 228
1941 - 103
1950s - ?

Total: 735 (Records incomplete.)
Average fineness: 973 (Metz and Hawkins, 1981)

Workings and Facilities:

For approximately 1 mile upstream of its confluence with California Creek, Jim Pup contains abundant stacked rocks on both sides of the creek. Above the stacked rocks, a current placer operation is using suction dredge equipment and temporary log dams.

Several shafts were sunk in the flats near the confluence of Jim Pup, Wakeup, and Californian Creeks. The remains of four shafts and three boiler houses are located about 0.3 mile upstream from the confluence with Jim Pup Creek. Drift mining equipment (including boilers and steam winches) is mostly intact.

Geologic Setting:

The bedrock at Jim Pup is predominantly Devonian quartz-mica schist and albite-chlorite-mica schist with minor calcareous schist. Farther upstream, near the headwaters, the bedrock is Devonian calcareous schist, marble, and calc-silicate hornfels. The units contact one another along an east-northeast trend (Brosge and Reiser, 1964).

The modern channel of Jim Pup was mined by booming and shoveling for about 1.5 miles upstream of the creek mouth. The depth to bedrock is 3 to 5 feet. The stream gradient is about 4.5%. The gold was said to be very coarse, production included a $50 nugget (Reed, 1938).

A deep channel is reported to lie along the right limit (north side) of Jim Pup, below the mouth of Wakeup Creek. At this location (elevation 2,190 feet), the gravels of the deep channel are thawed and approximately 55 feet below the surface. North of this location, at 2,210 feet elevation, a shaft reportedly reached a gravel layer 104 feet below the surface, but subsequently flooded. It is possible that this deep channel extends northeast to the deep channel on Wakeup Creek and southwest to the right limit of California Creek (Reed, 1938).

Bureau Investigation:

Geologists walked the lower 2 miles of Jim Pup. The bedrock exposure is intermittent, but shallow - usually consisting of less than 3 feet of gravel. The float observed at Jim Pup was significantly more varied than California Creek, containing conglomerate and greenstone glacial erratics, in addition to minor granite and hornfels.

Visible gold was panned from unbroken schist bedrock above the current placer operation, at elevation 2,500 feet. The schist strikes roughly east-west and perpendicular to the flow of the creek, forming perfect natural riffles. The dip is towards the north. A pan concentrate sample with 1 fine gold piece (11241, table C-1) contained 22.6 ppm gold and 0.7 ppm silver. No other anomalous results were detected.

At elevation 2,600 feet, a 12-foot-wide quartz vein was observed. The vein strikes roughly north-south and dips slightly to the east. No sulfides were observed in the milky-white quartz.

Resource Estimate: None.

Mineral Development Potential:

Moderate mineral development potential due to visible placer gold in samples collected upstream of current placer operations.

Recommendations: Continue prospecting present channel of Jim Pup.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Brooks, A.H., and others, 1916, Mineral resources of Alaska, report on progress of investigations in 1916: U.S. Geological Survey Bulletin 662, p. 59.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Dillon, J.T., 1987, Upper Koyukuk district land and mining claim status current to 1985: Alaska Division of Geological and Geophysical Surveys Public Data File 87-11, 25 p., 1 sheet, scale 1:125,000.

Maddren, A.G., 1910, The Koyukuk-Chandalar gold region *in* Brooks, A.E., Mineral resources of Alaska, report on progress of investigations in 1909: U.S. Geological Survey Bulletin 442, p. 292, 312.

____1913, The Koyukuk-Chandalar region, Alaska: U.S. Geological Survey Bulletin 532, p. 107-108.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 33.

Roehm, J.C., 1949, Report of investigations and itinerary of J.C. Roehm in the Koyukuk precinct, Alaska, August 15-22, 1949: Alaska Territorial Department of Mines Itinerary Report IR 31-1, p. 34-40.

Schrader, F.C., 1904, A reconnaissance in northern Alaska across the Rocky Mountains, along the Koyukuk, John, Anaktuvuk, and Colville Rivers and the Arctic coast to Cape Lisburne, in 1901: U.S. Geological Survey Professional Paper 20, p. 102.

Smith, P.S., 1936, Mineral industry of Alaska in 1934, *in* Smith, P.S. and others, 1936, Mineral resources of Alaska, report on progress of investigations in 1934: U.S. Geological Survey Bulletin 868A, p. 42.

____1939, Mineral resources of Alaska in 1938: U.S. Geological Survey Bulletin 917A, p. 55.

Swainbank, R.C., Bundtzen, T.K., and Wood, J.M., 1991, Alaska's mineral industry 1990: Alaska Division of Geological and Geophysical Surveys Special Report 45, p. 26.

Wimmler, N.L., 1922, Placer mining in Alaska in 1922: Alaska Territorial Department of Mines Miscellaneous Report MR-195-6, p. 38.

Property Summary

Name(s): Wakeup Creek
Wake Up Creek
Wake Up Association claim
Jim Pup no. 3 claim

Map No: C57
MAS No: 0020310098
Alaska Kardex 031-009
ARDF CH025

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar B-5
SE¼ sec. 26, T. 31 N., R. 9 W.
Meridian: Fairbanks
Elevation: 2,200 feet
Latitude: 67° 28.711' N.
Longitude: 149° 28.887' W.
Geographic: A 1.6-mile-long headwaters tributary of Jim Pup (map no. C56), 2 miles southwest of Big Lake.

History:

1909 - Mining reported on nearby creeks (Maddren, 1913).

1937 - H. Christensen drift mined on creek (Reed, 1938).

1948-49 - J. Blundell engaged in shaft sinking on creek (Roehm, 1949)

1940-50s - H. Christian Estate (aka Jim Pup Mining Company) owned 26 claims on California, Jim Pup, and Wake Up Creeks (Kardex).

1980-86 - Claims staked (Kardex).

1997 - E. Pyne staked placer claims on several creeks in the area including Wakeup Creek.

Production: (oz Au)

1926 - 228
1927 - 167
1928 - 36
1931 - 391
1932 - 155
1934 - 171
1935 - 230
1936 - 6

1937 - 65
1938 - 222
1939 - 5
1940 - 27
1941 - 92

Total: 1,795 (Records incomplete.)
Average fineness: 923 (Metz and Hawkins, 1981)

Workings and Facilities:

The remains of four shafts and three boiler houses are located about 0.3 mile upstream from the confluence with Jim Pup Creek. Drift mining equipment (including boilers and steam winches) is mostly intact. Water for sluicing had to be brought in with ditches to supplement the low flow of Wakeup Creek.

Geologic Setting:

Bedrock underlying upper Wakeup Creek has been mapped as Upper Devonian slate, siltstone, and sandstone with local conglomerate (Brosge and Reiser, 1964). Drift mines encountered schist at the bottom of the deep channel that underlies the creek. Wakeup Creek is reported to contain modern stream, bench, and deep channel placers. Pay gravels are frozen (Reed, 1938).

The deep channel has been the most productive. It is a continuation of the deep channel in Jim Pup and has been mined for a distance of 1,500 feet upstream from that creek. The channel depth ranges from 55 to 112 feet; the width, from 15 to 25 feet. The bottom of the channel contains a series of gutters from 2 to 4 feet deep. The gold is rather rough, but fine with a few pieces up to 1.1 oz. The gold is concentrated mostly on the high points of bedrock between the gutters, but is in some places distributed throughout the gravel. Values ran from 0.11 to 0.12 oz/bedrock foot (Reed, 1938).

The high channel on Wakeup Creek is reported to be a former channel of Jim Pup, which ran in a reverse direction to Wakeup Creek across the divide to the east and into Big Lake. The depth to bedrock in this channel was about 20 feet. By 1937, 1,000 feet of this channel had been explored and values of 0.02 oz/bedrock foot reported. At the time though, no production was reported. The channel contained coarse, angular gravel with few large boulders. At the time, it was believed that the high channel had a greater extent than the deep channel (Reed,1938).

A 100-foot-deep shaft, sunk in about 1948, produced pay from a 5- to 6-foot-thick gravel layer that averaged 0.12 to 0.19 oz/cy. Drifts had extended 100 feet in four directions from the shaft. The pay was distributed in channels 20 to 40 feet in width (Roehm, 1949).

Bureau Investigation:

BLM geologists investigated lower Wakeup Creek. No bedrock was encountered, but considerable evidence of drift mining was found upstream from Jim Pup. Test pans from three out of four dumps at the mine site contained fine flake gold. No gold was observed in test pans taken from the creek. A pan concentrate sample (11254, table C-1) collected downstream from the tailings piles contained 95 ppb gold and 925 ppm arsenic.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential on the deep channel because it appears to be mostly mined out. Low gold values found during previous exploration suggest the high channel has low potential.

Recommendations: Prospect high channel in the divide between California and Lake Creeks.

References:

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Heiner, L.E., and Wolff, E.N., 1968, Final report, mineral resources of northern Alaska: Mineral Industry Research Laboratory, University of Alaska, Report 16, p. 52.

Metz, P.A., and Hawkins, D.B., 1981, A summary of gold fineness values from Alaska placer deposits: Mineral Industry Research Laboratory, University of Alaska, Report 45, p. 36-37.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 36-38.

Roehm, J.C., 1949, Report of investigations and itinerary of J.C. Roehm in the Koyukuk precinct, Alaska, August 15-22, 1949: Alaska Territorial Department of Mines Itinerary Report IR 31-1, p. 38-40.

Smith, P.S., 1939, Mineral resources of Alaska in 1938: U.S. Geological Survey Bulletin 917A, p. 55.

Property Summary

Name(s): Lake Creek - Bob Johnson Lake Maglass bench claims Pitts bench claims Lake Creek Assoc. claims Inch Association claims	**Map No:** C58 **MAS No:** 0020310005 Alaska Kardex 031-009 ARDF CH026
Deposit Type: Placer	**Commodities:** Au

Location:

Quadrangle: Chandalar B-5	Center sec. 24, T. 31 N., R. 9 N.
Meridian: Fairbanks	Elevation: 2,100 feet
Latitude: 67° 29.746' N.	Longitude: 149° 27.044' W.

Geographic: A 1.5-mile-long creek that flows into the west side of Bob Johnson Lake. The site is 14 miles from the Dalton Highway via an all-terrain-vehicle trail.

History:

1915 - Gold discovered by J. Rooney (Reed, 1938).
1916 - Mining by shovel and sluice methods near the mouth of the creek. Drift mining took place along the left (north) limit, approximately 500 feet from the lake shore (Reed, 1938).
1930 - G. Maglass began mining a deep channel in an opencut, at upper Lake Creek (Reed, 1938).
1934 - G. Maglass and J. Rooney continued drift mine activities (Smith, 1936).
1936-37 - S. Larson sank a shaft 40 feet to bedrock at the southern side of upper Lake Creek, but no pay was found (Reed, 1938).
1938 - Rooney had advanced 1,500 feet upstream from the mouth of Lake Creek (Reed, 1938).
1949 - F. Pitts purchased Maglass' claims, which extended from Big Lake to the head of Lake Creek (U.S. Bureau of Mines PIMRs, 1949).
1949-59 - Pitts used hydraulic and sluice methods to mine Lake Creek (U.S. Bureau of Mines PIMRs, 1949-1959).
1980-86 - Several claims staked. Dillon (1987) reported active placer operations on Lake Creek.

Production: (oz Au)

1921 - 77	1932 - 53	1941 - 10
1923 - 44	1933 - 28	1949 - 61
1924 - 36	1934 - 25	1950 - 29
1926 - 53	1936 - 9	1951 - 99
1928 - 5	1937 - 15	1953 - 51
1929 - 29	1938 - 18	1954 - 45
1930 - 45	1939 - 14	1955 - 15
1931 - 22	1940 - 24	
		Total: 807

Records incomplete. Bureau of Mines records indicate production may be as high as 1,072 oz gold and 40 oz silver as of 1955. Average fineness: 964 (Metz and Hawkins, 1981); 906 (Reed, 1938)

Workings and Facilities:

Miners reportedly sank at least 4 shafts and drift mined on Lake Creek. A hydraulic cut, exposing bedrock, is located on the north side of the creek, 0.5 mile upstream from Bob Johnson (Big) Lake. A monitor, water pipe, and other evidence of hydraulicking and ground sluicing were found as well. Above the cut, placer tailings lie along the creek for at least 500 feet. A dilapidated cabin and cache are north of the hydraulic cut, near the all-terrain-vehicle trail that leads from the Dalton Highway. Due to its short length, this creek has a low flow during periods of dry weather.

Geologic Setting:

Brosge and Reiser (1964) report bedrock in the area to consist of Devonian slate, siltstone, sandstone, quartz-muscovite schist, schistose quartzite, phyllite, and limestone. The schistosity strikes north-south and dips 15° to 20° to the east (Roehm, 1949). Bedrock in the hydraulic cut consists of muscovite-chlorite schist interlayered with phyllite. Some of the phyllite contains 1-2% pyrite. Greenstone float in the creek contains 1% euhedral magnetite.

Lake Creek contains modern, bench, and possibly deep gold-bearing channels. The modern channel has been mined from 300 to 3,200 feet upstream from the lake. This includes a rich paystreak, reported to have ended about 660 feet above the lake. Above the delta, the creek flows in a steep gully 10 to 20 feet wide. Depth to bedrock is reportedly 9 to 12 feet. The gold is reported to be very coarse, with the ground containing 0.02 oz/bedrock foot. The creek gravel contains numerous cobbles and boulders. Drift mining is reported to have taken place on the north side of the creek, 500 feet upstream from Big Lake. This mining may have followed an extension of bedrock in the modern channel under alluvium (Reed, 1938).

A hydraulic cut on the north side of the creek exposes a bench deposit that is 75 to 100 feet above the modern channel. On this bench gold is concentrated in water-cut trenches in the bedrock about 1 foot in width. The trenches appear to follow parallel fracture planes. These trenches were probably formed by erosion of ancestral Lake Creek. In 1937 miners were excavating the bench in the hopes of finding a large, gold-bearing channel, which may have been the source of the gold in the trenches as well as lower Lake Creek. Hyrdraulic operations recovered values up to 0.08 oz/cy (U.S. Bureau of Mines PIMRs, 1953). Numerous boulders in the gravel made mining difficult. It is uncertain how far the bench may extend beyond the cut to the north, but it is possible that it may swing around the ridge to the northeast. This bench may be an extension of one explored on Wakeup Creek, 1.2 miles to the south (Reed, 1938).

Mention is made about a deep channel north of the small lake in the divide between Wakeup and Lake Creeks Depth to bedrock is reportedly 30 to 40 feet. Gold lies on and in the upper 1 foot of bedrock and produced about 0.01 oz/bedrock foot. Gravel on the bench averages 15 feet thick and is covered with 3 to 4 feet of moss and muck. The gravel is unsorted, coarse, angular and contains numerous boulders. One cut on the bench is reported to have averaged 0.08 oz/bedrock foot. The largest nugget weighed just over 1 oz. The bedrock was fractured, uneven, and difficult to clean (Reed, 1938; Williams, 1950; Saunders, 1959).

Bureau Investigation:

Pan concentrate samples were collected off bedrock in the stream bottom, below the tailings. The samples (11237, 11239, table C-1) contain 61 ppm and 94 ppm gold respectively. A placer sample from the same location (11270) contains 0.067 oz/cy gold, 215 ppm arsenic, and 185 ppm tungsten. The gold was flat and accompanied with abundant tarnished pyrite and moderate magnetite. No evidence was found of the deep channel reportedly mined near the divide with Wakeup Creek to the southwest. Mining on the bench, which first began in the late 1930s, does not appear to have extended north since that time. Samples of the phyllite with pyrite and greenstone with magnetite were not anomalous in any metals.

Resource Estimate: The site of placer sample 11270 contains an approximate 5 cy resource.

Mineral Development Potential:

Moderate potential for placer gold in the modern stream as gold values are high. However, gravel resources are small.

Recommendations:

Suction dredging in small pockets of remaining gravel in modern stream. Prospecting of hydraulic cut on the north side of the creek for extensions to the northeast.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Dillon, J.T., 1987, Upper Koyukuk district land and mining claim status current to 1985: Alaska Division of Geological and Geophysical Surveys Public Data File 87-11, 25 p., 1 sheet, scale 1:125,000.

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Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 123-136.

Roehm, J.C., 1949, Report of investigations and itinerary of J.C. Roehm in the Koyukuk precinct, Alaska, August 15-22, 1949: Alaska Territorial Department of Mines Itinerary Report IR 31-1, 9 p. 40.

Saunders, R.H., 1959, Itinerary report on a trip to the Chandalar district: Alaska Territorial Department of Mines Itinerary Report IR 31-3, 1959, p. 9-11.

Smith, P.S., 1930, Mineral industry of Alaska in 1927, *in* Smith, P.S. and others, 1930, Mineral resources of Alaska, report on progress of investigations in 1927: U.S. Geological Survey Bulletin 810, p. 28.

____1932, Mineral industry of Alaska in 1929: U.S. Geological Survey Bulletin 824A, p. 39.

____1933, Mineral industry of Alaska in 1930, *in* Smith, P.S. and others, 1933, Mineral resources of Alaska, report on progress of investigations in 1930: U.S. Geological Survey Bulletin 836, p. 39.

____1936, Mineral industry of Alaska in 1934, *in* Smith, P.S. and others, 1936, Mineral resources of Alaska, report on progress of investigations in 1934: U.S. Geological Survey Bulletin 868A, p. 42.

U.S. Bureau of Mines, 1953, Permanent Individual Mine Records (PIMR) for placer mines in Alaska: U.S. Bureau of Mines unpublished reports.

Williams, J.A., 1950, Mining operations in Fairbanks district and Innoko and Koyukuk precincts (Chandalar) Alaska: Alaska Territorial Department of Mines Miscellaneous Report MR-194-13, p. 4-5.

Property Summary

Name(s): Billy Glen Creek
Bill Creek
Houston Subdivision

Map No: C59
MAS No: 0020310102
Alaska Kardex 031-111

Deposit Type: Placer

Commodities: Au

Location:
Quadrangle: Chandalar C-5
NW¼ sec. 20, T. 31 N., R. 8 W.
Meridian: Fairbanks
Elevation: 1,770 feet
Latitude: 67° 30.300' N.
Longitude: 149° 22.667' W.
Geographic: A south-flowing creek emptying into the north end of Bob Johnson Lake. The site is on Doyon Ltd. land.

History:

1978 - Placer claim staked on Billy Glen Creek (Kardex).

Production: None.

Workings and Facilities:

The remains of an old claim marker were observed near the mouth of Billy Glen Creek.

Geologic Setting:

The bedrock at Billy Glen Creek is lower Paleozoic calcareous-chlorite-quartz schist with minor interlayers of quartzite. The creek bed may follow an antiform that plunges towards the north (Brosge and Reiser, 1964; Dillon and others, 1996). The drainage is narrow and highly vegetated.

Bureau Investigation:

A stream sediment and pan concentrate sample (11196-11197, table C-1) were collected off quartz-mica schist bedrock near the headwaters. The results were not anomalous. The creek was walked from headwaters to mouth: only a trace amount of sulfides were found in test pans.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential for placer gold due to lack of anomalous sample results.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Dillon, J.T., Reifenstuhl, R.R., and Harris, G.W., 1996, Geologic map of the Chandalar C-5 quadrangle, southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 104, 2 sheets, scale 1:63,360.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 41.

Property Summary

Name(s): Holy Moses Creek

Map No: C60
MAS No: 0020310100
Alaska Kardex 031-055

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar B-5
SE¼ sec. 19, T. 31 N., R. 8 W.
Meridian: Fairbanks
Elevation: 1,750 feet
Latitude: 67° 29.485' N.
Longitude: 149° 24.469' W.
Geographic: A northeast-flowing tributary of Bob Johnson Lake. The site is on Doyon Ltd. land.

History:

1930s - M. McCammit and M. Shea sank a 70-foot shaft; however, they reported no gold (Reed, 1938).
1969 - S. Wright staked 11 placer claims in the area (Kardex).

Production: None.

Workings and Facilities: None observed.

Geologic Setting:

Bedrock in the area is predominantly Devonian quartz-mica schist and albite-chlorite-muscovite schist with minor marble (Brosge and Reiser, 1964). Very little bedrock is exposed along the creek.

Bureau Investigation:

A brief investigation was conducted on Holy Moses Creek. An aerial reconnaissance of the stream found no locations of exposed bedrock. Glacially deposited conglomerate and greenstone were observed in float along the creek. Stream sediment and pan concentrate samples were collected from the delta area. The pan concentrate sample (11245, table C-1) contains 193 ppb gold, which is considered slightly anomalous.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential due to lack of visible gold.

Recommendations: Look for and test pan bedrock.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 40.

Property Summary

Name(s): Shamrock Creek
Butte Creek

Map No: C61
MAS No: 0020310087
Alaska Kardex 031-112
ARDF CH022

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar B-5
SE¼ sec. 29, T. 31 N., R. 8 W.
Meridian: Fairbanks
Elevation: 2,000 feet
Latitude: 67° 29.163' N.
Longitude: 149° 22.118' W.
Geographic: A short, northeast-flowing tributary of Bob Johnson Lake.

History:

1920 - G. Maglass reported to have struck pay on Shamrock Creek (Fairbanks Daily News-Miner, 1920; Reed, 1938).

1978 - Placer claim staked on Shamrock Creek (Kardex).

Production: None recorded.

Workings and Facilities: None.

Geologic Setting:

Bedrock is predominantly Devonian quartz-mica schist and albite-chlorite-muscovite schist. Calc-silicate hornfels also outcrops locally (Brosge and Reiser, 1964).

Bureau Investigation:

The creek is heavily vegetated and does not appear to cut bedrock. A stream sediment sample (11246, table C-1) collected near the outwash delta at the mouth of the creek was not anomalous. Test pans collected at the site did not contain gold.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential for placer gold due to lack of anomalous sampling results.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 16.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF 878B, 2 sheets, scale 1:250,000.

Fairbanks Daily News-Miner newspaper, Fairbanks, Alaska, February 27, 1920.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 40-41.

Property Summary

Name(s): Wolf Creek

Map No: C62
MAS No: 0020310103
Alaska Kardex 031-110

Deposit Type: Placer

Commodities: Au

Location:
Quadrangle: Chandalar B-5 — SE¼ sec. 23, T. 31 N., R. 8 W.
Meridian: Fairbanks — Elevation: 1,770 feet
Latitude: 67° 29.494' N. — Longitude: 149° 15.824' W.
Geographic: A southwest-flowing tributary of Bob Johnson Lake, at the south end of the lake. The site is on Doyon Ltd. land.

History:

1938 - Reed (1938) reported no history of prospecting the Wolf Creek.
1978 - Placer claim staked near the mouth of Wolf Creek (Kardex).

Production: None.

Workings and Facilities: None observed.

Geologic Setting:

Bedrock at Wolf Creek is mostly Devonian calcareous schist, marble, and calc-silicate hornfels which has been thrust over Devonian albite-chlorite-mica schist. The thrust fault trends north-south, and the creek flows along the fault for much of its length (Brosge and Reiser, 1964).

Bureau Investigation:

Wolf Creek was investigated near the prominent tributary at elevation 2,200 feet. Pan concentrate samples were collected from bedrock at Wolf Creek (11825, table C-1) and the tributary (11823). The pan concentrate samples contained moderate pyrite, but no visible gold. Unfortunately, the samples were lost at the laboratory before they could be analyzed for gold. Test pans collected nearby did not contain visible gold.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential due to lack of visible gold in samples.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 41.

Property Summary

Name(s): Horse Creek Lode

Map No: C63
MAS No: 0020310076
ARDF CH018

Deposit Type: Unknown lode

Commodities: Cu, Sb

Location:

Quadrangle: Chandalar B-4
NE¼ sec. 30, T. 30 N., R. 6 W.
Meridian: Fairbanks
Elevation: 3,900 feet
Latitude: 67° 23.043' N.
Longitude: 148° 58.132' W.
Geographic: Located on an eastern ridge above the headwaters of Horse Creek, 1.3 miles southwest of hill 3541.

History:

1959-60 - U.S. Geological Survey geologists reported small amounts of copper minerals in Devonian schist on Horse Creek (Berg and Cobb, 1967, p. 204).

Production: None.

Workings and Facilities: None.

Geologic Setting:

Bedrock in the area is composed of Devonian black, fine-grained quartz-muscovite-chlorite schist probably equivalent to unmetamorphosed black siltstone. An east-west-trending swath of quartz-mica schist with intercalated greenschist and greenstone along with schistose quartzite is host to the copper occurrence (Brosge and Reiser, 1964).

Copper sulfides appear to be concentrated in small pods and veinlets with coatings of malachite and azurite (Berg and Cobb, 1967).

Bureau Investigation:

No copper staining was noted on or around the Horse Creek site. A 30-foot-long area of limonite-stained outcrop was observed near the reported copper occurrence (Brosge and Reiser, 1964). At this location, a select outcrop sample of quartz-mica schist (11821, table C-1) contained 0.84% antimony, and a rubblecrop sample from a metamorphosed quartz vein crosscutting quartz-mica schist (11821) contained 549 ppm antimony. These results are considered very anomalous; however, no stibnite was observed.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential exists at Horse Creek due to limited metal content of samples.

Recommendations:

More sampling is required in order to determine the extent of the antimony mineralization.

References:

Berg, H.C., and Cobb, E.H., 1967, Metalliferous lode deposits of Alaska: U.S. Geological Survey Bulletin 1246, p. 204.

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

____1976, Summary of references to mineral occurrences (other than mineral fuels and construction materials) in the Chandalar and Wiseman quadrangles, Alaska: U.S. Geological Survey Open-File Report 76-340, p. 32.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Grybeck, D., 1977, Known mineral deposits of the Brooks Range, Alaska: U.S. Geological Survey Open-File Report 77-166C, p. 36.

Property Summary

Name(s): Sawlog Creek

Map No: C64
MAS No: 0020310039
Alaska Kardex 031-047
ARDF CH020

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar B-5
W½ sec. 29, T. 30 N., R. 7 W.
Meridian: Fairbanks
Elevation: 2,250 feet
Latitude: 67° 23.795' N.
Longitude: 149° 09.503' W.
Geographic: An eastern tributary to the South Fork Koyukuk River, approximately 2 miles southeast of South Fork Lake. The site is on Doyon Ltd. land.

History:

1948-57 - D. O'Keefe staked claims, prospected, and sank shafts on Denny's Gulch (Wolff, 1999).
1949 - E. Wolff staked claims at Sawlog Creek per suggestion of O'Keefe (Wolff, 1999).
1951 - Magnetic survey of Denny's Gulch and Sawlog Creek conducted by U.S. Department of Mines (Williams, 1952).
1960 - Richard Reimer and Pat Manguso staked placer claim at Sawlog Creek (Kardex).
1964 - Recent placer mining reported (DeYoung, 1978).
1975-76 - WGM Inc. collected reconnaissance stream silt samples in the O'Keefe Hills (Dashevsky, 1986).
1983 - WGM Inc. conducted additional investigations in the O'Keefe Hills (Dashevsky, 1986).

Production: No recorded production.

Workings and Facilities: None.

Geologic Setting:

The bedrock at Sawlog Creek is Devonian(?) quartz-muscovite schist and schistose quartzite, intercalated with greenschist and greenstone. A glacial morainal ridge is mapped near the creek mouth (Brosge and Reiser, 1964).

Bureau Investigation:

Sawlog Creek is a low-volume stream with little gravel. It did not appear that the creek cuts bedrock. A pan concentrate sample (11289, table C-1) was collected at 2,600 feet elevation. Gold was not observed in the pan. The sample results were not considered anomalous.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential exists at Sawlog Creek due to low assay results and limited gravel resources.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 59.

Dashevsky, S.S., 1986, Mines, prospects, and geochemical anomalies on Doyon Ltd. regional overselection lands Alaska, Blocks 1 - 8, v. I of II: unpublished report 86-01A for Doyon Ltd., v. 1, 42 p. [available from Doyon Ltd., Fairbanks, Alaska]

Heiner, L.E., and Wolff, E.N., 1968, Final report, mineral resources of northern Alaska: Mineral Industry Research Laboratory, University of Alaska, Report 16, 299 p.

Nicol, D. L., 1983, Evaluation of the mineral potential of Doyon Ltd.'s Blocks 5 and 22: unpublished report 83-04, 78 p. [available from Doyon Ltd., Fairbanks, Alaska]

Williams, J.A., 1952, Denny's Gulch and Sawlog Creek - magnometer survey: Alaska Territorial Department of Mines Property Exam, PE-31-2, 35 p.

Wolff, E.N., 1999, Frank Yasuda and the Chandalar: self-published booklet by the author, 66 p.

Property Summary

Name(s): Wizard

Map No: C65
MAS No: 0020310035
Alaska Kardex 031-020

Deposit Type: Vein(?)

Commodities: Zn(?), Au, quartz crystal

Location:

Quadrangle: Chandalar B-5
SE¼ sec. 32, T. 30 N., R. 7 W.
Meridian: Fairbanks
Elevation: 2,900 feet
Latitude: 67° 22.799' N.
Longitude: 149° 09.291' W.
Geographic: A headwaters tributary of Crooked Creek, 6 miles south of Twin Lakes.

History:

1948-57 - D. O'Keefe staked claims, prospected, and sank shafts on Denny's Gulch (Wolff, 1999).
1951 - Magnetic survey of Denny's Gulch and Sawlog Creek conducted by U.S. Department of Mines (Williams, 1952).
1955 - Six lode gold claims staked (Heiner, 1968).
1956 - Area sampled for uranium by U.S. Geological Survey (Freeman, 1963).
1975-76 - WGM Inc. collected reconnaissance stream silt samples in the O'Keefe Hills (Dashevsky, 1986).
1983 - WGM Inc. conducted additional investigations in the O'Keefe Hills (Dashevsky, 1986).

Production: No recorded production.

Workings and Facilities:

Remains of a cabin and shaft(?) are located at the bend, where Denny's Gulch begins to flow east.

Geologic Setting:

The bedrock at Denny's Gulch is Devonian quartz-mica schist and schistose quartzite with locally intercalated greenschist and greenstone (Brosge and Reiser, 1964).

The upper portion of Denny's Gulch contains prolific iron staining: the bedrock and all float is stained dark red. There are also numerous thin quartz veins at several orientations. No assay values of any interest have been obtained from the quartz veins, but it is reported that colors may be panned at will from almost any point in the formation and from the slide rock. Native iron appears nearly everywhere in small, bright pieces and is reportedly associated with sphalerite and rutile. Green stains were attributed to copper and the bitter taste of the creek was probably caused by arsenic. A few large gold nuggets have been picked up from the creek bed in the upper part where the grade is steep and the gravel is large and shallow. Both the lower and upper parts of the creek have been prospected for placer gold (map no. C66) (Williams, 1950, 1952).

The majority of the quartz veins in Denny's gulch have been related to a thrust separating graphitic schist from underlying quartz-muscovite schist. None of the quartz veins contained detectable gold (Central Alaska Gold Company, 1992).

The bedrock in Denny's Gulch has been prospected for uranium by the U.S. Geological Survey. The radioactivity in the area was reported as higher (as much as 0.035 miliroentgens per hour) than normal for mica schist. It was determined that the high readings were not be related to a body of uranium ore (Freeman, 1963).

Bureau Investigation:

The bedrock in upper Denny's Gulch is almost exclusively quartz-mica schist with lessor amounts of graphitic schist. Although minor greenstone and meta-granite/diorite was found in float, neither rock was found in place. Two samples (11249, 11290, table C-1) were collected at the upper end of the gulch from quartz veins with abundant limonite staining. The samples do not contain any gold, but average 144 ppm zinc. The veins are extremely weathered and lay at several orientations. The vein from which sample 11249 was collected strikes at N. 40° W. and has a vertical dip.

A pan concentrate collected at the upper part of the creek, off quartz-mica schist bedrock (11248), contains 235 ppm gold, 21.2 ppm silver, 133 ppm lead, 222 ppm zinc, and 116 barite. The three pan concentrate samples collected on Denny's Gulch average 167 ppm zinc and 171 ppm barite. No potential lode source for these anomalies was found.

Mineral Development Potential:

Low mineral development potential for vein and base metal deposits exists at Denny's Gulch. Although stream sediment and pan concentrate samples have been consistently anomalous in zinc, no lode source has been found in the area.

Recommendations: Continued prospecting in the area.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Central Alaska Gold Company, 1992, 1991 Annual report, Alaska field operations- Doyon Ltd. option, v. I: unpublished report 92-70 for Doyon Ltd, 39 p. [available from Doyon Ltd., Fairbanks, Alaska]

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 20.

Dashevsky, S.S., 1986, Mines, prospects, and geochemical anomalies on Doyon Ltd. regional overselection lands Alaska, Blocks 1 - 8, v. I of II: unpublished report 86-01A for Doyon Ltd., v. 1, 42 p. [available from Doyon Ltd., Fairbanks, Alaska]

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Freeman, F.L., 1956, Examination of uranium prospects, *in* U.S. Geological Survey, 1963, Contributions to economic geology of Alaska: U.S. Geological Survey Bulletin 1155, p. 31.

Heiner, L.E., and Wolff, E.N., 1968, Final report, mineral resources of northern Alaska: Mineral Industry Research Laboratory, University of Alaska, Report 16, p. 47.

Nicol, D. L., 1983, Evaluation of the mineral potential of Doyon Ltd.'s Blocks 5 and 22: unpublished report 83-04, 78 p. [available from Doyon Ltd., Fairbanks, Alaska]

Williams, J.A., 1950, Mining operations in Fairbanks district and Innoko and Koyukuk precincts (Chandalar) Alaska: Alaska Territorial Department of Mines Miscellaneous Report MR-194-13, p. 3-4.

____1952, Denny's Gulch and Sawlog Creek-magnometer survey: Alaska Territorial Department of Mines Property Exam, PE-31-2, 35 p.

Wolff, E.N., 1999, Frank Yasuda and the Chandalar: self-published booklet by the author, 66 p.

Property Summary

Name(s): Denny's Gulch
Shamrock Bench
Highjack Bench
Spruce Hen Bench

Map No: C66
MAS No:0020310034
Alaska Kardex 031-011
ARDF CH019

Deposit Type: Placer

Commodities: Au

Location:
Quadrangle: Chandalar B-5
SE¼ sec. 32, T. 30 N., R. 7 W.
Meridian: Fairbanks
Elevation: 2,970 feet
Latitude: 67° 22.649' N.
Longitude: 149° 08.932' W.
Geographic: A headwaters tributary of Crooked Creek, 6 miles south of Twin Lakes.

History:

1948-57 - D. O'Keefe staked claims, prospected, and sank shafts on Denny's Gulch (Wolff, 1999).
1950 - O'Keefe sinks a series of shafts across the lower part of the creek (Williams, 1950).
1951 - Magnetic survey of Denny's Gulch and Sawlog Creek conducted by U.S. Department of Mines (Williams, 1952).
1964 - Recent placer mining reported (DeYoung, 1978).
1975-76 - WGM Inc. collected reconnaissance stream silt samples in the O'Keefe Hills (Dashevsky, 1986).
1983 - WGM Inc. conducted additional investigations in the O'Keefe Hills (Dashevsky, 1986).

Production: No recorded production.

Workings and Facilities:

Remains of a small cabin and shaft(s) are located at the bend, where Denny's Gulch begins to flow towards the east.

Geologic Setting:

The upper part of Denny's Gulch (greater than 2,800 feet elevation) flows on bedrock composed of Devonian quartz-mica schist and schistose quartzite with locally intercalated greenschist and greenstone (Brosge and Reiser, 1964). Both bedrock and float in the upper gulch are heavily limonite-stained and have been investigated for lode deposits (map no. C65).

A few large gold nuggets were reportedly picked up from the creek bed in the upper part of the creek, where the grade is steep and the gravel is large and shallow. Native iron appears nearly everywhere in small, bright pieces and is reported to be associated with sphalerite and rutile. Green stains were attributed to copper and the bitter taste of the creek was probably caused by arsenic (Williams, 1952).

Several shafts were reportedly sunk to bedrock in the vicinity of the old cabin. A shaft on the north side of the creek hit bedrock at 40 feet, but with negative results. One of two holes sunk 75 feet away hit sloping bedrock at 86 feet. The bedrock was followed down diagonally for an unknown distance, and a few "specks" of gold found, but the bottom of the channel was never hit. Depth to bedrock at the lower portion of the creek, near the eastern bend, is reported to be at least 35 feet. What little gold was found seems to have been concentrated in a red gravel layer of unknown depth (Williams, 1950, 1952; Wolff, 1999).

A magnetometer survey conducted by the Territorial Department of Mines did not outline a paystreak in the creek bed that any placer concentration may have caused. Several extremely high anomalies were observed, but the source was not determined (Williams, 1952).

Bureau Investigation:

Bedrock in upper Denny's Gulch is almost exclusively quartz-mica schist with lesser amounts of graphitic schist. Although minor greenstone and meta-granite/diorite were found in float, neither rock was found in place. A pan concentrate collected off quartz-mica schist bedrock near the creek headwaters (11248, table C-1) contains 235 ppm gold, 21.2 ppm silver, 133 ppm lead, 222 ppm zinc, and 116 barite. A pan concentrate sample (11287), collected midway down the creek, contains 936 ppb gold and 137 ppm zinc.

The lower creek does not flow on bedrock, but stream float contains schist and meta-diorite. Test pans downstream from the shaft and near stacked rocks, did not contain visible gold, and a pan concentrate (11839) at the same site does not contain significant gold.

Three pan concentrate samples collected on Denny's Gulch average 167 ppm zinc and 171 ppm barite, which is slightly anomalous. The source may be the sphalerite reported in the upper part of the creek (Williams, 1952).

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential exists for placer. Anomalous pan concentrate results indicate fine placer gold on bedrock in the upper part of the creek. However, the results do not indicate economic amounts of gold.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

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Dashevsky, S.S., 1986, Mines, prospects, and geochemical anomalies on Doyon Ltd. regional overselection lands Alaska, Blocks 1 - 8, v. I of II: unpublished report 86-01A for Doyon Ltd., v. 1, 42 p. [available from Doyon Ltd., Fairbanks, Alaska]

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Freeman, F.L., 1956, Examination of uranium prospects, *in* U.S. Geological Survey, 1963, Contributions to economic geology of Alaska: U.S. Geological Survey Bulletin 1155, p. 31.

Heiner, L.E., and Wolff, E.N., 1968, Final report, mineral resources of northern Alaska: Mineral Industry Research Laboratory, University of Alaska, Report 16, p. 47.

Nicol, D. L., 1983, Evaluation of the mineral potential of Doyon Ltd.'s Blocks 5 and 22: unpublished report 83-04, 78 p. [available from Doyon Ltd., Fairbanks, Alaska]

Williams, J.A., 1950, Mining operations in Fairbanks district and Innoko and Koyukuk precincts (Chandalar) Alaska: Alaska Territorial Department of Mines Miscellaneous Report MR-194-13, p. 3-4.

____1952, Denny's Gulch and Sawlog Creek-magnometer survey: Alaska Territorial Department of Mines Property Exam, PE-31-2, 35 p.

Wolff, E.N., 1999, Frank Yasuda and the Chandalar: self-published booklet by the author, p. 41.

Property Summary

Name(s): Howard Creek Lode

Map No: C67
MAS No: 0020310075
ARDF CH034

Deposit Type: Polymetallic veins(?)

Commodities: Cu, Ni

Location:

Quadrangle: Chandalar B-6
SE¼ sec. 35, T. 30 N., R. 11 W.
Meridian: Fairbanks
Elevation: 4,500 feet
Latitude: 67° 22.600' N.
Longitude: 149° 55.267' W.
Geographic: Located on an eastern ridge in the headwaters of a 4-mile-long, north-flowing tributary of Minnie Creek (map no. W109).

History:

1959-60 - U.S. Geological Survey conducted geologic mapping and stream sediment sampling of the Chandalar quadrangle. The Howard Creek occurrence is noted as a copper and nickel anomaly (Brosge and Reiser, 1964).

Production: None.

Workings and Facilities: None.

Geologic Setting:

The bedrock at upper Howard Creek is lower Paleozoic(?) to Proterozoic(?) interbanded quartzite and graphitic schist that contacts calcareous schist and marble along a northeastern trend. Howard Creek is just south of the Wiseman thrust fault, which is a regional fault system trending roughly east-northeast. Proterozoic(?) or Paleozoic(?) interbanded quartzite and graphitic schist is thrust over Devonian metasediments of the Beaucoup Formation (Brosge and Reiser, 1964; Dillon and Reifenstuhl, 1995).

Mulligan (1974) reported chloritic schist with quartz, muscovite, garnet, ankerite-magnesite, and graphite that contained cherry-sized pods of quartz and pyrrhotite with traces of galena and chalcopyrite. The pods are very sparsely distributed.

Bureau Investigation:

The Howard Creek occurrence is a large, steep talus slope. The schist-marble contact was investigated along 1.5 miles of the contact. Eleven samples of marble, schist, and quartz veins were collected. One select piece of quartz-chlorite schist with pyrite (10757, table C-1) contains 455 ppm zinc. No other anomalous results were noted in the Howard Creek samples.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential due to lack of anomalous sample results.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

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Grybeck, D., 1977, Known mineral deposits of the Brooks Range, Alaska: U.S. Geological Survey Open-File Report 77-166C, p. 33.

Mulligan, J.J., 1974, Mineral resources of the Trans-Alaska Pipeline corridor: U.S. Bureau of Mines Information Circular 8626, p. 6.

Property Summary

Name(s): Boulder Creek

Map No: C68
MAS No: 0020310063
Alaska Kardex 031-056
ARDF CH050

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar B-6
N½ sec. 2, T. 28 N., R. 10 W.
Meridian: Fairbanks
Elevation: 1,900 feet
Latitude: 67° 16.952' N.
Longitude: 149° 40.726' W.
Geographic: Boulder Creek is an 11-mile-long, south-flowing tributary of the South Fork Koyukuk River.

History:

1969 - Placer claims owned by H. Leonard, R. Harry, and M. Shupe (Kardex).
1989 - W. Bell operated on Boulder Creek (Bundtzen and others, 1990).
1990-92 - Central Alaska Gold Company (1992) conducted reconnaissance sampling in the area.
1990s-present - Placer claims owned by M. Shupe.

Production: Unknown.

Workings and Facilities:

A trommel, loader, and backhoe are located approximately 1.5 miles upstream from the mouth, near a large tailings area. A camp with several cabins and an airstrip are also nearby.

Geologic Setting:

Lower Boulder Creek lies within the east-northeast-trending Angayucham thrust fault system. North of the fault lies the continentally derived Arctic Alaska terrane, which includes lower Paleozoic to Proterozoic interbanded quartzite and graphitic schist. South of the fault lies the oceanic Angayucham terrane, composed of Mesozoic-Paleozoic phyllite. The Arctic Alaska terrane is differentiated from the Angayucham by its highly metamorphosed structure. Evidence of the fault trace includes an abrupt, linear magnetic feature (Cady, 1978; Dillon, 1987; Dillon and Reifenstuhl, 1995). Several gold-producing creeks lie within this fault system, including Slate Creek (map no. C69), Myrtle Creek (map no. C70), Rosie Creek (map no. W119), and the South Fork Koyukuk River (map nos. W126-W134).

Central Alaska Gold Company (1992) conducted reconnaissance sampling in the area. They reported two anomalous sediment samples (averaging 148 ppb gold); however, they could not duplicate their results.

Bureau Investigation:

Boulder Creek was investigated upstream from the current placer operations. Most of the creek cuts through quartz-mica schist bedrock with minor pyrite. Conglomerate and greenstone glacial erratics were observed in float. The schistosity is often vertical and perpendicular with respect to the creek, forming perfect natural riffles. One very fine gold piece and minor rusty pyrite was observed in a pan concentrate sample collected from bedrock (11831) about 1.5 miles upstream of the current placer operation; unfortunately, the sample was lost at the laboratory before it could be analyzed for gold. Another pan concentrate sample collected from a gravel bar immediately upstream of the current placer operations (11834, table C-1) contained five very fine gold flakes, and analysis showed it contain 3,635 ppb gold.

Resource Estimate: None.

Mineral Development Potential:

Moderate mineral development potential due to visible gold found in pan upstream of current placer operation.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Bundtzen, T.K., Swainbank, R.C., Deagen, J.R., and Moore, J.L., 1990, Alaska's mineral industry 1989: Alaska Division of Geological and Geophysical Surveys Special Report 44, p. 31.

Cady, J.W., 1978, Aeromagnetic map and interpretation, Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-878C, 2 sheets, scale 1:250,000.

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Dillon, J.T., and Reifenstuhl, R.R., 1995, Geologic map of the Chandalar B-6 quadrangle southeastern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 103, 1 sheet, scale 1:63,360.

Property Summary

Name(s): Slate Creek

Map No: C69
MAS No: 0020310068
Alaska Kardex 031-026
Alaska Kardex 031-109
Alaska Kardex 031-147 to 150
ARDF CH007

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar A-6
NW¼ sec. 24, T. 28 N., R. 11 W.
Meridian: Fairbanks
Elevation: 1,800 feet
Latitude: 67° 14.550' N.
Longitude: 149° 51.417' W.
Geographic: Slate Creek is the largest tributary to the Middle Fork Koyukuk River. Mining has been conducted along much of its length; the referenced location is approximately 6 miles upstream from the confluence of Slate and Myrtle Creeks. Access is via all-terrane-vehicle (ATV) trail from Coldfoot.

History:

1899 - Coarse placer gold was discovered in paying quantities at the confluence of Slate and Myrtle Creeks by the "Dorothy Boys" from Boston, Massachusetts (Schrader, 1900). The discovery initiated 100 years of nearly continuous prospecting and mining on Slate Creek.

1904 - Schrader (1904) reported the diggings extend 5 to 6 miles up Myrtle Creek and considerably farther up Slate Creek.

1915 - E. Brooks, J. Woods, S. Simonson and others mined and prospected Slate Creek (Fairbanks Daily Times, November 21, 1915).

1920s - Drifting, drilling, and opencut mining were conducted on Slate Creek (Wimmler, 1925; Reed, 1938).

1925 - J. Kelley drilled at multiple(?) locations along Slate Creek. He was reported to have excellent prospects (Reed, 1938; Fairbanks Daily News-Miner, August 13, 1924).

1930s - Intermittent mining conducted by hydraulic and hand methods (Smith, 1939b).

1933 - B. Marr and M. Farley sank a hole on a bench (Fairbanks Daily News-Miner, February 8, 1933).

1940 - A modern dragline plant was installed at Myrtle Creek (Fairbanks Daily News-Miner, March 18, 1940).

1954 - Slate Creek Mining Company, owned by F. Theissen and E. Durand, operated on upper Slate Creek with a bulldozer and sluice plate (Saunders, 1954).

1960s - Up to six operations working on Slate Creek, including Haat Mining Company (U.S. Bureau of Mines PIMR, 1960-1964).

1983-present - L. Swenson operating on Slate Creek above the confluence with Myrtle Creek.

Production: (oz Au) (Maddren, 1910; U.S. Bureau of Mines PIMRs, 1908-1964)

Pre1909 - 145
1918 - 40
1921 - 126
1922 - 41
1923 - 128
1960 - 46
1961 - 46
1963 - 12
Total: 584 (Records incomplete.) Bureau of Mines records indicate production total could be as high as 1,394 oz gold and 121 oz silver as of 1963.

Mosier and Lewis (1986) analyzed placer gold from two locations on Slate Creek. The first location was the headwaters forks near sample 11876. They reported an average gold fineness of 951.8 for plus-35-mesh gold and 899.2 for minus-35-mesh. Also, gold collected approximately 2 miles downstream, near the canyon, had an average fineness of 879.6.

Metz and Hawkins (1981) reported a gold fineness of 920 for gold in Slate Creek within the Chandalar quadrangle.

Workings and Facilities:

Many generations of mining equipment lie along the flanks of Slate Creek. An old airstrip lies immediately northeast of the confluence of Myrtle and Slate Creeks.

Geologic Setting:

Slate Creek lies within the east-trending Angayucham thrust fault system. North of the fault lies the continentally derived Arctic Alaska terrane, which includes Devonian Hunt Fork Shale. South of the fault lies the oceanic Angayucham terrane, composed of Mesozoic-Paleozoic phyllite. The Arctic Alaska terrane is differentiated from the Angayucham by its highly metamorphosed structure (Dillon, 1987; Dillon and Reifenstuhl, 1995). Evidence of the fault trace includes an abrupt, linear magnetic feature (Cady, 1978). Several gold-producing creeks lie within this fault system, including Boulder Creek (map no. C68), Myrtle Creek (map no. C70), Rosie Creek (map no. W119), and the South Fork Koyukuk River (map nos. W126-W134).

Bedrock at Slate Creek is Devonian carbonaceous phyllite and micaceous quartz schist, both of which contain intense folds and considerable segregated quartz veinlets and knotty lenses. There are also several dikes of Devonian(?) altered dioritc intrusive rock. Most of the Slate Creek valley contains gravel 10 to 40 feet deep; however, the stream has cut the phyllite bedrock in several canyons (up to 80 feet high) on Slate and Myrtle Creeks (Maddren, 1910; Brosge and Reiser, 1964).

Placer mining has been conducted mostly in the upper half of Slate Creek (Chandalar quadrangle) on the present stream channel. Gravel bars between the creek mouth and the confluence with Myrtle Creek were reported to produce $3 to $4 (0.09 to 0.13 oz) a day in fine gold. In the upper canyon, about 6 miles upstream of Myrtle Creek, production was reported to be $8 (0.42 oz) a day. Upstream of this canyon, James Kelley drilled into the present channel, but the results are not known. No deep channel has been found on Slate Creek. At least three high channels were prospected between the mouth of Slate Creek and its confluence with Myrtle Creek; however, not enough gold was found to warrant mining (Reed, 1938).

Bureau Investigation:

Gold was panned from three separate locations within the lower Slate Creek canyon, about 4 miles upstream from Myrtle Creek. The three pan samples (11877, 12335-12336, table C-1) average 36.24 ppm gold and 3.23 ppm silver. All the pan samples were collected of schistose bedrock. The bedrock at least one of the locations had vertically oriented schistosity, which created well-formed, natural riffles.

Approximately 5 miles downstream, near the confluence of Myrtle Creek, test pans taken off soft phyllite bedrock just above the confluence with Myrtle Creek contained numerous fine gold colors. A placer sample taken from gravel and underlying bedrock at the same site (11861) contains 0.012 oz/cy gold.

About a quarter of a mile downstream from the Slate-Myrtle Creek junction, a northwest-trending resistant outcrop of altered diorite (greenstone) crosses the creek. It makes up an island of bedrock in the stream bed and is about 75 feet wide. Small iron-stained patches in the diorite contain pyrrhotite(?) and trace chalcopyrite. A sample (11862) contains 338 ppm copper and 51 ppm gold. Both results are slightly anomalous. Similar slightly mineralized dikes are reported at other sites in the area (map no. C71).

Resource Estimate: None.

Mineral Development Potential:

Gold detected in samples and current mining operations suggest that moderate mineral development potential exists at Slate Creek. Resources are limited; however, due to extensive historical mining.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

Cobb, E.H. and Kachadoorian, R., 1961, Index of metallic and nonmetallic mineral deposits of Alaska compiled from published reports of Federal and State agencies: U.S. Geological Survey Bulletin 1139, p. 49.

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Heiner, L.E., and Wolff, E.N., 1968, Final report, mineral resources of northern Alaska: Mineral Industry Research Laboratory, University of Alaska, Report 16, p. 51.

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____1913, The Koyukuk-Chandalar region, Alaska: U.S. Geological Survey Bulletin 532, p. 69, 86-89.

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Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 91-94.

Saunders, R.H., 1954, Koyukuk district operations (Wiseman, Chandalar): Alaska Territorial Department of Mines Miscellaneous Report MR-194-16, p. 3-4.

Schrader, F.C., 1900, Preliminary report on a reconnaissance along the Chandalar and Koyukuk Rivers, Alaska in 1899: Twenty-first annual report of the U.S. Geological Survey Part 2, p. 483-485.

____1904, A reconnaissance in northern Alaska across the Rocky Mountains, along the Koyukuk, John, Anaktuvuk, and Colville Rivers and the Arctic coast to Cape Lisburne, in 1901: U.S. Geological Survey Professional Paper 20, p. 98-102.

Smith, P.S., 1939a, Mineral resources of Alaska in 1937: U.S. Geological Survey Bulletin 910A, p. 56.

____1939b, Mineral resources of Alaska in 1938: U.S. Geological Survey Bulletin 917A, p. 55.

____1941, Mineral resources of Alaska in 1939: U.S. Geological Survey Bulletin 926A, p. 52.

U.S. Bureau of Mines, 1908-1964, Permanent Individual Mine Records (PIMR) for placer mines in Alaska: U.S. Bureau of Mines unpublished reports.

Wimmler, N.L., 1925, Placer mining in Alaska in 1925: Alaska Territorial Department of Mines Miscellaneous Report MR-195-8, p. 103.

Property Summary

Name(s): Myrtle Creek
Myrtle Creek Mining Co.
Prospectors Inc.
Fairbanks Earth Movers

Map No: C70
MAS No: 0020310033
Alaska Kardex 031-006
Alaska Kardex 031-007
Alaska Kardex 031-010
Alaska Kardex 031-015
Alaska Kardex 030-126

Deposit Type: Placer

Commodities: Au, Ag

Location:
Quadrangle: Chandalar B-6
NW¼ sec. 28, T. 28 N., R. 11 W.
Meridian: Fairbanks
Elevation: 1,430 feet
Latitude: 67° 13.835' N.
Longitude: 149° 59.793' W.
Geographic: A 9-mile-long northeastern tributary of Slate Creek, 5 miles east of Coldfoot. The creek is accessible from the Dalton Highway via an all-terrain-vehicle trail.

History:

1899 - Coarse placer gold discovered by members of the "Dorothy Party", 2.5 miles above the mouth of Myrtle Creek, marking the first major discovery in the Koyukuk district (Schrader,1900).
1906 - About 80 men working on creek (Fairbanks Daily News-Miner, August 4, 1906).
1909-10 - Hydraulic mining below Myrtle Creek canyon, the first in the Koyukuk district (Reed, 1938).
1934 - Opencut mining by Haslem & Associates and William Marr (Smith, 1934).
1937 - Knut Ellington and company groundsluiced and sank shafts on claim #14 (Reed, 1938).
1940 - A dragline-dozer operation initiated at Myrtle Creek by A. Schwaesdal and J. Repo was the first mechanized mining in the district (Fairbanks Daily News-Miner, March 18, 1940).
1954 - Prospectors Inc. mined and drilled (U.S. Bureau of Mines PIMR, 1954).
1979-98 - Mined by M. Fleming.

Production: (oz Au) Includes both upper and lower Myrtle Creek.

1900 - 1,934	1915 - 97	1927 - 30	1939 - 35
1901 - 338	1916 - 516	1928 - 38	1941 - 251
1902 - 2,417	1918 - 189	1929 - 18	1948 - 200
1903 - 1,451	1919 - 346	1932 - 58	1949 - 737
1904 - 725	1920 - 135	1933 - 39	1950 - 3,141
1905 - 727	1921 - 167	1934 - 123	1951 - 63
1906 - 242	1922 - 87	1935 - 74	1952 - 559
1907 - 144	1923 - 60	1936 - 121	1953 - 711
1908 - 242	1924 - 66	1937 - 84	1954 - 47
1909 - 73	1925 - 29	1938 - 80	1955 - 11
1914 - 483	1926 - 62		

Total: 16,952 (Records incomplete).
Average gold fineness is 886 for modern channel gold and 914 for high channel gold (Reed, 1938)

Workings and Facilities:

Members of the Dorothy Party, which made the gold discovery on Myrtle Creek, are reported to have sunk 24 holes to bedrock with an average depth of 6 to 7 feet, before making their big strike (Ingman, 1988). Mining on Myrtle Creek in the early days was done by groundsluicing and shoveling in, followed by drifting, hydraulicking, then by utilizing draglines and dozers. Amalgamation plates were not used in the early days, which resulted in the loss of finer gold. Placer tailings, campsites, and mining equipment are still present along the lower 6 miles of the creek, with an active camp 2.0 miles upstream from the creek mouth. An airstrip is 1.4 miles south of the camp. A dragline shovel, brought in to do the first mechanized mining in the Koyukuk district, still lies midway up the creek (Schrader, 1900, 1904; Maddren, 1913; Reed, 1938).

By 1913, Myrtle Creek had been mined from its mouth up to claim number 20, about 5 miles upstream from Slate Creek. (The claims were numbered from 1 to 33 in ascending order from the creek mouth to its headwaters.) The most profitable section of the creek has been from approximately 2.5 to 5.5 miles above the mouth. Mining was reportedly not profitable above claim number 15 (Nelson Creek). In recent years attempts were made to mine bench gravels with considerable overburden on the east side and midway up the creek. In 1998 a small wash plant was being used to test ground midway up the creek, and in 2000 a suction dredge was being used to mine bedrock potholes in the narrows, approximately 1.4 miles upstream from Slate Creek (Schrader, 1900, 1904; Maddren, 1913; Reed, 1938; M. Fleming, personal communication, 1998).

Geologic Setting:

The flat-bottomed Myrtle Creek valley has steeply rising sides and is anywhere from 20 to 300 feet wide from its headwaters to approximately 2 miles above its mouth. In the lower 2 miles of the valley, the creek has cut through a gravel bench and down into the bedrock beneath. The valley narrows to a canyon approximately 2.5 miles above the mouth and continuing for 300 to 400 feet upstream. The canyon is approximately 20 feet across and has steep walls on both sides (Schrader, 1904; Maddren, 1913; Reed, 1938).

Upper Myrtle Creek drains Devonian interbanded quartzite and graphitic schist. A northwest-trending high-angle fault cuts this unit near the creek headwaters. About midway down the creek, these rocks are in thrust-fault contact with shale and graphitic schist of the Middle Devonian Hunt Fork Shale(?). The fault trends east-west and the Hunt Fork Shale makes up the upper plate. Several east-west trending dikes of altered diorite intrusive rock (greenschist) occur along Myrtle Creek; the most notable outcropping is just above the narrow canyon, 1.5 miles upstream from Slate Creek. Maddren (1913) described the bedrock in Myrtle Creek as a carbonaceous phyllite below the canyon and quartz schist above. Both units contain considerable segregated quartz veinlets, leaflets, and knotty lenses (Brosge and Reiser, 1964; Dillon and Reifenstuhl, 1995).

Boulders of extremely resistant eclogite float occur along the creek as well as boulders of pyrite-rich chlorite schist and metamorphic quartz. The first two rock types have not been found in place, although an eclogite outcrop has been mapped near the mouth of Clara Creek, 4.5 miles to the northwest (Gottschalk, 1987). There may be similar, though unmapped, exposures that extend into the Myrtle Creek drainage. It is possible that some of the greenschist dikes in the area were further metamorphosed to eclogite under high pressure (Dillon and others, 1989).

Placer gold on Myrtle Creek is concentrated in modern stream and bench gravels. The width of the modern channel below the canyon is about 30 feet and above the canyon from 30 to 300 feet. Depth to bedrock has been reported to be from 2 to 4 feet with gold concentrated mostly at the bottom of the loose shingle gravels and in the cracks and crevices of the slabby, schistose bedrock. When the schistosity dips steeply and cuts across the creek bed, it forms excellent natural riffles for catching gold. This bedrock was loose enough such that from 1.5 to 2.0 feet could be taken up and washed using hand methods. The gold appeared to be well distributed across the width of the stream bed and early day miners were reported to be recovering from $5 (0.26 oz) to $15 (0.79 oz) per day. The best ground in the modern channel in the early days was reported to be from 2 to 3 miles upstream from Slate Creek. The stream at that point probably carried a combination of gold derived from upper Myrtle Creek and possibly that deposited on the surrounding benches by ancestral Slate Creek (Maddren, 1913; Reed, 1938).

By 1937 the modern channel had been mostly worked out, but there was mining activity midway up the creek. At this site 6 to 7 feet of fairly coarse, subangular gravel without many boulders overlies schist bedrock. The value of the ground was reportedly $1.20 (0.039 oz) per bedrock foot. The gravel in the creek was thawed, but that on the benches was permanently frozen (Reed, 1938).

Reed (1938) reported two runs of gold: one is fine and flaky, and the other is rounded, heavy, and waterworn. Nuggets valued up to $800 (25 oz) have been found. Maddren (1913) described the gold as the size that miners called "shot and wheat gold." It was generally coarse, clean and rolled or hammered flat.

A low-high channel can be traced on both sides of Myrtle Creek from the creek mouth to a point 3 miles upstream. The channel ranges from 6 feet on the upper end to 30 feet above the modern channel below the canyon. It also swings from the west side of the canyon on the upper end to the east side below the canyon. Depth to bedrock ranges from 1 to 30 feet. Values from this bench were reported to range from 35 cents (0.011oz) to 75 cents (0.023 oz) per bedrock foot. Along the lower two miles of Myrtle Creek, this bench consists largely of Slate Creek channel wash. It has been mined by hydraulic methods. Here the overburden is from 10 to 30 feet thick, and rest on a bench of bedrock 10 to 15 feet above the modern stream channel. Some of the gold in these gravels may have been supplied by Slate Creek (Reed, 1938).

At least four other high channels are discernable on Myrtle Creek. These include benches on top of the canyon narrows. As of 1937 none of these channels had been prospected. In recent years attempts have been made to mine the benches midway up and on the east side of the creek, which contain up to 50 feet of overburden. The results of this work is not known (Reed, 1938; M. Fleming, personal communication 1998).

Bureau Investigation:

Sections of Myrtle Creek were walked and test pans taken off bedrock where possible. A placer sample(11904, table C-1) was taken from low-high(?) channel gravels and underlying bedrock near the mouth of June Pup, an eastern tributary, 4 miles upstream from Slate Creek. The sample contained 0.024 oz/cy gold, which ranged from coarse to very fine in character. Some of the gold was coated with mercury, which indicates that previous mining and amalgamation had taken place at the site. Test pans taken from the bottom of a 50-foot-deep cut in frozen gravel, 0.5 mile downstream and on the same side of the creek, contained no gold. The pyritic chlorite schist was sampled to determine whether that unit might be the source of the gold in Myrtle Creek. Two float samples of the pyritic chlorite schist (11313, 11857) averaged 17 ppb gold. The average abundance of gold in the earth's crust is about 4 ppb

(Levinson, 1974).

Quartz veins and greenschist dikes near the head of the canyon contain minor pyrrhotite and pyrite(?), but samples were not anomalous in any metals (11847-11848, 11851). A sample of eclogite float (11852) contained 683 ppm copper. Test pans taken off bedrock at this site (11849) contained coarse, flat gold flakes, greater than 2 mm in size. A sluice concentrate obtained from M. Fleming, a miner on Myrtle Creek, contained 710 ppm arsenic and 146 ppm cobalt (11312).

The headwaters of the creek above the mined area was investigated and pan concentrate samples were collected at the major forks, 6 miles upstream from Slate Creek (11853-11856). None of the samples were anomalous in gold.

Resource Estimate: None

Mineral Development Potential:

Low development potential for gold in modern stream gravels because the resource has been mostly mined out. Bench (high channel) gravels midway up and on the east side of the creek are a potential resource. It seems that those sections of bench with thin overburden have been mined. Benches with thicker overburden (up to 50 feet) have been sampled by the claim owners, but the results are unknown.

Recommendations:

Utilize seismic and ground penetrating radar surveys to determine the extent of overburden-covered benches on the east side and midway up the creek. Testing of bedrock potholes in the canyon narrows with a suction dredge.

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Property Summary

Name(s): South Fork Koyukuk River Tributary
Unnamed Occurrence

Map No: C71
MAS No: 0020310084
ARDF CH005

Deposit Type: Greenstone copper

Commodities: Cu

Location:

Quadrangle: Chandalar A-6
E½ sec. 33, T. 28 N., R. 10 W.
Meridian: Fairbanks
Elevation: 2,650 feet
Latitude: 67° 12.750' N.
Longitude: 149° 44.583' W.
Geographic: Descriptions of the location vary. The stated location is accurate within one mile. The site is on Doyon Ltd. land, at the headwaters of an unnamed western tributary to South Fork Koyukuk River.

History:

1959-60 - U.S. Geological Survey conducted geologic mapping and stream sediment sampling of the Chandalar quadrangle. A stream sediment sample collected at the site contained 65 ppm copper (Brosge and Reiser, 1964).

Production: None.

Workings and Facilities: None.

Geologic Setting:

The occurrence lies within the east-trending Angayucham thrust fault system. North of the fault lies the continentally derived Arctic Alaska terrane, and south of the fault lies the oceanic Angayucham terrane. Bedrock in the area includes Middle Paleozoic to Mesozoic phyllite, slate, graywacke, volcanic rocks, and chert. Devonian greenstone also outcrops near the low hills, dividing South Fork Koyukuk River and Slate Creek (Brosge and Reiser, 1964; Dillon, 1987).

An anomalous copper stream sediment sample and copper staining in volcanic rocks have been reported in the area (Brosge and Reiser, 1964; DeYoung, 1978).

Bureau Investigation:

The headwaters of the unnamed tributary and the hills dividing Slate Creek and the South Fork Koyukuk River were investigated. The area is characterized by low, gently undulating hills with little outcrop exposure. No copper staining was observed. A grab sample of the greenstone that outcrops near hill 3226 (11880) contained 182 ppm copper. Farther south, two soil samples (11878-11879) were collected at a terminal moraine cut by an unnamed creek. No anomalies were noted; copper assay values were 32 ppm for both samples.

Greenschist and eclogite have been observed on Clara (map no. W117), Slate (map no. C69) and Myrtle (map no. 70) Creeks. The eclogite may be the result of continued metamorphism of the greenschist dikes (Dillon and others, 1989). Samples of these two units have contained up to 683 ppm copper.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential due to extremely low sample results. Greenstone with anomalous copper values outcrops in the area, but the BLM investigation indicates it does not represent a mineable resource.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

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Property Summary

Name(s): Hill 3816
Unnamed Occurrence

Map No: C72
MAS No: 0020310085
ARDF CH004

Deposit Type: Mafic-ultramafic lode

Commodities: Cu, Ni

Location:

Quadrangle: Chandalar A-6
SE¼ sec. 25, T. 27 N., R. 10 W.
Meridian: Fairbanks
Elevation: 3,200 feet
Latitude: 67° 08.044' N.
Longitude: 149° 38.667' W.
Geographic: South of hill 3816 and approximately 2.5 miles west-northwest of the confluence of Siwash Creek and Mosquito Fork. The site is on Doyon Ltd. land.

History:

1959-60 - U.S. Geological Survey conducts geologic mapping and stream sediment sampling of the Chandalar quadrangle. The occurrence is a rock sample that was anomalous in copper and nickel (Brosge and Reiser, 1964).

Production: None.

Workings and Facilities: None.

Geologic Setting:

The occurrence is located at the contact between Devonian phyllite and chlorite-quartz schist and Devonian volcanic rocks (pyroxene andesite flows, pyroxene diorite intrusives, and hornblende andesite pyroclastic rocks) and hornblende hornfels (Brosge and Reiser, 1964).

Bureau Investigation:

In the vicinity of the reported occurrence, an approximately 1,000-wide, northeast-trending band of mafic-ultramafic(?) rock is bounded on both margins by chlorite-quartz schist. The mafic-ultramafic rock contains magnetite, a resistant red-brown weathering mineral (harzburgite?), and is serpentinized near the schist contacts. The unit has been mapped as pyroxene diorite and/or gabbro by Brosge and Reiser (1964), but may actually be dunitic. The schist contains barren metamorphic quartz lenses up to 3 feet wide that extend for up to 100 feet along strike. Samples of the serpentinized rocks average 977 ppm nickel and 1,078 ppm chromium (11922-11923) (Klieforth and others, 2001, p. A121-A123). No sulfide minerals were noted in the samples.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential due to low metal values and lack of sulfides.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

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Property Summary

Name(s): Siwash Creek Lode

Map No: C73
MAS No: 0020310077
ARDF CH002

Deposit Type: Quartz veins(?)

Commodities: Cu

Location:

Quadrangle: Chandalar A-5
S½ sec. 31, T. 27 N., R. 8 W.
Meridian: Fairbanks
Elevation: 2,130 feet
Latitude: 67° 06.315' N.
Longitude: 149° 23.196' W.
Geographic: A north-facing bluff at an unnamed tributary of Siwash Creek, 0.7 mile northwest of hill 3165.

History:

1959-60 - U.S. Geological Survey (USGS) conducted geologic mapping and stream sediment sampling of the Chandalar quadrangle. The Siwash Creek occurrence was noted as a copper anomaly (Brosge and Reiser, 1964).

Production: None.

Workings and Facilities: None.

Geologic Setting:

Bedrock at the site consists of Devonian volcanic rocks (pyroxene andesite flows, pyroxene diorite intrusives, and hornblende andesite pyroclastic rocks) and radiolarian chert and siliceous argillite (Brosge and Reiser, 1964).

USGS reported copper sulfides and/or malachite-azurite stains in the cherty part of a volcanic unit (Grybeck, 1977).

Bureau Investigation:

The west-facing bluff is approximately 30 feet high by 100 feet wide (at the base). The bedrock appears to be a pyroxine diorite that is highly silicified. Quartz veins, 1 to 2 inches thick, cut the host rock at numerous orientations. Two samples of pyrite-bearing quartz veins were collected from outcrop along the bluff. One vein sample (11946) was exposed for 3 feet along a N. 58° E. strike and 52° N. dip. The other vein (11947) was exposed for 4 feet along a northerly strike with a vertical dip. A sample of the mafic volcanic rock that hosting the quartz veins (11948) was also collected. No anomalies were noted in any of the analytical results.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential exists at the Siwash occurrence due to minimal metal content in assay results.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., 1972, Metallic mineral resources map of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-457, 1 sheet, scale 1:250,000.

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-File Report 83-278, p. 62.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Grybeck, D., 1977, Known mineral deposits of the Brooks Range, Alaska: U.S. Geological Survey Open-file report 77-166C, p. 33.

Property Summary

Name(s): Mosquito Fork

Map No: C74
MAS No: 0020310056
Alaska Kardex 031-146
Alaska Kardex 031-154

Deposit Type: Placer

Commodities: Au

Location:
Quadrangle: Chandalar A-6
SE¼ sec. 23, T. 26 N., R. 11 W.
Meridian: Fairbanks
Elevation: 1,240 feet
Latitude: 67° 03.498' N.
Longitude: 149° 53.021' W.
Geographic: Eastern tributary of the South Fork Koyukuk River, near Eagle Cliff.

History:

1979 - Claims staked (Kardex).

Production: No recorded production.

Workings and Facilities: None observed.

Geologic Setting:

Bedrock in the Mosquito Fork drainage consists of a Cretaceous conglomerate unit, Devonian volcanic rocks and chert, and Paleozoic granitic rocks and hornfels. Several outcrops of Bergman Group, a Lower and Upper Cretaceous conglomerate, are located in the hills south of the sample site (Brosge and Reiser, 1964).

Bureau Investigation:

Four test pan samples were collected from gravels in the Mosquito Fork. Test pans were also collected off gravels and banks of the southern tributary in section 23. No gold was found in the test pans. Results from the stream sediment and pan concentrate (11919-20) samples are not considered anomalous. Results from a sample of pyrite-bearing metamorphic quartz (11921) are not considered anomalous.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential due to lack of gold in samples.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Property Summary

Name(s): Granite Creek

Map No: C75
MAS No: 0020310116
Alaska Kardex 031-052
ARDF CH003

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Chandalar A-6
SE¼ sec. 4, T. 25 N., R. 11 W.
Meridian: Fairbanks
Elevation: 1,400 feet
Latitude: 67° 01.000' N.
Longitude: 149° 58.000' W.
Geographic: On the west fork of Granite Creek, about 2.5 miles south of Eagle Cliff.

History:

1967, 69 - Five claims staked by T. Dalquist and C. Larson. Suction dredge work was reportedly done (DeYoung, 1978).

Production: None recorded.

Workings and Facilities: None observed.

Geologic Setting:

Bedrock in Granite Creek consists of Devonian volcanic rocks and upper Paleozoic to Mesozoic intrusive rocks. The volcanic rocks include pyroxene andesite flows, pyroxene diorite, hornblende andesite pyroclastic rocks, and some diabase and gabbro. The intrusive rocks are located in upper Granite Creek and include hornblende-granodiorite, quartz monzonite, and (porphyritic) granite (Brosge and Reiser, 1964).

Bureau Investigation:

The west fork of Granite Creek was investigated. No gold was found in two test pans that were collected near an altered mafic volcanic outcrop in the creek bed. A stream sediment and pan concentrate sample (12544-12545) were collected at the same site, but no anomalies were noted. A float sample of hornfels with trace chalcopyrite (12546) was also collected. It assayed 199 ppm copper. No other anomalies were noted.

Resource Estimate: None.

Mineral Development Potential: Low mineral development potential for placer gold.

Recommendations: None.

References:

Brosge, W.P., and Reiser, H.N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-375, 1 sheet, scale 1:250:000.

Cobb, E.H., and Cruz, E.L., 1983, Summaries of data on and lists of references to metallic and selected nonmetallic mineral deposits in the Chandalar quadrangle, Alaska: U.S. Geological Survey Open-file Report 83-278, p. 31.

DeYoung, 1978, Mineral resources of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Investigation Map MF-878B, 2 sheets, scale 1:250,000.

Table C-1. Selected results from samples collected in the Chandalar quadrangle.

Explanation

Sample site

core	drill core
drum	55 gallon drum
dump	mine dump
flt	float
otc	outcrop
rub	rubblecrop
tail	mine tailings
trn	trench

Placer gold: size classification

v. fine	< 0.5 mm
fine	0.5 - 1.0 mm
coarse	1 -2 mm
v. coarse	> 2 mm

Abbreviations:

Ck	creek
confl	confluence
Mtn	mountain
R	river

Footnotes:

Bold numbers indicate multiple erratic results, which were averaged.

Results for Au are reported in ppb unless other units are stated.

Sample type

cont	continuous chip
grab	grab sample
pan	pan concentrate
plac	placer concentrate
rand	random chip
rep	representative chip
sed	sediment sample
sel	select
slu	sluice concentrate
soil	soil sample
spac	spaced chip

Sample description

abu	abundant
alt	altered, alteration
amph	amphibole
ank	ankerite
apy	arsenopyrite
az	azurite
ba	barite
bio	biotite
blk	black
bn	bornite
box	boxwork texture
brn	brown
ca	calcite
calc	calcareous
carb	carbonate
cc	chalcocite
cgl	conglomerate
ch	chlorite
chm	chromite
comp	composite
cpy	chalcopyrite
cst	cassiterite
cv	covellite
diss	disseminated
ep	epidote
feld	feldspar
ft	foot (12 inches)
fuch	fuchsite
gar	garnet
gd	granodiorite
gn	galena
gwy	graywacke
hbl	hornblende
hem	hematite
hfls	hornfels
hydro	hydrothermal
in	inch
intr	intrusive
lim	limonite
ls	limestone
mag	magnetite

Sample description

mal	malachite
mar	marcasite
mdst	mudstone
meta	metamorphic
MnO	manganese oxide
mod	moderate
monz	monzonite
musc	muscovite
oz/cyd	ounces per cubic yard
oz/t	ounces per ton
pct	percent
po	pyrrhotite
porph	porphyry
ppb	parts per billion
ppm	parts per million
psuedo	psuedomorph
py	pyrite
qtz	quartzite
qz	quartz
sch	scheelite
sco	scorodite
ser	sericite
serp	serpentinized
sid	siderite
silic	siliceous
sl	sphalerite
slts	siltstone
ss	sandstone
stb	stibnite
tet	tetrahedrite
tm	tourmaline
tr	trace
v	very
val	valentinite
vis	visible
vlets	veinlets
volc	volcanic
w/	with
xcut	crosscutting
xln	crystalline
xls	crystals

Elements

Ag	silver
Al	aluminum
As	arsenic
Au	gold
Ba	barium
Bi	bismuth
Ca	calcium
Cd	cadmium
Co	cobalt
Cr	chromium
Cu	copper
Fe	iron
Ga	gallium
Hg	mercury
K	potassium
La	lanthanum
Li	lithium
Mg	magnesium
Mn	manganese
Mo	molybdenum
Na	sodium
Nb	niobium
Ni	nickel
Pb	lead
Pd	palladium
Pt	platinum
Sb	antimony
Sc	scandium
Sn	tin
Sr	strontium
Ta	tantalum
Te	tellurium
Th	thorium
Ti	titanium
U	uranium
V	vanadium
W	tungsten
Y	yttrium
Zn	zinc
Zr	zirconium

Table C-1. Selected results from samples collected in the Chandalar quadrangle.

Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	As ppm	Sb ppm	Sn ppm	W ppm
C 1	8051	Kuyuktuvuk Ck	flt	grab	felsic schist w/ py, mal	<5	<5			<200	3	8	15.0	<200	<2
C 1	11462	Kuyuktuvuk Ck		sed		<5	<0.2	44	19	108	<1	<5	<5	<20	<20
C 1	11463	Kuyuktuvuk Ck		pan	no mag, no vis Au	11	<0.2	50	24	115	<1	7	<5	<20	<20
C 2	8052	Trembley Ck	rub	grab	carbonaceous paper shale	<5	<5			<200	<2	72	8.2	<200	3
C 2	11508	Trembley Ck		sed		<5	<0.2	42	14	490	3	11	<5	<20	<20
C 2	11509	Trembley Ck		pan	no mag	12	<0.2	45	13	265	6	12	<5	<20	<20
C 3	11640	Nutirwik Ck trib		sed		<5	1.0	15	7	32	1	17	<5	<20	<20
C 3	11641	Nutirwik Ck trib		pan	6 py cubes (<2mm), no mag	3	0.3	33	7	50	2	28	17	<20	<20
C 3	11642	Nutirwik Ck trib	flt	sel	qz mica schist w/ <3% diss py	17	1.1	55	16	148	29	50	13	<20	<20
C 3	11643	Nutirwik Ck		sed		6	0.5	37	7	68	2	17	<5	<20	<20
C 3	11644	Nutirwik Ck		pan		1	<0.2	68	12	130	2	22	<5	<20	<20
C 3	12550	Nutirwik Ck		sed		<5	<0.2	33	10	86	3	17	<5	<20	<20
C 3	12551	Nutirwik Ck		pan	tr mag	8	<0.2	74	25	185	3	12	<5	<20	<20
C 4	8053	Big Jim Ck	rub	grab	qz vein w/ lim	<5	<5			<200	2	5	12.0	<200	<2
C 4	8054	Big Jim Ck	otc	sel	qz vein w/ <1% cpy, tr gn	<5	<5	0.36%		<200	6	4	16.0	<200	<2
C 5	11084	Snowden Ck	otc	sel	ls w/ cal vein	7	0.8	354	4	9	3	6	<5	<20	<20
C 5	11085	Snowden Ck	flt	sel	ls w/ qz, cal, py, cpy	2	1.5	3	9	6	1	6	<5	<20	<20
C 5	11086	Snowden Ck	flt	sel	qz-ch schist w/ 5% euhedral py	8	0.2	19	16	42	2	93	<5	<20	<20
C 5	11150	Snowden Mtn	rub	rep	ca-gypsum vein w/ euhedral py	<5	0.2	92	<2	66	1	<5	<5	<20	<20
C 5	11151	Snowden Mtn	otc	sel	ca-gypsum vein w/ euhedral py	<5	0.2	52	<2	59	<1	6	<5	<20	<20
C 6	11145	Mathews R, upper	flt	sel	dol w/ py, qz vlets	6	<0.2	5	6	42	8	8	<5	<20	<20
C 6	11146	Mathews R, upper		sed		9	0.2	47	13	139	5	13	<5	<20	<20
C 6	11147	Mathews R, upper		pan	no mag, no vis Au	9	<0.2	48	17	127	5	10	<5	<20	<20
C 6	11148	Mathews R		sed		7	0.4	29	11	78	2	9	<5	<20	<20
C 6	11149	Mathews R		pan	no mag, no vis Au	8	0.7	21	7	60	2	7	<5	<20	<20
C 7	10875	Kalhabuk Ck		sed		<5	<0.2	32	10	94	1	9	<5	<20	<20
C 7	10876	Kalhabuk Ck		pan	mod sulfides, no vis Au	18	0.3	66	145	84	2	37	<5	<20	<20
C 7	10877	Kalhabuk Ck	flt	sel	schist w/ 1% py	<5	<0.2	21	3	56	<1	78	5	<20	<20
C 8	8032	Vi Ck	otc	sel	qz vein w/ <1% cpy, gn	<5	<5			<200	22	140	356.0	<200	<2
C 8	8033	Vi Ck	flt	sel	vein qz w/ <1% cpy, gn	<5	<5			580	<2	35	151.0	<200	<2
C 9	11082	Brockman Ck		pan	minor sulfides, from cutbank	16	0.7	51	4	141	3	22	6	<20	<20
C 9	11083	Brockman Ck		pan	tr sulfides	12	<0.2	37	4	105	3	13	5	<20	<20
C 9	11152	Brockman Ck trib	otc	ran	Skajit ls w/ 3% py	7	1.0	23	60	84	3	119	<5	<20	<20
C 9	11153	Brockman Ck trib		sed		8	<0.2	27	6	79	<1	8	<5	<20	<20
C 9	11154	Brockman Ck trib		pan	1 v fine Au(?), no mag	12	<0.2	53	9	84	5	12	<5	<20	<20
C 9	11192	Brockman Ck trib	otc	rep	graphitic calc schist w/ 2% py	<5	0.5	16	8	36	2	<5	<5	<20	<20
C 9	11193	Brockman Ck trib		pan	mod euhedral py	55	0.4	48	10	82	3	20	<5	<20	<20

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Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	As ppm	Sb ppm	Sn ppm	W ppm
C 9	12404	Brockman Ck upper trib		pan	no vis Au, no mag	<5	1.9	22	4	25	<1	10	<5	<20	<20
C 9	12405	Brockman Ck		sed		<5	<0.2	37	7	80	2	12	<5	<20	<20
C 9	12406	Brockman Ck		pan	minor fine sulfides	<5	<0.2	39	10	110	3	14	<5	<20	<20
C 10	11646	Mathews R lode	flt	sel	vein qz w/ 1% gn, cpy, and apy	85	1.4	329	700	366	1	5017	74	<20	<20
C 10	11647	Mathews R lode	flt	sel	vein qz w/ diss gn, cpy, po, lim	7	0.4	32	240	254	1	353	11	<20	<20
C 10	11648	Mathews R lode	flt	sel	vein qz w/ gn, cpy, and py	124	4.5	412	2840	320	2	4993	46	<20	<20
C 11	11729	Eva	flt	sel	qz-ser schist, suspected "erratic"	7159	110.2	3933	13.98%	253	2	73	4.46%	<20	<20
C 11	11737	Eva	otc	sel	qz-ser schist w/ 3-5% cpy, py(?)	68	2.1	2853	306	93	2	44	105	<20	<20
C 11	11738	Eva	otc	sel	calc-silicate w/ abu mal & az	23	1.4	1354	42	144	13	19	32	<20	<20
C 11	11739	Eva	otc	rep	calc-schist w/ <5% py stringers	16	9.7	54	3395	3931	3	17	22	<20	<20
C 11	11740	Eva	flt	sel	mafic meta-intrusive w/ 3% po	14	0.5	358	46	54	3	35	18	<20	<20
C 11	11744	Eva	otc	rand	qz-ser schist w/ 10% diss cpy, lim	<5	<0.2	94	4	66	<1	36	<5	<20	<20
C 11	11745	Eva	flt	sel	granite gneiss w/ 1-3% po	<5	0.3	12	124	108	2	11	9	<20	<20
C 11	11746	Eva	rub	sel	qz-ser schist w/ py blebs, stringers	<5	<0.2	44	17	27	<1	8	12	<20	<20
C 11	11747	Eva	flt	sel	massive cpy, py	48	2.1	0.79%	13	54	2	<5	11	<20	<20
C 11	12403	Eva	otc	sel	calc-silicate w/ 1-2% diss cpy	105	3.5	8125	6	199	3	45	151	<20	<20
C 12	8028	Peak 5274, Victor	rub	grab	skarn w/ cpy, py, mal, az	979	22	4.68%		<340	52	248	1440.0	<1200	150
C 12	8029	Peak 5274, Victor	otc	grab	skarn w/ cpy, gar, ep	<5	<5	0.14%		<200	7	50	258.0	<200	80
C 12	8030	Peak 5274, Victor	rub	sel	massive sulfide (cpy)	1020	15	7.76%		300	21	122	555.0	<530	19
C 12	11185	Peak 4737	otc	cont	ep-gar-qz skarn w/ 5% cpy	101	10.8	5695	<2	72	12	18	<5	<20	<20
C 12	11186	Peak 4737	otc	cont	ep-gar-qz skarn w/ cpy, py	321	12.5	1.22%	3	102	13	50	<5	<20	<20
C 12	11187	Peak 4737	otc	cont	ep-qz skarn w/ 5% cpy	49	2.5	2999	<2	47	4	15	19	<20	<20
C 12	11188	Peak 5274, Victor	otc	rep	ep-gar-qz skarn w/ cpy, py	<5	0.7	455	6	56	4	37	<5	<20	<20
C 12	11189	Peak 5274, Victor	flt	sel	calc hfls w/ 3% po, abu lim	<5	0.4	58	<2	23	3	34	<5	<20	<20
C 12	11190	Peak 5274, Victor	flt	sel	calc silicate rock w/ 3% cpy	8	0.8	1.20%	<2	37	3	<5	<5	<20	<20
C 12	11191	Peak 5274, Victor	otc	rep	ser granite w/ abu lim	10	<0.2	86	<2	33	1	23	<5	<20	<20
C 12	11697	Peak 5274, Victor	otc	cont	15-ft-long gar-ep skarn w/ cpy, py	183	18.8	2.10%	21	93	133	101	14	<20	<20
C 12	11698	Peak 5274, Victor	otc	rand	gar skarn w/ >1% cpy	41	3.0	7631	12	74	100	20	54	<20	<20
C 12	11699	Peak 5274, Victor	otc	cont	3.2-ft-long skarn w/ abu py, cpy	1093	20.6	7.20%	27	287	64	54	44	<20	<20
C 12	11700	Peak 5274, Victor	otc	sel	gar-ep skarn w/ 1% cpy, <10% py	99	25.5	3.90%	16	134	46	27	8	<20	54
C 13	8047	Big Spruce Ck, Venus	core	grab	monz, hfls, skarn	7	<5	0.09%		<200	160	8	11.0	<200	7
C 13	8048	Big Spruce Ck, Venus	flt	grab	skarn w/ 40% py, gar	55	<5			<200	4	23	14.0	<200	<2
C 13	8050	Big Spruce Ck, Venus	rub	sel	meta granite w/ cpy, moly	8	<5	0.05%		<200	236	4	14.0	<200	13
C 13	11109	Big Spruce Ck, Venus	otc	rep	silic rock w/ 3% cpy	10	0.7	2073	2	16	9	<5	<5	<20	<20
C 13	11110	Big Spruce Ck, Venus	otc	sel	0.25-ft-wide qz vein w/ 2% cpy	5	0.7	1609	<2	56	3	<5	<5	<20	<20
C 13	11125	Big Spruce Ck, Venus	otc	rep	meta granite w/ 3% cpy	4	0.2	272	<2	12	2	9	<5	<20	<20
C 13	11126	Big Spruce Ck	otc	grab	sericitized prophyry w/ 3% cpy	3	<0.2	179	<2	10	2	<5	<5	<20	<20

Table C-1. Selected results from samples collected in the Chandalar quadrangle.

Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	As ppm	Sb ppm	Sn ppm	W ppm
C 13	11127	Big Spruce Ck	otc	grab	blk fine-grained rock w/ cpy, py	5	0.3	607	<2	34	1	<5	<5	<20	<20
C 13	11128	Big Spruce Ck	otc	grab	rhyolite (?) w/ cpy, po	3	<0.2	150	<2	33	2	<5	<5	<20	<20
C 13	11130	Big Spruce Ck, Venus	flt	sel	massive sulfide w/ lim, MnO	441	2.4	0.47%	<2	171	3	27	609	<20	<20
C 13	11131	Big Spruce Ck, Venus	flt	sel	massive cpy	43	1.8	2030	5	37	11	65	<5	<20	<20
C 13	11180	Venus Ck	otc	grab	ser granite w/ cpy, py, mal, lim	14	1	1382	<2	22	3	6	<5	<20	<20
C 13	11181	Venus Ck	otc	ran	skarn w/ >20% cpy, py, mag, po	39	2.2	0.17%	<2	36	4	16	239	<20	<20
C 13	11182	Venus Ck	otc	sel	calc hfls w/ diss cpy, py, ep(?)	6	<0.2	86	<2	32	1	13	<5	<20	<20
C 13	11607	Venus Ck		sed		12	0.3	417	6	47	4	16	<5	<20	<20
C 13	11608	Venus Ck		pan		22	<0.2	1008	17	76	3	17	<5	<20	<20
C 13	11609	Venus Ck	otc	ran	silic meta granite w/ cpy, py	12	0.4	660	<2	27	2	8	<5	<20	<20
C 13	11689	Venus Ck	flt	sel	vein qz w/ 2-5% Mo	49	0.5	1560	7	37	1473	21	0.66%	<20	<20
C 13	11693	Venus Ck	otc	sel	ch-qz schist	10	0.9	1184	3	12	8	7	83	<20	<20
C 13	11694	Venus Ck	otc	rand	mag skarn w/ cpy, py, actinolite(?)	13	1.6	2704	<2	126	<1	21	54	<20	24
C 13	11695	Venus Ck	otc	rand	metagranite w/ <5% py, mal	<5	<0.2	247	4	12	13	<5	315	<20	<20
C 13	11696	Venus Ck	otc	rand	ser schist w/ Mo smears & vlets	13	<0.2	346	<2	4	212	<5	55	<20	<20
C 13	12384	Big Spruce Ck, Venus	otc	rand	gd porph w/ 1% py, mal	11	1.0	1271	54	220	8	10	<5	<20	<20
C 13	12385	Big Spruce Ck, Venus	otc	rand	gd porph w/ 1% py, cpy	9	0.7	217	11	32	8	12	<5	<20	<20
C 13	12386	Big Spruce Ck, Venus	otc	rand	gd porph w/ 3%py,1%cpy	12	1.0	1462	6	30	11	6	<5	<20	<20
C 13	12387	Big Spruce Ck, Venus	otc	rand	gd porph w/ 1% py, tr cpy	<5	0.2	571	4	32	2	7	<5	<20	<20
C 13	12388	Big Spruce Ck, Venus	otc	rand	gd porph w/ <1% py	<5	<0.2	149	3	18	3	<5	<5	<20	<20
C 13	12389	Big Spruce Ck, Venus	otc	rand	hfls w/ <1% py, mal on fractures	17	1.1	1592	24	56	11	11	<5	<20	83
C 13	12390	Big Spruce Ck, Venus	otc	rand	gd porph w/ 1% py, tr cpy	<5	<0.2	231	2	18	3	11	<5	<20	<20
C 13	12393	Big Spruce Ck, Venus	otc	rand	gd porph w/ 1% py, cpy	12	0.7	1413	4	20	40	<5	<5	<20	<20
C 13	12394	Big Spruce Ck, Venus	otc	rand	schistose hfls w/ 1% py, cpy, az	<5	0.2	244	2	47	2	9	7	<20	<20
C 14	8036	Evelyn Lee Prospect	otc	grab	skarn w/ 5% cpy, gar, ep, mal, az	<5	<5	1.46%		210	36	17	33.9	<200	<2
C 14	8037	Evelyn Lee Prospect	otc	grab	gar-rich skarn w/ mal	<5	<5			<200	<2	9	29.5	<200	2
C 14	8038	Evelyn Lee Prospect	rub	sel	skarn w/ <10% cpy	82	28	6.42%		<200	<2	16	81.7	<200	<2
C 14	8039	Evelyn Lee Prospect	otc	grab	brn gar skarn w/ no sulfides	17	<5			<200	97	33	27.5	<200	3
C 14	8040	Evelyn Lee Prospect	flt	sel	skarn w/ 50% cpy, gar, ca	200	13	5.01%		<200	7	25	22.2	<200	<2
C 14	11046	Evelyn Lee Prospect	otc	sel	skarn w/ 1% cpy, 5% py, mal, az	1896	8.6	3.50%	<2	165	4	21	<5	<20	<20
C 14	11104	Evelyn Lee Prospect	otc	sel	qz vein w/ 1% cpy & po	5	0.9	1407	<2	32	7	<5	<5	<20	<20
C 14	11105	Evelyn Lee Prospect	otc	sel	skarn w/ 10% cpy, mal, az	270	35.7	4.60%	<2	77	11	38	453	<20	93
C 14	11106	Evelyn Lee Prospect	otc	sel	ser calc rock w/ qz, cpy, mal, az	41	4	1.90%	<2	38	3	<5	<5	<20	<20
C 14	11107	Evelyn Lee Prospect	trn	rep	skarn w/ 3% cpy, mal, gar	82	18.5	7.00%	12	148	4	15	<5	<20	<20
C 14	11108	Evelyn Lee Prospect	rub	sel	skarn w/ cpy, ep, gar, qz	32	3.1	4637	5	33	109	<5	<5	<20	<20
C 14	11726	Sheep Ck	flt	sel	qz-ep skarn w/ 2-5% cpy & py	28	2.6	3307	51	16	2	20	20	<20	<20
C 14	11727	Sheep Ck trib		sed		111	0.5	38	7	36	1	12	<5	<20	<20

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Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	As ppm	Sb ppm	Sn ppm	W ppm
C 14	11728	Sheep Ck trib		pan	tr mag, no vis Au	2795	<0.2	201	51	45	2	20	<5	<20	29
C 15	11221	Sheep Ck		sed		<5	0.2	29	8	56	<1	14	<5	<20	<20
C 15	11222	Sheep Ck		pan	minor mag, from bedrock	14	0.4	81	22	85	3	46	<5	<20	<20
C 15	11223	Sheep Ck	otc	grab	ch-qz schist w/ py, po	<5	0.8	44	9	77	3	5	<5	<20	<20
C 15	11224	Sheep Ck		pan	1 v fine Au, mod mag and py	678	0.5	78	21	81	3	130	<5	<20	<20
C 15	11683	Sheep Ck		sed		<5	<0.2	23	9	52	1	19	<5	<20	<20
C 15	11684	Sheep Ck		pan	abu py, no mag, no vis Au	1	<0.2	37	11	61	<1	113	5	<20	<20
C 15	11685	Sheep Ck	flt	sel	qz-ca rock w/ sl(?)	20	<0.2	1	11	19	2	<5	557	<20	<20
C 15	11686	Sheep Ck	flt	sel	ep skarn w/ 1% diss bn or cc	9	0.7	488	7	7	<1	31	182	<20	<20
C 15	11687	Sheep Ck	flt	sel	qz-ep skarn w/ diss mag	38	0.8	384	4	8	4	6	192	<20	<20
C 15	11688	Sheep Ck	flt	sel	qz-ep skarn w/ 3% diss cpy	54	2.1	2274	6	19	273	10	183	<20	<20
C 15	11724	Sheep Ck		sed		<5	0.2	27	5	49	1	15	<5	<20	<20
C 15	11725	Sheep Ck		pan	1 v fine Au	23	<0.2	29	6	50	1	10	<5	<20	<20
C 16	12349	Horace Mtn	otc	sel	musc qz ser schist w/ 4% py, apy	155	8.7	154	146	36	12	1.58%	39	<20	<20
C 16	12350	Horace Mtn	flt	sel	qz mica schist w/ 5-7% py, lim	100	22.6	2084	874	546	16	7400	35	22	<20
C 16	12376	Horace Mtn		sed		<5	<0.2	141	61	775	3	120	<5	<20	<20
C 16	12377	Horace Mtn		pan	minor py, no mag, no vis Au	<5	<0.2	87	43	159	4	104	<5	<20	<20
C 16	12378	Horace Mtn		sed		15	1.8	197	110	158	3	189	<5	<20	<20
C 16	12379	Horace Mtn		pan	minor py, no mag, no vis Au	18	<0.2	78	29	158	3	67	<5	<20	<20
C 16	12380	Horace Mtn	otc	sel	qz musc sch w/ 3-5% py, no lim	23	1.9	16	64	27	7	112	<5	<20	<20
C 16	12480	Horace Mtn	otc	sel	qz ser sch w/ 1% diss py	9	1.4	11	46	4	116	54	<5	<20	<20
C 16	12481	Horace Mtn	otc	sel	qz ser sch w/ 2-5% py	62	0.6	17	44	7	37	134	6	<20	<20
C 16	12482	Horace Mtn		sed		<5	0.2	52	19	81	4	17	<5	<20	<20
C 16	12483	Horace Mtn		pan	no vis Au, mod mag, minor py	6	0.3	34	16	70	4	10	<5	<20	<20
C 17	8041	Ginger	otc	sel	skarn w/ <10% cpy, py, mal	548	42	3.61%		<200	<2	166	33.2	<200	<2
C 17	8042	Ginger	otc	grab	skarn w/ <1% cpy, gar, ep	<5	<5	0.04%		<200	<2	34	28.0	<200	3
C 17	8043	Ginger	rub	sel	skarn w/ 30% cpy, ep, qz	78	<5	1.00%		<200	4	41	16.0	<200	25
C 17	11047	Ginger	otc	sel	felsic ser schist w/ 2% py, cpy	16	1.2	1043	35	55	4	266	43	<20	<20
C 17	11048	Ginger	otc	ran	diabase sill w/ <1% diss po	3	<0.2	57	<2	38	1	<5	<5	<20	<20
C 17	11219	Ginger	otc	ran	skarn w/ 20 %py, 5% cpy	99	12.7	2.90%	<2	75	13	229	<5	<20	<20
C 17	11220	Ginger	otc	spac	ep-gar skarn w/ cpy, py, po	41	3.3	3709	2	22	10	33	<5	<20	42
C 17	11251	Ginger	otc	sel	calc silicate w/ py, cpy, qz, ep	1201	17.5	2.80%	18	118	9	115	<5	<20	57
C 17	11709	Ginger	rub	rand	qz-ser schist w/ <5% py	15	0.6	358	18	23	1	98	<5	<20	<20
C 17	11751	Ginger	rub	rand	ep-gn skarn w/ 1% cpy, <10% py	826	15.1	1.9%	<2	78	1	131	10	<20	78
C 17	11752	Ginger	flt	sel	qz-ser schist w/ <10% py, tr cpy	58	8	1.5%	32	211	52	235	18	<20	<20
C 17	11753	Ginger	rub	sel	ep skarn w/ 1-2% cpy, <10% py	16	11.5	1.9%	3	85	8	67	<5	<20	<20
C 18	11204	Deimos	flt	sel	ser-qz schist w/ py	9	<0.2	90	41	62	1	64	<5	<20	<20

Table C-1. Selected results from samples collected in the Chandalar quadrangle.

Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	As ppm	Sb ppm	Sn ppm	W ppm
C 18	11205	Deimos	flt	sel	skarn w/ abu mag, 1% cpy	<5	0.8	622	<2	17	1	80	<5	<20	<20
C 18	11243	Deimos	otc	sel	skarn w/ 2% cpy, mal, az	56	4.0	3871	16	22	2	76	<5	<20	<20
C 19	8044	Hurricane-Diane	otc	sel	skarn w/ 25% cpy, py, lim, MnO	390	32	2.44%		840	<2	138	14.0	<200	<2
C 19	8045	Hurricane-Diane	flt	grab	skarn w/ gar, ep	<5	<5			<200	<2	49	18.0	<200	17
C 19	8046	Hurricane-Diane	otc	sel	skarn w/ 25% cpy, 25% mag	290	12	1.09%		450	<2	121	23.7	<200	<2
C 19	11658	Hurricane-Diane	otc	sel	qz-ser schist w/ 5-7% cpy, mal	60	19.7	1.3%	37	147	1	73	<5	<20	<20
C 19	11748	Hurricane-Diane	otc	cont	1.5-ft-long skarn w/ 10% po, cpy, py	1272	26.3	2.6%	<2	180	1	162	<5	<20	37
C 19	11749	Hurricane-Diane	otc	spac	skarn w/ minor cpy, abu py	1299	42.6	8.0%	<2	493	3	504	13	<20	<20
C 19	11750	Hurricane-Diane	flt	sel	skarn w/ <50% cpy, py & po	25	0.5	983	7	48	<1	100	<5	<20	<20
C 19	11767	Hurricane-Diane	otc	grab	skarn w/ py & cpy 2-5% in blebs	46	7.5	9888	3	241	1	94	683	<20	65
C 20	10698	Luna Prospect	flt	sel	calc-qz-ser schist w/ 15% cpy, py	553	44.6	4.50%	16	375	2	848	6	<20	<20
C 20	10699	Luna Prospect	flt	sel	qz-ser schist w/ 60% sl, 5% cpy	385	18.6	8338	34	8320	<1	2133	<5	<20	87
C 20	10700	Luna Prospect	flt	sel	qz-ser schist w/ 45% cpy & py, sl	1129	98.4	10.20%	71	8447	6	2931	60	<20	<20
C 20	10761	Luna Prospect	flt	sel	ep skarn w/ <1% cpy, mag, gar	13	3.2	2149	12	59	1	219	<5	<20	64
C 20	11754	Luna Prospect	rub	sel	massive sulfide w/ abu py, tr cpy	141	24.9	5.3%	8	226	12	539	<5	<20	<20
C 20	11755	Luna Prospect	otc	sel	qz-ser schist w/ 1-2% diss py	81	1.5	242	7	134	4	151	28	<20	<20
C 20	11756	Luna Prospect	flt	sel	massive sulfide w/ 10% sl, 5% cpy	1402	43.1	5.1%	<2	29.91%	<1	1442	51	<20	568
C 20	11757	Luna Prospect	flt	sel	massive sulfide w/ 15% cpy, 5% sl	219	49.1	6.0%	<2	0.15%	<1	314	<5	<20	<20
C 21	11769	Mike	otc	sel	qz-ep skarn	29	0.8	167	15	45	12	69	335	<20	<20
C 22	12345	Cindy	otc	cont	silic marble w/ massive py	473	5.6	131	197	51	33	1808	33	<20	<20
C 22	12382	Cindy	otc	sel	marble w/ 0.5-ft-wide py vein	1438	91.3	319	1422	50	18	1220	464	<20	<20
C 22	12383	Cindy	flt	sel	hematite w/ 5% gn	147	151.6	1591	4.24%	21.01%	<1	1038	32	<20	<20
C 23	11768	Pilgrim	rub	sel	ser-qz schist w/ 1% diss py & cpy	6	<0.2	332	3	75	3	47	115	<20	<20
C 24	11881	Arsine	rub	sel	granitic gneiss w/ 2-3% po	<5	0.3	130	<2	127	3	19	9	<20	<20
C 24	11882	Arsine	otc	sel	qz-monz w/ minor po, 1-2% py	<5	<0.2	64	5	47	3	84	21	<20	<20
C 24	11883	Arsine		pan	no mag, no vis Au	8	<0.2	45	9	77	5	35	<5	<20	<20
C 24	11884	Arsine West	flt	sel	silic rock w/ 5% py	<5	<0.2	19	3	3	3	<5	11	<20	<20
C 24	11885	Arsine West	flt	sel	silic rock w/ <20% mag, py	<5	0.8	138	100	140	135	<5	14	<20	<20
C 25	11863	Geroe Ck	flt	sel	meta granite w/ 1% py, cpy, sl(?)	37	0.6	1457	25	40	37	41	189	<20	<20
C 25	11864	Geroe Ck	flt	sel	qz-ser rock w/ 1% Mo, <10% py	<5	<0.2	23	106	7	5212	<5	15	<20	<20
C 25	11865	Geroe Ck	flt	sel	qz-ser rock w/ <10% py	<5	<0.2	14	12	3	46	<5	116	<20	<20
C 25	11866	Geroe Ck trib		sed		<5	<0.2	92	46	172	14	8	<5	<20	<20
C 25	11867	Geroe Ck trib		pan	tr mag, no vis Au	34	<0.2	53	30	59	12	9	<5	<20	<20
C 25	11868	Geroe Ck trib		sed		29	<0.2	68	11	91	3	64	<5	<20	<20
C 25	11869	Geroe Ck trib		pan	minor mag, tr py, no vis Au	65	<0.2	93	20	93	6	284	<5	<20	37
C 26	11710	Willow Ck	flt	sel	hfls w/ sl(?), abu lim, tr MnO	153	<0.2	29	4	36	1	29	1.46%	<20	<20
C 26	11711	Willow Ck	otc	rand	qz-mica schist w/ sl(?)	8	0.9	26	89	33	21	44	229	<20	<20

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Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	As ppm	Sb ppm	Sn ppm	W ppm
C 26	11712	Willow Ck trib		sed		<5	<0.2	63	15	106	5	39	<5	<20	<20
C 26	11713	Willow Ck trib		pan	no mag, no vis Au	5	<0.2	35	10	87	6	22	5	<20	<20
C 26	11714	Willow Ck trib		sed		<5	<0.2	32	17	85	7	35	<5	<20	<20
C 26	11715	Willow Ck trib		pan	tr mag, no vis Au	105	<0.2	58	6	105	4	21	<5	<20	<20
C 26	11716	Willow Ck trib	flt	sel	aplite	<5	<0.2	17	4	78	7	<5	69	<20	<20
C 26	11717	Willow Ck		sed		11	<0.2	51	13	126	3	64	<5	<20	<20
C 26	11718	Willow Ck		pan	tr mag, 2 small gar	15	<0.2	50	23	95	5	167	5	<20	<20
C 26	12344	Willow Ck	otc	cont	silic hfls w/ 3% gray mineral	11	0.3	35	3	113	8	26	<5	<20	<20
C 26	12381	Willow Ck	otc	cont	calc hfls w/ 1-2% diss sulfides	<5	0.6	11	29	988	3	8	<5	<20	<20
C 26	12337	Willow Ck	otc	cont	silic hfls w/ 1% fine py, po, sl	9	0.6	60	4	3.09%	16	61	<5	<20	<20
C 26	12338	Willow Ck	otc	cont	hfls w/ 5% diss sulfides	<5	0.3	99	16	149	13	62	<5	<20	<20
C 27	11886	Willow Ck	otc	sel	calc-hfls w/ tr po	8	0.6	227	4	17	16	25	60	<20	<20
C 27	12296	Willow Ck	flt	sel	gar-ep-skarn w/ tr cpy, py, po	<5	0.2	16	22	3295	1	16	<5	<20	<20
C 27	12297	Willow Ck	otc	sel	musc ch sch w/ 5-10% po/apy	12	2.2	287	123	36	3	4.64%	32	<20	<20
C 27	12298	Willow Ck	otc	sel	ser musc sch w/ 1% cpy, 1% py	6	0.4	384	23	85	4	88	<5	<20	<20
C 27	12299	Willow Ck	otc	sel	musc qz sch w/ 0.8-ft-wide py lens	9	1.7	142	101	94	13	187	<5	<20	<20
C 27	12371	Willow Ck, South trib	otc	sel	qz musc ser sch w/ 5% py/apy, sl	18	1.4	840	71	118	6	129	<5	<20	<20
C 27	12372	Willow Ck, South trib	otc	spac	musc qz sch w/ py, tr cpy, apy, sl	48	2.4	1679	137	367	5	85	<5	29	<20
C 27	12373	Willow Ck	otc	sel	1-ft-wide qz vein w/ 1% py & apy	<5	0.3	83	18	39	6	27	<5	<20	<20
C 27	12374	Willow Ck		sed		<5	<0.2	50	14	104	2	41	<5	<20	<20
C 27	12375	Willow Ck		pan	collected from broken bedrock	10	<0.2	46	12	52	4	23	<5	<20	<20
C 28	11887	Willow Ck		sed		<5	<0.2	36	25	114	3	56	<5	<20	<20
C 28	12291	Willow Ck		pan	1 fine, 1 v fine Au; abu gar	9322	<0.2	70	29	87	5	326	<5	<20	31
C 28	12292	Willow Ck		sed		<5	<0.2	57	13	136	3	52	<5	<20	<20
C 28	12293	Willow Ck	flt	sel	mica qtz w/py, tr cpy(?), bn	<5	<0.2	28	23	34	8	73	<5	<20	<20
C 28	12294	Willow Ck		pan	minor mag & gar, mod py	21.12 ppm	0.3	56	28	88	5	246	<5	<20	51
C 28	12295	Willow Ck		sed		<5	<0.2	60	20	140	4	41	<5	<20	<20
C 29	11194	Big Jim (Sulak) Ck		sed		<5	<0.2	26	11	66	2	27	<5	<20	<20
C 29	11195	Big Jim (Sulak) Ck		pan	no mag, no vis Au	10	<0.2	25	16	42	4	20	<5	<20	<20
C 30	11232	Phoebe Ck		sed		<5	0.3	25	9	52	1	12	<5	<20	<20
C 30	11233	Phoebe Ck		pan	minor mag	12	0.3	34	11	45	2	24	<5	<20	<20
C 30	11234	Phoebe Ck	flt	sel	blk mica schist w/ po, py	<5	0.9	11	6	30	2	<5	<5	<20	<20
C 30	11235	Phoebe Ck		sed		53	<0.2	29	12	67	1	20	<5	<20	<20
C 30	11236	Phoebe Ck		pan	minor mag	316	<0.2	43	13	74	5	35	<5	<20	<20
C 31	11225	Robert Ck		sed		<5	<0.2	48	12	76	1	16	<5	<20	<20
C 31	11226	Robert Ck		pan	mod mag, gar (?), lim cube (?)	259	<0.2	91	16	78	5	35	<5	<20	<20
C 31	11227	Robert Ck	otc	sel	meta qz w/ 1% po, cpy (?), lim	<5	0.3	59	39	40	<1	<5	<5	<20	<20

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Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	As ppm	Sb ppm	Sn ppm	W ppm
C 31	11228	Robert Ck		pan	mod mag, minor py	1219	1.7	34	15	73	2	40	<5	<20	<20
C 31	11229	Robert Ck		sed		<5	<0.2	60	11	80	1	16	<5	<20	<20
C 31	11230	Robert Ck	otc	ran	ch-qz schist w/ tr py, lim	<5	<0.2	39	22	75	<1	<5	<5	<20	<20
C 31	12436	Robert Ck trib		sed		<5	0.2	29	6	80	<1	11	<5	<20	<20
C 31	12437	Robert Ck trib		pan	no vis Au, tr mag, minor sulfides	8	0.2	34	39	102	<1	10	<5	<20	<20
C 32	12346	Big Spruce Ck		sed		<5	0.6	57	8	55	2	16	<5	<20	<20
C 32	12347	Big Spruce Ck		pan	mod fine, rusty py	<5	0.7	185	15	68	2	41	<5	<20	<20
C 32	12348	Big Spruce Ck		pan	mod fine py & mag	485	0.3	107	9	95	2	36	<5	<20	<20
C 32	11605	Big Spruce Ck, Venus		sed		7	0.4	26	6	38	2	9	<5	<20	<20
C 32	11606	Big Spruce Ck, Venus		pan	1 v fine Au, mag, abu sulfides	753	0.3	346	38	67	3	128	<5	<20	22
C 32	12391	Big Spruce Ck, Venus		pan	minor mag & fine py	671	0.8	163	18	74	2	55	<5	<20	<20
C 32	12392	Big Spruce Ck, Venus		sed		<5	0.7	76	7	58	2	17	<5	<20	<20
C 33	11719	Shady Ck	flt	sel	Skajit ls w/ minor po, 1% py	12	1.4	4	23	17	<1	45	119	<20	<20
C 33	11720	Shady Ck	flt	sel	Skajit ls w/ 2% py	<5	1.5	17	7	25	2	13	91	<20	<20
C 33	11721	Shady Ck	flt	sel	calc-silicate	56	0.7	157	<2	107	<1	7	29	<20	<20
C 33	11722	Shady Ck		sed		9	<0.2	18	10	61	2	19	<5	<20	<20
C 33	11723	Shady Ck		pan	1 fine Au	11.67 ppm	0.3	18	13	44	2	40	<5	<20	<20
C 34	11073	Mule Ck	flt	sel	qtz w/ 3% po, 1% cpy, 1% py	47	0.6	217	7	14	<1	<5	<5	<20	<20
C 34	11074	Mule Ck		sed		3	0.3	44	11	87	3	39	<5	<20	<20
C 34	11075	Mule Ck		pan	tr mag, 1 fine Au	>10000	6.4	43	10	160	4	30	21	<20	<20
C 34	11076	Mule Ck		pan	1 v fine Au(?)	32	0.6	60	9	101	4	54	89	<20	25
C 34	11077	Mule Ck		pan	tr rusty sulfides	235	0.7	120	19	249	4	87	20	<20	<20
C 35	11092	Limestone Ck	otc	sel	Skajit ls w/ 1% diss sulfides	4	1.3	12	5	15	5	142	<5	<20	<20
C 35	11093	Limestone Ck		sed		2	0.7	24	6	42	1	15	<5	<20	<20
C 35	11094	Limestone Ck		pan	tr fine sulfides	14	1.3	21	2	51	1	15	10	<20	<20
C 35	11095	Limestone Ck	flt	sel	massive cpy w/ mal & az	77	3.3	1.41%	<2	43	2	8	109	<20	<20
C 36	11096	Limestone Ck		pan		15	1	108	9	270	10	94	13	<20	<20
C 36	11097	Limestone Ck		pan	minor mag, no vis Au	18	0.6	76	8	247	3	20	25	<20	<20
C 37	11099	Eightmile Ck		sed		3	0.4	32	10	78	3	25	<5	<20	<20
C 37	11100	Eightmile Ck		pan	tr mag, from bedrock	19	0.4	46	6	133	4	23	10	<20	<20
C 37	11101	Eightmile Ck		pan	tr mag, no vis Au	1434	1	84	22	147	4	80	11	<20	<20
C 38	11102	Garnet Ck		sed		3	<0.2	44	11	96	2	20	<5	<20	<20
C 38	11103	Garnet Ck		pan	tr mag, no vis Au	57	0.2	53	15	111	4	26	<5	<20	<20
C 39	11078	Bettles R		pan		718	0.3	70	14	155	3	26	13	<20	<20
C 39	11098	Bettles R		pan	1 v fine Au, tr mag	2247	0.7	95	32	122	5	46	7	<20	<20
C 39	12498	Bettles R trib		sed		<5	<0.2	33	9	86	1	18	<5	<20	<20
C 30	12499	Bettles R trib		pan	no vis Au, tr mag	10	<0.2	23	9	57	2	25	<5	<20	<20

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Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	As ppm	Sb ppm	Sn ppm	W ppm
C 30	12500	Bettles R		pan	no vis Au, abu py, tr mag	<5	0.3	37	11	74	5	23	<5	<20	<20
C 40	11779	Ready Bullion Ck		sed		<5	<0.2	49	11	71	1	14	<5	<20	<20
C 40	11802	Ready Bullion Ck		pan	no mag, no vis Au		<0.2	27	8	68	3	10	<5	<20	<20
C 41	11079	Emery Ck		sed		4	0.3	36	5	69	2	16	6	<20	<20
C 41	11080	Emery Ck		pan	minor rusty sulfides	65	0.5	40	9	92	4	45	15	<20	<20
C 41	11081	Emery Ck		pan	from upper bench (clay)	16	0.5	61	12	86	3	41	17	<20	<20
C 42	8023	Sukakpak Mtn	otc	grab	gossan zone w/ hem	<57	<14			<600	160	3880	2000.0	<2400	<8
C 42	8024	Sukakpak Mtn	flt	sel	vein qz w/ stb, val								30.23%		
C 42	8025	Sukakpak Mtn	flt	sel	vein qz w/ 1-2% stb	<440	<85			<3500	<200	2010	2.54%	<18000	<50
C 42	8026	Sukakpak Mtn	flt	grab	massive stb boulders								62.52%		
C 42	8027	Sukakpak Mtn	otc	sel	stb vein								48.87%		
C 42	11049	Sukakpak Mtn	otc	chip	3.2-ft-wide stb and qz vein	16.14 ppm	6.2	63	209	26	1	10	40.25%	<20	44
C 42	11111	Sukakpak Mtn	otc	chip	2.4-ft-wide qz vein w/ abu Sb	14.71 ppm	2.3	38	6	44	3	56	14.33%	<20	27
C 42	11112	Sukakpak Mtn	flt	sel	massive stb	47.26 ppm	31.9	60	4	7	1	16	65.21%	<20	69
C 42	11113	Sukakpak Mtn	flt	rand	vein qz w/ abu Sb, Sb alteration	43.24 ppm	3.1	35	37	49	3	63	18.66%	<20	32
C 42	11649	Sukakpak Mtn	otc	cont	7.5-ft-wide qz-Sb vein	56.17 ppm	25.6	76	27	31	8	540	9.17%	<20	<20
C 42	11650	Sukakpak Mtn	otc	cont	1.7-ft-wide qz-Sb vein	13.81 ppm	2.0	6	16	99	3	99	16.92%	<20	<20
C 42	11651	Sukakpak Mtn	otc	cont	5.0-ft-wide qz-Sb vein	**27.49 ppm**	8.9	51	118	26	2	127	23.30%	<20	<20
C 42	11652	Sukakpak Mtn	otc	cont	4.0-ft-wide qz-Sb vein	2753	1.0	13	42	20	2	47	7.78%	<20	<20
C 42	11653	Sukakpak Mtn	otc	cont	5.0-ft-wide qz-Sb vein	65.4 pmm	3.3	19	61	13	1	173	32.39%	<20	<20
C 42	11654	Sukakpak Mtn	flt	sel	vein qz w/ Sb	**5.58 ppm**	1.5	5	3	20	2	465	18.27%	<20	<20
C 42	11815	Sukakpak Mtn trib		sed		73	<0.2	42	8	60	<1	166	77	<20	<20
C 42	11816	Sukakpak Mtn trib		pan	minor py		0.6	32	7	57	2	127	130	<20	<20
C 42	12286	Sukakpak Mtn	flt	sel	qz-carb vein w/ Sb, kermisite	6027	3.6	22	3	44	2	<5	27.60%	<20	<20
C 42	12287	Discovery Ck		sed		63	<0.2	43	9	72	1	174	81	<20	<20
C 42	12288	Discovery Ck		pan	no visble Au, no mag, minor py	2396	0.9	42	8	84	3	181	334	<20	<20
C 42	12289	Discovery Ck		pan	1 v fine Au	154	1.0	42	11	73	4	145	176	<20	<20
C 42	12290	Discovery Ck		sed		41	<0.2	52	10	74	1	122	55	<20	<20
C 42	12319	Sukakpak Mtn	otc	spac	qz vein w/ Sb	25.13 ppm	5.7	19	9	34	4	<5	21.22%	<20	<20
C 42	12395	Sukakpak Mtn	otc	cont	0.1-ft-wide qz vein w/ Sb	19.4 ppm	5.6	38	<2	48	6	38	2.43%	<20	<20
C 42	12396	Sukakpak Mtn	otc	cont	1.5-ft-wide qz vein w/ Sb	163.23 ppm	7.6	11	<2	11	2	<5	24.20%	<20	<20
C 42	12424	Sukakpak Mtn		sed		15	1.9	12	4	30	<1	57	54	<20	<20
C 42	12425	Sukakpak Mtn		pan	no vis Au, no blk sands	<5	0.7	23	6	62	2	30	35	<20	<20
C 43	11810	Unnamed Ck		sed		<5	<0.2	36	11	56	<1	10	<5	<20	<20
C 43	11811	Unnamed Ck		pan	2 v fine, nuggety Au		0.7	40	12	84	2	26	<5	<20	<20
C 43	11812	Unnamed Ck	flt	sel	igneous qz w/ gn, cpy, sl, stb(?)	<5	0.2	29	70	9	1	6	1406	<20	<20
C 43	11813	Discovery Ck		sed		24	<0.2	12	6	36	<1	65	47	<20	<20

Table C-1. Selected results from samples collected in the Chandalar quadrangle.

Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	As ppm	Sb ppm	Sn ppm	W ppm
C 43	11814	Discovery Ck		pan	1-2mm py xls, no vis Au		0.4	16	6	39	2	68	54	<20	<20
C 44	11817	Vi Ck		sed		<5	<0.2	27	8	60	<1	7	<5	<20	<20
C 44	11835	Vi Ck		pan	mod mag, no vis Au	12	<0.2	34	6	66	2	6	<5	<20	<20
C 44	11836	Vi Ck	flt	sel	meta qz w/ >1% finely diss py	<5	<0.2	18	10	130	2	6	173	<20	<20
C 45	10697	Linda Ck		slu	no mag, v fine Au		8914.6	1237	>10000	275	3	6366	91	247	979
C 46	11257	Sheep Ck		sed		<5	<0.2	26	9	67	2	18	<5	<20	<20
C 46	11258	Sheep Ck		pan	tr sulfides, from tailings	446	<0.2	30	45	64	3	19	<5	<20	<20
C 46	12438	Sheep Ck		sed		<5	<0.2	22	9	64	<1	15	<5	<20	<20
C 46	12439	Sheep Ck		pan	no vis Au, no mag	210	<0.2	20	7	56	2	17	<5	<20	<20
C 46	12440	Sheep Ck		pan	1 coarse, 5 fine, 9 v fine Au	257.15 ppm	9.1	11	12	36	<1	16	<5	<20	<20
C 47	11803	Wolf Pup		sed		<5	<0.2	21	11	61	<1	7	<5	<20	<20
C 47	11804	Wolf Pup		pan	no mag, no vis Au		<0.2	21	9	62	3	11	<5	<20	<20
C 48	11774	Victor Gulch		sed		<5	<0.2	38	9	82	2	14	<5	<20	<20
C 48	11775	Victor Gulch		pan	no mag, no vis Au	5	<0.2	30	10	94	3	17	<5	<20	<20
C 48	11776	Nugget Ck		sed		<5	<0.2	28	9	65	1	14	<5	<20	<20
C 48	11777	Nugget Ck		pan	1 fine Au, no mag	**84.77 ppm**	1.1	22	14	66	3	18	<5	<20	<20
C 48	11778	Nugget Ck		pan	1 coarse, 1 fine, 1 v fine Au		33.8	28	8	68	4	16	<5	<20	<20
C 48	11805	Nugget Ck		plac	4 v coarse, 8 coarse Au	0.224 oz/cyd	0.3	51	75	78	3	180	<5	<20	<20
C 48	12304	Nugget Ck, upper		sed		6	<0.2	50	15	125	2	21	<5	<20	<20
C 48	12305	Nugget Ck, upper		pan	no mag, no vis Au	12	0.3	24	14	88	4	9	<5	<20	<20
C 48	12306	Nugget Ck, upper		pan	minor sulfides, no mag, no vis Au	357	0.2	29	14	88	4	8	<5	<20	<20
C 48	12307	Nugget Ck, upper	flt	sel	calc-qz rock w/ 5% po, apy	18	0.5	61	59	8	6	<5	0.67%	<20	<20
C 48	12308	Nugget Ck, upper		sed		<5	<0.2	41	11	122	3	26	<5	<20	<20
C 48	12309	Nugget Ck, upper		pan	no mag, no vis Au	9	<0.2	24	10	92	3	27	<5	<20	<20
C 48	12310	Nugget Ck		pan	2 v fine Au, tr mag, no py	6095	0.8	27	15	74	3	25	<5	<20	<20
C 48	12409	Victor Gulch, upper		sed		<5	<0.2	77	16	118	2	13	<5	<20	<20
C 48	12410	Victor Gulch, upper		pan	no mag, minor sulfides	<5	<0.2	55	12	155	1	11	<5	<20	<20
C 48	12423	Victor Gulch, upper	rub	sel	xln calcite vein w/ 2% py	<5	0.3	5	4	9	<1	<5	26	<20	<20
C 49	11341	Magnet Ck		sed		<5	<0.2	17	8	56	<1	8	<5	<20	<20
C 49	11342	Magnet Ck		pan	1 coarse, 1 fine, 1 v fine Au	267.41 ppm	12.8	23	9	48	2	11	<5	<20	<20
C 49	12312	Magnet Ck		sed		11	<0.2	30	9	64	<1	11	<5	<20	<20
C 49	12313	Magnet Ck		pan	1 v fine Au, no mag, minor py	318	<0.2	34	17	74	4	17	8	<20	<20
C 49	12314	Magnet Ck, East trib		sed		15	<0.2	31	9	63	1	11	<5	<20	<20
C 49	12315	Magnet Ck, East trib		pan	1 v fine Au, no mag, minor py	5574	0.4	37	16	76	5	36	<5	<20	<20
C 49	12316	Magnet Ck, West trib		sed		18	<0.2	30	9	61	<1	10	<5	<20	<20
C 49	12317	Magnet Ck, West trib		pan	1 v fine Au, no mag, minor py	245	<0.2	28	13	67	3	14	<5	<20	<20
C 50	10740	Gold Ck	flt	grab	diorite	<5	<0.2	60	<2	41	1	<5	19	<20	<20

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Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	As ppm	Sb ppm	Sn ppm	W ppm
C 50	11293	Gold Ck		slu	from 500 cubic yards of gravel		0.4	37	221	59	4	1399	56	<20	<20
C 50	11294	Gold Ck		slu	from 300 cubic yards of gravel		2.1	54	339	101	2	189	<5	<20	<20
C 50	11405	Gold Ck		slu	from 200 cubic yards of gravel		96.2	282	8361	120	9	2570	95	22	1066
C 50	12283	Gold Ck		slu	abu fine to coarse Au, tr sch		53.0	45	5856	319	4	407	6	<20	<20
C 50	12426	Gold Ck, upper		sed		<5	<0.2	28	7	79	<1	12	<5	<20	<20
C 50	12427	Gold Ck, upper		pan	no vis Au, no mag	36.03 ppm	1.9	29	7	85	1	17	<5	<20	<20
C 50	12428	Gold Ck, upper	otc	sel	bio qz sch w/ 1% diss po	<5	<0.2	49	5	86	1	10	7	<20	<20
C 50	12429	Gold Ck		sed		<5	<0.2	32	6	66	<1	11	<5	<20	<20
C 50	12430	Gold Ck		pan	1 coarse, 2 v fine Au; no mag	96.33 ppm	3.9	26	12	60	2	12	<5	<20	<20
C 50	12431	18 Pup		pan	no vis Au, no mag	95	<0.2	26	7	78	2	14	<5	<20	<20
C 50	12432	18 Pup		sed		<5	<0.2	34	7	89	<1	12	<5	<20	<20
C 51	11826	Canyon Ck		soil		<5	<0.2	47	13	88	1	13	<5	<20	<20
C 51	11827	Canyon Ck		pan	no mag, no vis Au		<0.2	27	9	72	2	8	<5	<20	<20
C 52	11198	Last Chance Ck		sed		<5	<0.2	28	10	85	1	15	<5	<20	<20
C 52	11199	Last Chance Ck		pan		16	<0.2	21	7	69	4	10	<5	<20	<20
C 53	11255	Glacier R trib		sed		<5	<0.2	32	9	74	<1	13	<5	<20	<20
C 53	11256	Glacier R trib		pan	no vis Au, from bedrock	69	<0.2	57	7	85	2	16	<5	<20	<20
C 54	11841	Bore Ck	flt	sel	qz w/ rutile, 10% stb	97	6.9	46	1.17%	22	1	7	1.01%	<20	<20
C 54	11842	Bore Ck		sed		8	<0.2	56	12	116	1	16	<5	<20	<20
C 54	11843	Bore Ck		pan	1 v v fine Au	7	<0.2	36	11	123	3	11	<5	<20	<20
C 54	11844	Bore Ck	flt	sel	calc ss w/ 1% finely diss py	<5	0.9	56	39	138	1	9	254	<20	<20
C 54	12414	Poss Mtn	otc	sel	qz ch schist w/ <1% po, lim	13	<0.2	183	27	90	8	<5	39	<20	<20
C 54	12415	Poss Mtn	flt	sel	qz ch schist w/ silic py-rich lens	18	1.0	758	50	98	16	12	26	<20	<20
C 54	12416	Bore Ck, south fork		sed		8	<0.2	424	48	288	3	31	<5	<20	<20
C 54	12417	Bore Ck, south fork		pan	no vis Au, no blk sands	<5	<0.2	100	17	151	2	8	<5	<20	<20
C 54	12418	Bore Ck, west fork		sed		10	<0.2	297	39	338	3	38	<5	<20	<20
C 54	12419	Bore Ck, west fork		pan	no vis Au, minor sulfides	<5	<0.2	82	17	203	2	18	<5	<20	<20
C 54	12420	Bore Ck, west fork	flt	sel	qz-carb veins w/ <1% py, po	<5	1.0	52	26	148	3	13	49	<20	<20
C 54	12421	Bore Ck	otc	sel	qz-carb vein w/ <1% po	<5	0.2	23	10	27	4	<5	27	<20	<20
C 54	12422	Bore Ck	flt	sel	ch sch xcut by meta qz w/ 1% apy	9	0.4	11	94	103	<1	714	18	<20	<20
C 54	12446	Poss Mtn	flt	sel	bio qz sch w/ 1% fine py, abu lim	17	<0.2	151	32	80	7	<5	7	<20	<20
C 54	12447	Poss Mtn	otc	spac	bio qz sch w/ 1-2% po	<5	<0.2	216	17	84	16	<5	<5	<20	<20
C 55	11200	California Ck	flt	sel	granite w/ <1% po	8	<0.2	55	7	101	1	9	<5	<20	<20
C 55	11201	California Ck		pan	tr mag	7	<0.2	46	19	109	4	48	<5	<20	<20
C 55	11202	California Ck		sed		<5	<0.2	37	13	107	2	25	<5	<20	<20
C 55	11203	California Ck		pan	from cutbank	23	<0.2	41	12	114	5	21	<5	<20	<20
C 55	12401	California Ck		sed		<5	<0.2	38	14	118	2	19	<5	<20	<20

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Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	As ppm	Sb ppm	Sn ppm	W ppm
C 55	12402	California Ck		pan	no vis Au, no mag, mod py	13	<0.2	77	11	143	8	49	21	<20	<20
C 56	11240	Jim Pup		sed		<5	<0.2	26	10	82	1	19	<5	<20	<20
C 56	11241	Jim Pup		pan	1 fine Au, tr mag	22.59 ppm	0.7	38	9	100	4	18	<5	<20	<20
C 56	11242	Jim Pup	flt	sel	blk hfls w/ 2% diss po	7	<0.2	25	3	90	10	34	<5	53	<20
C 57	11252	Wakeup Ck	tail	sel	phyllite w/ 1% diss py	<5	0.9	96	6	32	4	14	<5	<20	<20
C 57	11253	Wakeup Ck		sed		<5	<0.2	29	10	120	1	142	<5	<20	<20
C 57	11254	Wakeup Ck		pan		95	<0.2	23	7	65	3	932	<5	<20	<20
C 58	11237	Lake Ck		pan	2 fine Au, minor mag and py	61.36 ppm	4.8	35	10	85	4	33	<5	<20	<20
C 58	11238	Lake Ck		sed		<5	0.4	26	8	48	1	16	<5	<20	<20
C 58	11239	Lake Ck		pan	1 fine and 1 v fine Au, tr mag	94.28 ppm	6.6	35	11	66	3	32	<5	<20	<20
C 58	11269	Lake Ck	flt	sel	blk phyllite w/ 1% py	9	0.7	75	17	121	11	37	5	<20	<20
C 58	11270	Lake Ck		plac	12 coarse, 28 fine, 28 v fine Au	0.067 oz/cyd	1.3	86	203	181	4	215	<5	111	185
C 58	11271	Lake Ck	flt	sel	blk phyllite w/ <1% py	<5	1.3	33	13	80	10	22	9	<20	<20
C 58	11272	Lake Ck		sed		<5	0.2	23	9	56	2	14	<5	<20	<20
C 58	11273	Lake Ck		pan	v fine py & mag	24	0.3	22	8	57	3	13	<5	<20	<20
C 58	11274	Lake Ck	flt	grab	greenstone w/ 1% euhedral mag	6	<0.2	17	<2	87	1	<5	<5	<20	<20
C 59	11196	Billy Glen Ck		sed		<5	<0.2	34	12	93	<1	15	<5	<20	<20
C 59	11197	Billy Glen Ck		pan	no vis Au, from bedrock	13	<0.2	36	6	106	3	11	<5	<20	<20
C 60	11244	Holy Moses Ck		sed		<5	<0.2	31	9	96	2	18	<5	<20	<20
C 60	11245	Holy Moses Ck		pan		193	<0.2	19	8	73	3	11	<5	<20	<20
C 61	11246	Shamrock Ck		sed		<5	<0.2	40	17	134	2	29	<5	<20	<20
C 62	11822	Wolf Ck trib		sed		<5	<0.2	50	13	105	2	33	<5	<20	<20
C 62	11823	Wolf Ck trib		pan	mod sulfides, no mag, no vis Au		0.5	29	14	74	3	18	<5	<20	<20
C 62	11824	Wolf Ck		sed		<5	<0.2	31	12	88	1	26	<5	<20	<20
C 62	11825	Wolf Ck		pan	mod sulfides, no mag, no vis Au		0.2	29	47	71	3	25	<5	<20	<20
C 63	11820	Horse Ck	otc	sel	qz-mica schist w/ 1% py	9	<0.2	36	5	62	1	20	0.84%	<20	<20
C 63	11821	Horse Ck	rub	sel	meta qz	<5	<0.2	16	3	31	1	<5	549	<20	<20
C 64	11288	Sawlog Ck		sed		<5	<0.2	28	10	95	2	11	<5	<20	<20
C 64	11289	Sawlog Ck		pan	no vis Au	18	<0.2	28	8	95	5	10	<5	<20	<20
C 65	11249	Dennys Gulch, upper	otc	rep	0.2-ft-wide qz vein w/ abu lim	<5	<0.2	62	5	163	3	7	<5	<20	<20
C 65	11290	Dennys Gulch, upper	otc	sel	qz vein w/ cpy (?), abu lim	<5	<0.2	46	<2	124	<1	<5	<5	<20	<20
C 66	11248	Dennys Gulch		pan	2 coarse angular Au pieces	235.11 ppm	21.2	94	133	222	4	39	<5	93	<20
C 66	11250	Dennys Gulch		sed		8	<0.2	30	9	93	2	12	<5	<20	<20
C 66	11287	Dennys Gulch		pan		936	0.3	55	17	137	5	30	<5	<20	<20
C 66	11839	Denny's Gulch		pan	few py xls, no mag, no vis Au	22	<0.2	58	14	143	6	40	<5	<20	<20
C 66	11840	Denny's Gulch		sed		7	<0.2	46	11	108	2	20	<5	<20	<20
C 67	10750	Howard Ck, upper	flt	sel	qz lense in schist w/ lim	<5	<0.2	9	15	24	5	6	7	<20	<20

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Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	As ppm	Sb ppm	Sn ppm	W ppm
C 67	10751	Howard Ck, upper	flt	sel	vein qz w/ ank (?), lim	<5	<0.2	19	41	22	2	<5	9	<20	<20
C 67	10752	Howard Ck, upper	rub	sel	calc-qz-mica schist w/ lim	<5	<0.2	21	8	75	2	32	6	<20	<20
C 67	10753	Howard Ck, upper	otc	rep	marble w/ minor green alt	<5	2.1	<1	<2	1	<1	<5	<5	<20	<20
C 67	10754	Howard Ck, upper	rub	sel	marble w/ hem(?)	<5	1.9	<1	<2	6	1	<5	<5	<20	<20
C 67	10755	Howard Ck, upper	rub	sel	marble w/ lim, green alt	<5	1.9	<1	5	9	<1	<5	<5	<20	<20
C 67	10756	Howard Ck, upper	rub	sel	calc-qz-mica schist w/ lim	<5	1.5	7	6	41	<1	6	<5	<20	<20
C 67	10757	Howard Ck, upper	rub	sel	qz-chl schist w/ py, lim	<5	<0.2	16	39	455	1	<5	<5	<20	<20
C 67	10758	Howard Ck, upper	flt	sel	phyllite w/ diss py, tr lim	19	0.3	56	20	7	21	131	11	<20	<20
C 67	10759	Howard Ck, upper	flt	sel	marble w/ py, lim	<5	2.3	86	16	165	3	23	9	<20	<20
C 67	10760	Howard Ck, upper	flt	sel	qz-mica schist w/ hem	19	<0.2	80	16	86	2	8	10	<20	<20
C 68	11830	Boulder Ck		sed		<5	<0.2	40	13	114	<1	10	<5	<20	<20
C 68	11831	Boulder Ck		pan	1 v fine Au, no mag		<0.2	31	10	124	2	13	<5	<20	<20
C 68	11832	Boulder Ck		pan	minor sulfides, no mag, no vis Au		<0.2	56	15	160	2	11	<5	<20	<20
C 68	11833	Boulder Ck	otc	sel	qz-mica schist w/ 1% po, 3% py	9	<0.2	184	15	132	2	22	72	<20	<20
C 68	11834	Boulder Ck		pan	5 v fine Au, tr mag	3635	<0.2	42	21	134	3	18	<5	<20	<20
C 69	11858	Slate Ck		sed		<5	<0.2	32	15	103	<1	11	<5	<20	<20
C 69	11859	Slate Ck		pan	6 fine, 50+ v fine Au	**136.13 ppm**	2.8	39	14	129	2	18	<5	<20	<20
C 69	11860	Slate Ck	otc	sel	qz veins w/ <1% py	<5	<0.2	22	11	17	2	<5	14	<20	<20
C 69	11861	Slate Ck		plac	50 fine, 100 v fine Au	0.012 oz/cyd	<0.2	44	807	127	3	21	<5	<20	<20
C 69	11862	Slate Ck	otc	sel	greenstone w/ 2-3% po, tr cpy	51	<0.2	338	<2	86	1	<5	11	<20	<20
C 69	11876	Slate Ck		pan	no mag, no vis Au	11	<0.2	43	41	172	2	14	<5	<20	<20
C 69	11877	Slate Ck		pan	1 fine, 7 v fine Au; tr mag	**20.82 ppm**	0.4	32	13	119	4	11	<5	<20	<20
C 69	12335	Slate Ck		pan	6 fine Au, tr mag	15.59 ppm	1.8	46	14	130	2	10	<5	<20	<20
C 69	12336	Slate Ck		pan	1 coarse, 6 fine Au; tr mag	72.32 ppm	7.5	43	12	131	2	14	<5	<20	<20
C 70	11310	Myrtle Ck		sed		<5	<0.2	44	17	130	1	13	<5	<20	<20
C 70	11311	Myrtle Ck		pan	2 fine Au	9790	0.9	72	19	154	3	21	<5	<20	<20
C 70	11312	Myrtle Ck		slu			14.1	80	1099	106	10	710	<5	91	59
C 70	11313	Myrtle Ck	flt	sel	bio-qz schist w/ 20% py	23	0.2	55	71	166	33	80	<5	<20	<20
C 70	11847	Myrtle Ck	rub	sel	greenstone-greenschist w/ <1% po	<5	<0.2	48	28	172	2	8	41	<20	<20
C 70	11848	Myrtle Ck narrows	flt	sel	vein qz w/ minor gn, 5% py, po(?)	<5	<0.2	29	25	37	2	<5	27	<20	<20
C 70	11849	Myrtle Ck narrows		pan	1 v coarse, 2 fine, 1 v fine Au	61.73 ppm	2.7	66	20	164	3	27	<5	<20	<20
C 70	11850	Myrtle Ck narrows		sed		<5	<0.2	53	15	136	<1	12	<5	<20	<20
C 70	11851	Myrtle Ck narrows	otc	sel	qz vein w/ <1% py, po	<5	<0.2	24	27	36	1	6	37	<20	<20
C 70	11852	Myrtle Ck narrows	flt	sel	eclogite w/ 1% py, po	8	0.3	683	2	56	2	12	18	<20	<20
C 70	11853	Myrtle Ck		sed		<5	<0.2	35	15	107	2	11	<5	<20	<20
C 70	11854	Myrtle Ck		pan	minor sulfides, no mag, no vis Au	15	<0.2	46	13	153	2	9	<5	<20	<20
C 70	11855	Myrtle Ck		sed		<5	<0.2	72	14	185	2	15	<5	<20	<20

Table C-1. Selected results from samples collected in the Chandalar quadrangle.

Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	As ppm	Sb ppm	Sn ppm	W ppm
C 70	11856	Myrtle Ck		pan	no mag, no vis Au	10	<0.2	61	11	153	4	14	<5	<20	<20
C 70	11857	Myrtle Ck	flt	sel	meta-mudstone(?) w/ 10% diss py	10	0.3	42	28	83	22	60	26	<20	<20
C 70	11904	Myrtle Ck		plac	4 coarse, 3 fine, 17 v fine Au	0.024 oz/cyd	<0.2	48	19	143	2	22	<5	<20	<20
C 71	11878	Unnamed Occurrence		soil		<5	<0.2	33	17	131	<1	14	<5	<20	<20
C 71	11879	Unnamed Occurrence		soil		<5	<0.2	32	17	125	1	13	<5	<20	<20
C 71	11880	Unnamed Occurrence	otc	grab	greenstone	<5	<0.2	182	<2	73	1	<5	16	<20	<20
C 72	11922	Hill 3816	rub	rand	gabbro(?) & serpentine	<5	<0.2	16	10	19	<1	8	14	<20	<20
C 72	11923	Hill 3816	rub	rand	gabbro(?) w/ mag	<5	<0.2	17	7	17	<1	17	13	<20	<20
C 73	11946	Siwash Ck	otc	sel	1-in-wide qz vein w/ minor py	9	0.4	13	<2	7	1	<5	6	<20	<20
C 73	11947	Siwash Ck	otc	sel	1.5-in-wide qz vein w/ 1% py	<5	0.5	42	3	20	1	6	<5	<20	<20
C 73	11948	Siwash Ck	otc	grab	mafic volc rock	<5	<0.2	99	<2	81	2	<5	<5	<20	<20
C 74	11919	Mosquito Fork trib		pan	tr mag, no vis Au	<1	<0.2	40	8	98	2	11	<5	<20	<20
C 74	11920	Mosquito Fork trib		sed		<5	<0.2	49	5	107	<1	10	<5	<20	<20
C 74	11921	Mosquito Fork trib	flt	sel	vein qz w/ ch partings, <1% po	<5	<0.2	21	25	62	1	10	34	<20	<20
C 75	12544	Granite Ck		sed		<5	<0.2	19	8	66	1	6	<5	<20	<20
C 75	12545	Granite Ck		pan	abu blk sand	9	<0.2	62	16	88	1	11	<5	<20	<20
C 75	12546	Granite Ck	flt	sel	hfls w/ tr cpy(?)	<5	<0.2	199	<2	30	2	<5	<5	<4	5

Appendix D

Summaries of mines, prospects, and mineral occurrences in the Chandler Lake quadrangle (listed by map number)

Property Summary

Name(s): Grizzly Creek Lode

Map No: CL1
MAS No: 0020220006

Deposit Type: Quartz veins(?)

Commodities: Pb, Zn, Cu, Ag

Location:

Quadrangle: Chandler Lake A-2
NE¼ sec. 4, T. 16 S., R. 6 E.
Meridian: Umiat
Elevation: 3,750 feet
Latitude: 68° 04.900' N.
Longitude: 150° 44.617' W.
Geographic: South side of Cockedhat Mountain, at the headwaters of Grizzly Creek.

History:

1986 - Reported sphalerite and galena in a gangue of quartz, calcite, and siderite (Duttweiler, 1986).

Production: None.

Workings and Facilities: None observed.

Geologic Setting:

Bedrock in the headwaters of the Grizzly Creek basin consists of Mississippian Lisburne Group, Kayak Shale, and Mississippian(?) to Devonian Kanayut Conglomerate. These units are composed of interbedded limestone, dolomite, conglomerate, sandstone, siltstone, and shale layers. An east-west-trending fault is mapped along the ridge immediately south of Grizzley Creek (Brosge and others, 1979).

Sphalerite, galena, and pyrite reportedly occur in discordant quartz-calcite-siderite veins that cut the coarse conglomerate and sandstone units of the Kanayut Conglomerate. Oxidation of the sulfides has produced discontinuous red-weathering layers in the conglomerate (Duttweiler, 1986).

Bureau Investigation:

The site was briefly investigated, but no sulfide mineralization was found. A stream sediment, pan concentrate, and rock sample were collected at the confluence of two headwaters tributaries of Grizzly Creek (11459-11461, table D-1). The assay results were not considered anomalous.

Resource Estimate: Unknown.

Mineral Development Potential: Low mineral development potential due to lack of anomalous results.

Recommendations: None.

References:

Brosge, W.P., Reiser, H.N., Dutro, J.T., Jr., and Nilsen, T.H., 1979, Geologic map of Devonian rocks in parts of the Chandler Lake and Killik River quadrangles, Alaska: U.S. Geological Survey Open-File Report 79-1224, 1 sheet, scale 1:200,000.

Duttweiler, K.A., 1986, Sulfide occurrences in the Itkillik River region, southeast Chandler Lake quadrangle, Brooks Range: U.S. Geological Survey Circular 978, p. 10-13.

Table D-1. Selected results from samples collected in the Chandler Lake quadrangle.

Explanation

Sample site

core	drill core
drum	55 gallon drum
dump	mine dump
flt	float
otc	outcrop
rub	rubblecrop
tail	mine tailings
trn	trench

Sample type

cont	continuous chip
grab	grab sample
pan	pan concentrate
plac	placer concentrate
rand	random chip
rep	representative chip
sed	sediment sample
sel	select
slu	sluice concentrate
soil	soil sample
spac	spaced chip

Sample description

abu	abundant
alt	altered, alteration
amph	amphibole
ank	ankerite
apy	arsenopyrite
az	azurite
ba	barite
bio	biotite
blk	black
bn	bornite
box	boxwork texture
brn	brown
ca	calcite
calc	calcareous
carb	carbonate
cc	chalcocite
cgl	conglomerate
ch	chlorite
chm	chromite
comp	composite
cpy	chalcopyrite
cst	cassiterite
cv	covellite
diss	disseminated
ep	epidote
feld	feldspar
ft	foot (12 inches)
fuch	fuchsite
gar	garnet
gd	granodiorite
gn	galena
gwy	graywacke
hbl	hornblende
hem	hematite
hfls	hornfels
hydro	hydrothermal
in	inch
intr	intrusive
lim	limonite
ls	limestone
mag	magnetite

Sample description

mal	malachite
mar	marcasite
mdst	mudstone
meta	metamorphic
MnO	manganese oxide
mod	moderate
monz	monzonite
musc	muscovite
oz/cyd	ounces per cubic yard
oz/t	ounces per ton
pct	percent
po	pyrrhotite
porph	porphyry
ppb	parts per billion
ppm	parts per million
psuedo	psuedomorph
py	pyrite
qtz	quartzite
qz	quartz
sch	scheelite
sco	scorodite
ser	sericite
serp	serpentinized
sid	siderite
silic	siliceous
sl	sphalerite
slts	siltstone
ss	sandstone
stb	stibnite
tet	tetrahedrite
tm	tourmaline
tr	trace
v	very
val	valentinite
vis	visible
vlets	veinlets
volc	volcanic
w/	with
xcut	crosscutting
xln	crystalline
xls	crystals

Elements

Ag	silver
Al	aluminum
As	arsenic
Au	gold
Ba	barium
Bi	bismuth
Ca	calcium
Cd	cadmium
Co	cobalt
Cr	chromium
Cu	copper
Fe	iron
Ga	gallium
Hg	mercury
K	potassium
La	lanthanum
Li	lithium
Mg	magnesium
Mn	manganese
Mo	molybdenum
Na	sodium
Nb	niobium
Ni	nickel
Pb	lead
Pd	palladium
Pt	platinum
Sb	antimony
Sc	scandium
Sn	tin
Sr	strontium
Ta	tantalum
Te	tellurium
Th	thorium
Ti	titanium
U	uranium
V	vanadium
W	tungsten
Y	yttrium
Zn	zinc
Zr	zirconium

Placer gold: size classification

v. fine	< 0.5 mm
fine	0.5 - 1.0 mm
coarse	1 -2 mm
v. coarse	> 2 mm

Abbreviations:

Ck	creek
confl	confluence
Mtn	mountain
R	river

Footnotes:

Bold numbers indicate multiple erratic results, which were averaged.

Results for Au are reported in ppb unless other units are stated.

Table D-1. Selected results from samples collected in the Chandler Lake quadrangle.

Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	As ppm	Sb ppm	Sn ppm	W ppm
CL 1	11459	Grizzly Ck		sed		<5	<0.2	25	16	104	<1	12	<5	<20	<20
CL 1	11460	Grizzly Ck		pan	no mag, no vis Au	6	<0.2	35	16	127	2	10	<5	<20	<20
CL 1	11461	Grizzly Ck	flt	sel	siltstone(?) w/ qz vlets, tr sulfides, lim	<5	<0.2	10	18	68	<1	<5	<5	<20	<20

Appendix E

Summaries of mines, prospects, and mineral occurrences in the Hughes quadrangle (listed by map number)

Property Summary

Name(s): Helpmejack Hills

Map No: H1
MAS No: 0020380001

Deposit Type: Unknown lode

Commodities: Mn

Location:

Quadrangle: Hughes D-2
NW¼ sec. 6, T. 18 N., R. 23 E.
Meridian: Kateel River
Elevation: 3,250 feet
Latitude: 67° 00.000' N.
Longitude: 153° 53.000' W.
Geographic: In the Helpmejack Hills 12 miles southwest of Walker Lake and approximately 2,000 feet northeast of peak 3610.

History: Unknown.

1966 - U.S. Geological Survey reported occurrence of manganese minerals in the area (Patton and Miller, 1966).

Production: None.

Workings and Facilities: None.

Geologic Setting:

From south to north, the bedrock consists of undifferentiated altered mafic volcanics, diabase, and phyllite in complex faulted relationships. Volcanic rocks include dark greenish gray aphanitic amygdabidal andesite and basalt flows; dark greenish gray, fine- to coarse-grained diabase intrusives; and varicolored radiolarian(?) cherts. Fine-grained recrystallized limestone, locally calcareous and chloritic phyllite, quartz-mica schist, and quartzite occur in lessor amounts. Rhodochrosite, manganite, and pyrolusite reportedly occur in altered mafic volcanic rocks and phyllite (Patton and Miller, 1966).

Bureau Investigation:

A one-mile-long traverse was made in the vicinity of the reported occurrence looking for indications of manganese minerals. An intercalated sequence of phyllite, greenstone, and finely laminated mudstone was observed. The greenstone contained numerous barren quartz-carbonate veins. Some rust-weathering greenstone that contained minor pyrrhotite was located. One sample (10898, table E-1) contained 852 ppm manganese and 152 ppm copper. North of peak 3610, the volcanic rocks become more coarsely crystalline (andesitic?) and contain cherty lenses.

Resource Estimate: Unknown.

Mineral Development Potential: The mineralization reported by the USGS was not located.

Recommendations: Continue to search the site for reported manganese minerals.

References:

Foley, J.Y., 1992, Ophiolitic and other mafic-ultramafic metallogenic provinces in Alaska (west of the 141st Meridian): U.S. Geological Survey Open-File Report 92-20B, 55 p.

Patton, W.W., Jr., and Miller, T.P., 1966, Regional geologic map of the Hughes quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-459, 1 sheet, scale 1:250,000.

Property Summary

Name(s): Helpmejack Creek

Map No: H2
MAS No: 0020380013
Alaska Kardex 029-007

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Hughes D-2
NE¼ sec. 11, T. 19 N., R. 24 E.
Meridian: Kateel River
Elevation: 760 feet
Latitude: 66° 59.167' N.
Longitude: 153° 31.760' W.
Geographic: On Helpmejack Creek 3.5 miles upstream from the Alatna River.

History:

1898 - The Galesburg-Alaska Mining and Development Company and the Beaver Party staked claims on portions of Helpmejack Creek. Other groups, including the Kyle Party, reported good prospects on the creek (Ingman, 1988).

Production: Unknown.

Workings and Facilities:

No workings were located, but records indicate that shafts were sunk along the creek in 1899 in search of bedrock (Ingman, 1988).

Geologic Setting:

Bedrock underlying the hills surrounding Helpmejack Creek consists of two units. One is Jurassic or early Cretaceous altered mafic volcanic rocks that include andesite and basalt flows, diabase intrusives, and radiolarian cherts. Flows show well developed pillows locally. The unit is dynamically metamorphosed to greenschist west of Helpmejack Lakes. The second is Upper Devonian(?) or Jurassic altered, mafic volcanic rocks or phyllite (Patton and Miller, 1966).

Gold colors were found on a number of creeks in the Alatna River Valley including Helpmejack Creek, but nothing rich enough to warrant mining (Mendenhall, 1902).

Bureau Investigation:

No sites where the stream flowed on bedrock were located. A stream sediment and pan concentrate sample were collected from a gravel bar approximately 3.5 miles upstream from the Alatna River. No gold was visible; the sample contained 54 ppb gold (10900, table E-1). An outcrop sample of greenstone (10934) was not anomalous in any metals. Float in the creek consists of quartzite, massive quartz, basalt, mudstone, and metagranite. No sulfides were observed in any of the rocks.

Resource Estimate: Unknown.

Mineral Development Potential:

Low development potential for placers due to lack of visible gold in test pans.

Recommendations: None.

References:

Cobb, E.H., 1972, Metallic mineral resources map of the Survey Pass quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-382, 1 sheet, scale 1:250,000.

Ingman, G., 1988, Journey to the Koyukuk: the photos of J.N. Wyman, 1898-1899: Pictorial Histories Publishing Company, Missoula, Montana, p. 40-43.

Mendenhall, W.C., 1902, Reconnaissance from Fort Hamlin to Kotzebue Sound, Alaska by way of Dall, Kanuti, Allen and Kowak Rivers: U.S. Geological Survey Professional Paper 10, p. 50.

Patton, W.W., Jr., and Miller, T.P., 1966, Regional geologic map of the Hughes quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-459, 1 sheet, scale 1:250,000.

WGM Inc., 1978, Mineral studies of the western Brooks Range, Alaska: U.S. Bureau of Mines Open-File Report 103-78, p. 158.

Property Summary

Name(s): Lost Pipe

Map No: H3
MAS No: 0020380012

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Hughes D-1
Center sec. 30, T. 18 N., R. 25 E.
Meridian: Kateel River
Elevation: 600 feet
Latitude: 66° 56.108' N.
Longitude: 153° 27.510' W.
Geographic: On the Alatna River, 2.2 miles downstream from Helpmejack Creek.

History:

1898 - Prospectors rushed into the Alatna River area, following rumors of gold on the Koyukuk River. Small amounts of gold were found, but none of the deposits proved economic (Mendenhall, 1902).
1901 - Only a few prospectors in the area (Mendenhall, 1902).
1924 - No miners living in the area (Smith and Mertie, 1930).
1928 - Activity reported in area (Smith, 1930).
1937 - Activity reported in area (Smith, 1939).
1938 - Activity reported in area (Smith, 1939).
1939 - Activity reported in area (Smith, 1941).

Production: Unknown.

Workings and Facilities: None.

Geologic Setting:

Bedrock underlying the hills on both sides of the Alatna River is made up of Lower and Upper(?) Cretaceous graywacke and mudstone, which strike east-west and dip to the south. Rocks to the north consist of Upper Jurassic altered mafic volcanic rocks and conglomerate (Patton and Miller, 1966).

Bureau Investigation:

Bedrock was not located in the vicinity of the reported occurrence. Out of four test pans taken from gravel bars at the site, three contained fine gold. One pan concentrate sample (11496, table E-1) contained 1 fine and 2 very fine, flat gold flakes. This is probably fine gold, transported by flood waters and deposited on gravel bars as the water recedes. None of the other samples collected contained anomalous amounts of metal.
Resource Estimate: Unknown.

Mineral Development Potential:

Low development potential due to the fine size of gold and lack of bedrock to concentrate it.

Recommendations: None.

References:

Cobb, E.H., 1972, Metallic mineral resources map of the Survey Pass quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-382, 1 sheet, scale 1:250,000.

Mendenhall, W.C., 1902, Reconnaissance from Fort Hamlin to Kotzebue Sound, Alaska by way of Dall, Kanuti, Allen and Kowak Rivers: U.S. Geological Survey Professional Paper 10, p. 50.

Patton, W.W., Jr., and Miller, T.P., 1966, Regional geologic map of the Hughes quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-459, 1 sheet, scale 1:250,000.

Smith, P.S., 1913, The Noatak-Kobuk region, Alaska: U.S. Geological Survey Bulletin 536, p. 143.

____1930, Mineral industry of Alaska in 1928, *in* Smith, P.S. and others, 1930, Mineral resources of Alaska, report on progress of investigations in 1928: U.S. Geological Survey Bulletin 813, p. 45.

____1939, Mineral resources of Alaska in 1937: U.S. Geological Survey Bulletin 910A, p. 56.

____1941, Mineral resources of Alaska in 1939: U.S. Geological Survey Bulletin 926A, p. 52.

Smith, P.S., and Mertie, J.B., Jr., 1930, Geology and mineral resources of northwestern Alaska: U.S. Geological Survey Bulletin 815, p. 334-335.

U.S. Bureau of Mines, 1979, Mineral deposits of the Alatna, John, Killik, Kobuk and the North Fork of the Koyukuk River areas, Alaska: Preliminary Comment: U.S. Bureau of Mines Open-File Report 36-79, p. 14.

WGM Inc., 1978, Mineral studies of the western Brooks Range, Alaska: U.S. Bureau of Mines Open-File Report 103-78, p. 158.

Property Summary

Name(s): Rockybottom Creek

Map No: H4
MAS No: 0020380014

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Hughes D-1
SE¼ sec. 18, T. 18 N., R. 26 E.
Meridian: Kateel River
Elevation: 910 feet
Latitude: 66° 57.239' N.
Longitude: 153° 14.192' W.
Geographic: On Rockybottom Creek 4.6 miles upstream from the Alatna River.

History:

1898 - Good gold colors found in stream by the Galesburg-Alaska Mining and Development Company (Ingman, 1988)

1901 - Two prospectors worked on Rockybottom Creek (Mendenhall, 1902).

Production: Unknown.

Workings and Facilities: None.

Geologic Setting:

The lower part of Rockybottom Creek flows on bedrock primarily composed of Cretaceous conglomerate. The conglomerate is made up of pebble- to boulder-size clasts of quartz, chert, mafic volcanic rocks, schist, quartzite, and granitic rock in a matrix of sand and silt (Patton and Miller, 1966). A thin layer of gravel overlies the conglomerate bedrock. Fractures and depressions in the conglomerate bedrock contain gold-bearing gravel. Farther upstream, dark greenish gray to brown graywacke and mudstone are present.

Bureau Investigation:

At a point 4.6 miles upstream from the Alatna River, four test pans of broken-up bedrock produced a total of 5 fine, 4 very fine flat gold flakes. A placer sample collected from the thin gravel layer on bedrock contained 0.0003 oz/cy gold (10935, table E-1). The highest gold values are concentrated in bedrock fractures.

Resource Estimate: Unknown.

Mineral Development Potential:

Low development potential due to low gold values and small resource of gold-bearing gravel.

Recommendations: None.

References:

Cobb, E.H., 1972, Metallic mineral resources map of the Survey Pass quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-382, 1 sheet, scale 1:250,000.

Ingman, G., 1988, Journey to the Koyukuk: the photos of J.N. Wyman, 1898-1899: Pictorial Histories Publishing Company, Missoula, Montana, p. 41.

Mendenhall, W.C., 1902, Reconnaissance from Fort Hamlin to Kotzebue Sound, Alaska by way of Dall, Kanuti, Allen and Kowak Rivers: U.S. Geological Survey Professional Paper 10, p. 50.

Patton, W.W., Jr., and Miller, T.P., 1966, Regional geologic map of the Hughes quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-459, 1 sheet, scale 1:250,000.

Property Summary

Name(s): Discovery Creek - Niltitkoktalog Mtn
Grandfather 1-9 claims

Map No: H5
MAS No: 0020380011
Alaska Kardex 038-021

Deposit Type: Placer

Commodities: Au

Location:
Quadrangle: Hughes B-2
SE¼ sec. 6, T. 12 N., R. 25 E.
Meridian: Kateel River
Elevation: 770 feet
Latitude: 66° 28.01' N.
Longitude: 153° 36.09' W.
Geographic: On Discovery Creek, 4.5 miles northeast of Niltitkoktalog Mountain.

History:

1971 - W. Williams and Associates staked nine claims on the creek (Kardex).

Production: Unknown.

Workings and Facilities: There are remains of a cabin near the creek.

Geologic Setting:

The stream does not run on bedrock, but the area is underlain by Cretaceous graywacke and mudstone. The graywacke is poorly sorted, locally calcareous, and interbedded with dark gray to olive mudstone (Patton and Miller, 1966).

Bureau Investigation:

Three test pans taken from gravel bars at the site produced one fine gold flake. However, analysis of the sample showed it contained no gold (10624, table E-1).

Resource Estimate: Unknown.

Mineral Development Potential:

Low development potential due to small amounts of gold in test pans.

Recommendations: None.

References:

Patton, W.W., Jr., and Miller, T.P., 1966, Regional geologic map of the Hughes quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-459, 1 sheet, scale 1:250,000.

Property Summary

Name(s): Red Mountain

Map No: H6
MAS No: 0020380010

Deposit Type: Hypabyssal Porphyry

Commodities: Au, Zn

Location:

Quadrangle: Hughes B-2
Center sec. 2, T. 10 N., R. 23 E.
Meridian: Kateel River
Elevation: 420 feet
Latitude: 66° 17.672' N.
Longitude: 153° 53.800' W.
Geographic: On the north bank of the Koyukuk River, 0.3 mile south of hill 1020, approximately 20 miles northeast of Hughes.

History:

1965 - Berg and Cobb (1967) reported pyritic latite porphyry near the mouth of Red Mountain Creek.

Production: None.

Workings and Facilities: None.

Geologic Setting:

Pyritic hypabyssal latite porphyry and quartzite outcrop on a bluff, 1.5 miles west of the mouth of Red Mountain Creek. The exposure is recognizable by conspicuous limonite stain. The Cretaceous(?) latite has intruded Cretaceous graywacke and mudstone. Samples reportedly contain traces of zinc, gold, and other metals (Berg and Cobb, 1967; Cobb and Miller, 1981).

Bureau Investigation:

Investigators working near the base of the bluff found the latite contained minor amounts of pyrite or pyrrhotite as did quartzite and slate, which may be in faulted contact with the intrusive rock. Three rock samples were collected: two of the limonite-stained latite porphyry (10621, 10623, table E-1) and one quartzite (10622). No anomalies were noted in any of the samples.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential due to low metal values in samples.

Recommendations: None.

References:

Berg, H.C., and Cobb, E.H., 1967, Metalliferous lode deposits of Alaska: U.S. Geological Survey Bulletin 1246, p. 226

Cobb, E.H., and Miller, T.P., 1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in the Hughes, Kotzebue, Melozitna, Selawik, and Shungnak quadrangles, west-central Alaska, Supplement to Open-File Report 75-627, U.S. Geological Survey Open-File Report 81-847A, p. A5.

Cobb, E.H., 1972, Metallic mineral resources map of the Hughes quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-458, 1 sheet, scale 1:250,000.

Patton, W.W., Jr., and Miller, T.P., 1966, Regional geologic map of the Hughes quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-459, 1 sheet, scale 1:250,000.

Property Summary

Name(s): Red Mountain Placer

Map No: H7
MAS No: 0020380009

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Hughes B-2
S½ sec. 1, T. 10 N., R. 23 E.
Meridian: Kateel River
Elevation: 370 feet
Latitude: 66° 17.466' N.
Longitude: 153° 51.805' W.
Geographic: Gravel bars on the south side of the Koyukuk River, opposite hill 1020. Location is approximately 22 miles northeast of Hughes.

History:

1916 - Reports of minor gold production on the south bank of the Koyukuk River at Red Mountain (Eakins, 1916).

Production: Unknown.

Workings and Facilities: None.

Geologic Setting:

Deposits of fine flood gold are reported to occur intermittently along the gravel bars of the Koyukuk River, from Bettles downriver to Hughes. Most of the gold is extremely fine (<0.5 mm), concentrating near the upper end of point bars formed on the inside portion of river bends. The gold-bearing gravels are usually only a few inches thick, hence the name “skim bars.” This gold can be renewed on a yearly basis, depending on the amount and intensity of river flooding (Schrader, 1904).

In recent years, after spring runoff, residents of Bettles reportedly recovered up to several oz of gold from gravel bars on the Koyukuk River. A similar bar near Hughes, 22 miles downriver, is reported to have produced about 200 oz of gold (Cobb and Miller, 1981). The location and concentration of the flood gold can vary considerably from year to year, depending on factors such as amount and intensity of spring runoff.

Bureau Investigation:

The Koyukuk River does not cut bedrock near Red Mountain Creek. Six test pans collected off a 500-foot-long area of the gravel bar along the south side of the Koyukuk River, all contained very fine to fine gold. A pan concentrate sample (12227, table E-1) from one of the better pans collected at the upstream end of the bar in cobble gravel contained 1 fine and 12 very fine flakes of gold. Analysis showed the sample contained 3,848 ppb gold.

The source of the gold may be placer deposits upstream on the Koyukuk River. The possibility of a local source also exists. A pan concentrate sample (10539) collected from bedrock on Fish Creek, 2 miles to the southwest, contained 309 ppb gold. Fish Creek drains the Indian Mountains to the south, an area with historic placer production. The source for these placers may also be providing gold to the Koyukuk River placers. Limonite-stained rocks on the north side of the river consist of latite porphyry containing fine-grained pyrite(?). Samples from these rocks did not contain anomalous amounts of any metals (map no. H6).

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential due to small size and difficultly of gold recovery.

Recommendations:

Prospect river point bars with equipment capable of recovering very fine gold.

References:

Cobb, E.H., and Miller, T.P., 1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in the Hughes, Kotzebue, Melozitna, Selawik, and Shungnak quadrangles, west-central Alaska, Supplement to Open-File Report 75-627, U.S. Geological Survey Open-File Report 81-847A, p. A5.

Eakin, H.M., 1916, The Yukon-Koyukuk region, Alaska: U.S. Geological Survey Bulletin 631, p. 82.

Reed, I.M., 1938, Upper Koyukuk region, Alaska: Alaska Territorial Department of Mines Miscellaneous Report 194-7, p. 163-164.

Schrader, F.C., 1904, A reconnaissance in northern Alaska across the Rocky Mountains, along the Koyukuk, John, Anaktuvuk, and Colville Rivers and the Arctic coast to Cape Lisburne, in 1901: U.S. Geological Survey Professional Paper 20, p. 98.

Property Summary

Name(s): Black Creek

Map No: H8
MAS No: 0020380004
Alaska Kardex 38-004

Deposit Type: Placer

Commodities: Au, W

Location:

Quadrangle: Hughes A-2
S½ sec. 20, T. 8 N., R. 24 E.
Meridian: Kateel River
Elevation: 1,800 feet
Latitude: 66° 04.259' N.
Longitude: 153° 51.351' W.
Geographic: A 1.9-mile-long southwest tributary at the headwaters of the Indian River, 4.5 miles due west of Indian Mountain. Access is via a 16-mile winter trail from Hughes on the Koyukuk River or a 9-mile all-terrain-vehicle (ATV) trail from the Utopia Creek airstrip. The airstrip is part of a U.S. Air Force installation and is closed to the public. The site is on Doyon Ltd. lands.

History: The history of mining on Black Creek is tied closely to that of the Indian River (map no. H11).

1909 - Placer gold was discovered on the Indian River by a native, who related the information to J.C. Felix (Brooks, 1914).

1910 - Felix visited the Indian River site and struck pay dirt late in the summer (Brooks, 1914).

1911 - The first actual placer mining in the area by 10 men on 4 claims (Brooks, 1914).

1912 - A total of 7 claims were worked by about 20 men (Brooks, 1914).

1913 - A total of 35 men were working on 13 claims along the Indian River (Brooks, 1914).

1917 - Only 8 men reported in the district, producing $4,000 of gold (Martin and others, 1919).

1918 - E. McConnell sluiced on creek (U.S. Bureau of Mines PIMR, 1918).

1942 - J. Haley hydraulicked bench gravels (U.S. Bureau of Mines PIMR, 1942).

1950s - Placer drilling and mining with dragline by Strandberg and Sons. Airstrip and road constructed. Up to 18 men were employed. This figure probably included mining operations at Black Creek (U.S. Bureau of Mines PIMRs, 1950-1959).

1961 - Large scale placer operations in the Indian River ceased (Cobb, 1975).

1963-65 - Phillip Goetting and George Norton operate a small sluicing operation at the head of Indian River (Black Creek?) (U.S. Geological Survey, 1965; Alaska Kardex).

Production: (oz Au)

1914 - 414	1958 - 9
1915 - 123	1959 - 474
1918 - 68	1962 - 3
1942 - 148	1964 - 113
	Total: 1,352 (Records incomplete.)

Average fineness: 843 (U.S. Bureau of Mines PIMRs, 1918-1959).

Workings and Facilities:

Dragline tailings piles extend for nearly 1.0 mile up Black Creek from the Indian River. A small cabin still stands near the upper end of the tailings piles. A monitor, pipe, and sluice box are leftover from a hydraulic operation near the creek headwaters. There are numerous open cuts associated with recent small scale mining.

Geologic Setting:

The upper Indian River cuts across three rock units (figure E-1, E-2). The oldest is Late Jurassic to Early Cretaceous andesitic volcanic rock consisting of crystal-bearing lithic tuff, tuff breccia, and agglomerate intercalated with porphyritic pyroxene andesite and trachyandesite flows. Overlying that unit is a thick sequence of late Early Cretaceous volcanic graywacke and mudstone. These rocks are composed of angular detritus that has been derived primarily from the underlying volcanic rocks. Both units have been intruded by Late Cretaceous granodiorite and quartz monzonite of the Indian River Pluton. The pluton contains a constriction near the headwaters of the Indian River, which divides it into a north and south lobe. Intrusion-related thermal effects have created an aureole of epidote and hornblende hornfels around the pluton (Patton and Miller, 1966). Hypabyssal felsic sills and dikes associated with the intrusive rocks exist throughout the contact area; however, only a few have been mapped (Patton and Miller, 1966; Miller and Ferrians, 1968). The pluton is enriched in tungsten as indicated by scheelite observed in pan concentrates and placer samples taken in the area by the BLM.

Black Creek is located on the west side of the constriction in the pluton. The hornfels aureole is nearly 1 mile wide and cut by felsic dikes related to the pluton. This would indicate that a cupola of the pluton may underlie the creek at a shallow depth. The hornfels contains up to 1-2% finely disseminated pyrite, with concentrations highest near felsic dikes. The hornfels is cut by a series of northeast-trending faults. These are locally represented by breccia zones cemented by quartz and containing minor chalcopyrite. The hornfels also contains quartz veinlets with trace chalcopyrite.

Tailings piles leave the Indian River at Black Creek and follow that drainage nearly to its headwaters, which indicates that Black Creek was a substantial contributor of gold to the Indian River placers. Near the lower end, a train of tailings shows that the pay zone followed an ancient buried channel of Black Creek, southwest of the modern stream. The streambed width varies from 20 to 50 feet. Overburden was reportedly about 20 feet thick; and the pay zone, about 12 feet wide. Unlike the Indian River, Black Creek does not contain large boulders (Eakin, 1916).

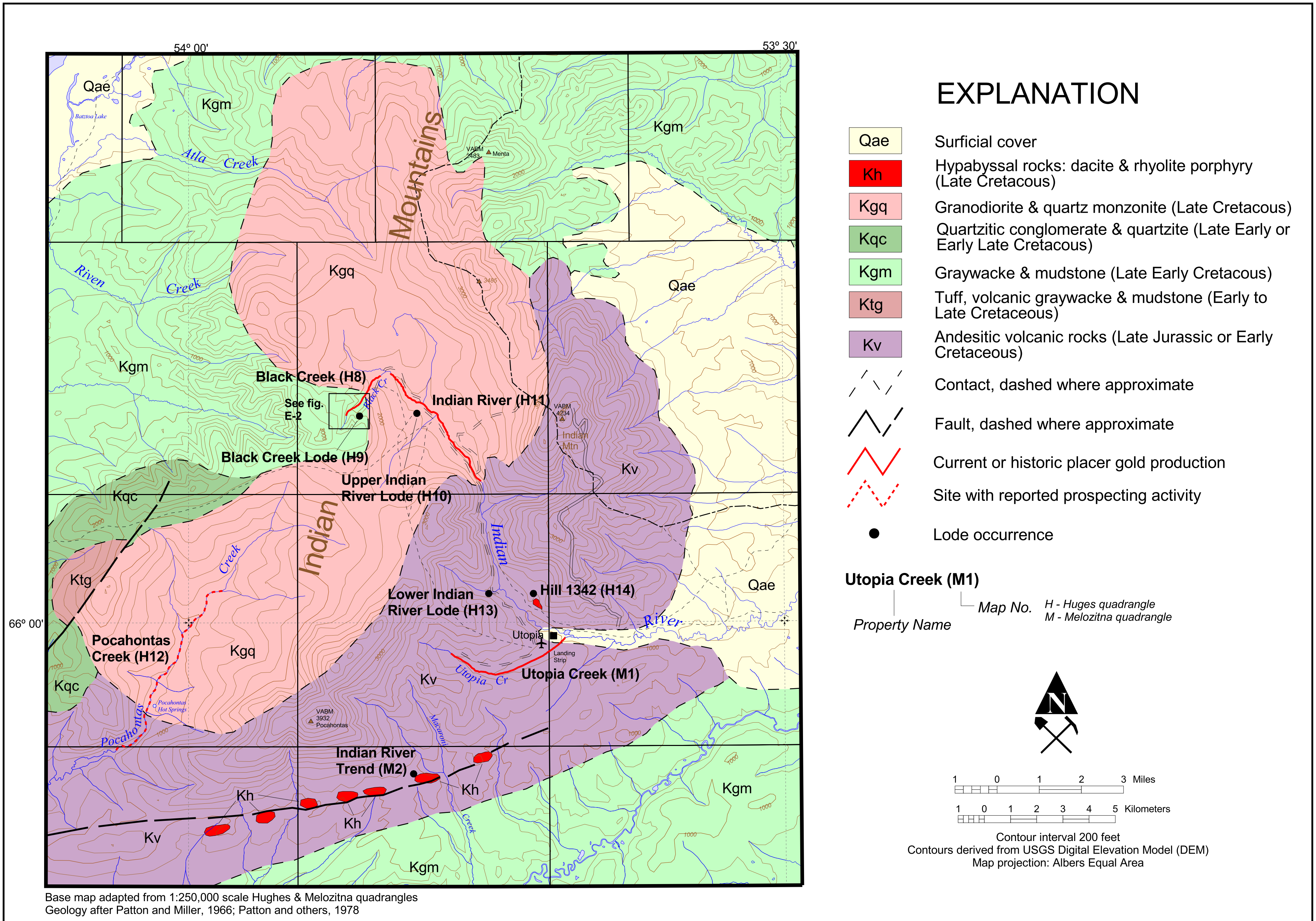


Figure E-1. Map of the Indian Mountain area showing geology, mines prospects, and mineral occurrences.

Though Black Creek has been extensively mined for placer gold, small areas of gold-bearing gravel and bedrock still exist. The placers occur in two modes. In the modern stream the hornfels is vertically fractured, which gives the bedrock a blocky appearance. Gold is confined to the fractures and an overlying clay-rich layer at the base of 1 to 2 feet of overburden. The gold is flat, smooth, and flaky. Bench placers appear confined to the east side of the creek at a level from 5 to10 feet above the modern channel. The gold is nuggety in appearance and is associated with clay layers in angular colluvial material.

Bureau Investigation:

A placer sample taken from 6-inch-deep fractures in hornfels bedrock contained 0.84 oz/cy gold, 813 ppm arsenic, 445 ppm tungsten, 127 ppm copper, and 100 ppm bismuth (10589, table E-1). Individual flakes weighing up to 0.01 oz were recovered. This site appears to be within the area that was mined by either hydraulic methods or dragline; neither operation penetrated far into the resistant hornfels bedrock. Two placer samples from the clay-rich layer and associated colluvium on benches on the right limit averaged 0.15 oz/cy of recoverable gold (10590, 10638). In addition a placer sample (10638) contained >2,000 ppm tungsten and sample 10590 contained 139 ppm bismuth. The source of the gold appears to be the hornfels-intrusive contact zone underlying the upper Black Creek basin.

Resource Estimate:

Inferred resources: 370 cy in modern steam and 75 cy in benches/colluvium. Three placer samples collected from the sites average 0.38 oz/cy gold. A larger resource exists, but dragline tailings up to 20 feet thick cover the pay in places.

Mineral Development Potential:

High development potential exists for small placer operations using mostly hand methods. This site is on Doyon Ltd. lands.

Recommendations:

Suction dredging on bedrock and mining of bench gravels with a small track-mounted backhoe and sluice box setup.

References:

Bright, M.J., 1988, A review of the geology and mineral potential in the vicinity of Indian Mountain, near Hughes, Alaska: unpublished report 88-06 for Doyon Ltd., 29 p. [available from Doyon Ltd., Fairbanks, Alaska]

Brooks, A.H., and others, 1914, Mineral resources of Alaska, report on progress of investigations in 1913: U.S. Geological Survey Bulletin 592, p. 383-384.

Cobb, E.H., 1975, 1975, Summary of references to mineral occurrences (other than mineral fuels and construction materials) in five quadrangles in west-central Alaska (Hughes, Kotzebue, Melozitna, Selawik, Shungnak): U.S. Geological Survey Open-File Report 75-627, p. 10.

Cobb, E.H., and Miller, T.P., 1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in the Hughes, Kotzebue, Melozitna, Selawik, and Shungnak quadrangles, west-central Alaska, Supplement to Open-File Report 75-627, U.S. Geological Survey Open-File Report 81-847A, p. A5.

Eakin, H.M., 1916, The Yukon-Koyukuk region, Alaska: U.S. Geological Survey Bulletin 631, p. 83-84.

Martin, G.C., and others, 1919, Mineral resources of Alaska, report on progress of investigations in 1917: U.S. Geological Survey Bulletin 692, p. 39.

Miller, T.P., and Ferrians, O.J., Jr., 1968, Suggested areas for prospecting in the central Koyukuk River region, Alaska: U.S. Geological Survey Circular 570, p. 5-6.

Patton, W.W., Jr., and Miller, T.P., 1966, Regional geologic map of the Hughes quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-459, 1 sheet, scale 1:250,000.

U.S. Bureau of Mines, 1908-1959, Permanent Individual Mine Records (PIMR) for placer mines in Alaska: U.S. Bureau of Mines unpublished reports.

Property Summary

Name(s): Black Creek Lode

Map No: H9
MAS No: 0020380028

Deposit Type: Plutonic-related epithermal gold

Commodities: Au, Cu,

Location:

Quadrangle: Hughes A-2
N½ sec. 29, T. 8 N., R. 24 E.
Meridian: Kateel River
Elevation: 2,130 feet
Latitude: 66° 04.377' N.
Longitude: 153° 51.284' W.
Geographic: The ridge on the east side of Black Creek, 1.3 miles northeast of hill 3045. Access is via a 16-mile winter trail from Hughes on the Koyukuk River or a 9-mile all-terrain-vehicle (ATV) trail from the Utopia Creek airstrip. The airstrip is part of a U.S. Air Force installation and is closed to the public. The site is on Doyon Ltd. land.

History:

1991 - Central Alaska Gold Company evaluated lode potential of the area for Caithness Gold Mining Company (Central Alaska Gold Company, 1992).

1997 - Airborne geophysical survey of Black Creek area done by North Star Exploration Inc. Results are available from Doyon Ltd. (Harry Noyes, personal communication, 1997).

Production: None.

Workings and Facilities:

A rusted shovel was located near an outcrop of pyritic hornfels. No other evidence of lode prospecting was found.

Geologic Setting:

The upper Indian River cuts across three main rock units (figure E-1). The oldest is Late Jurassic to Early Cretaceous andesitic volcanic rock consisting of crystal-bearing lithic tuff, tuff breccia, and agglomerate intercalated with porphyritic pyroxene andesite and trachyandesite flows. Overlying that unit is a thick sequence of late Early Cretaceous interbedded volcanic graywacke and mudstone. These rocks are composed of angular detritus that has been derived primarily from the underlying volcanic rocks. The mudstone contains cross-bedded textures and small folds locally. Both units have been intruded by Late Cretaceous granodiorite and quartz monzonite of the Indian River Pluton. Randomly oriented hypabyssal sills and dikes associated with the pluton cut the sedimentary rocks throughout the contact area, but only a few have been mapped (Patton and Miller, 1966; Miller and Ferrians, 1968).

The pluton constricts to a narrow neck near the headwaters of the Indian River where it is divided into north and south lobes. Intrusion-related thermal effects have altered the sedimentary and volcanic rocks, and created a contact aureole of resistant dark-brown epidote and hornblende hornfels (Patton and Miller, 1966; Miller and Ferrians, 1968).

Black Creek is located on the west side of the pluton neck and cuts across the sedimentary-intrusive contact zone. Here the contact aureole is nearly 1 mile wide, and the hornfels is cut by felsite, porphyritic andesite, and fine-grained monzonitic(?) dikes. The dikes appear related to the Indian Mountain Pluton. This, along with the extensive hornfelsing, would indicate that a cupola of the pluton may shallowly underlie the creek. The hornfels contains 1-2% disseminated and stringer pyrrhotite, pyrite, arsenopyrite, and acicular tourmaline(?). Reddish-brown colluvium is indicative of higher sulfide concentrations. Sulfide boxworks occur locally in the hornfels, which is cut by a series of northwest-trending faults. These faults are represented by topographic breaks and breccia zones cemented by quartz. The hornfels is also cut by quartz veinlets, some of which crosscut breccia textures. In both cases the quartz contains minor chalcopyrite. The lode occurrence lies adjacent to extensive placer workings (See Black Creek placer, map no. H8).

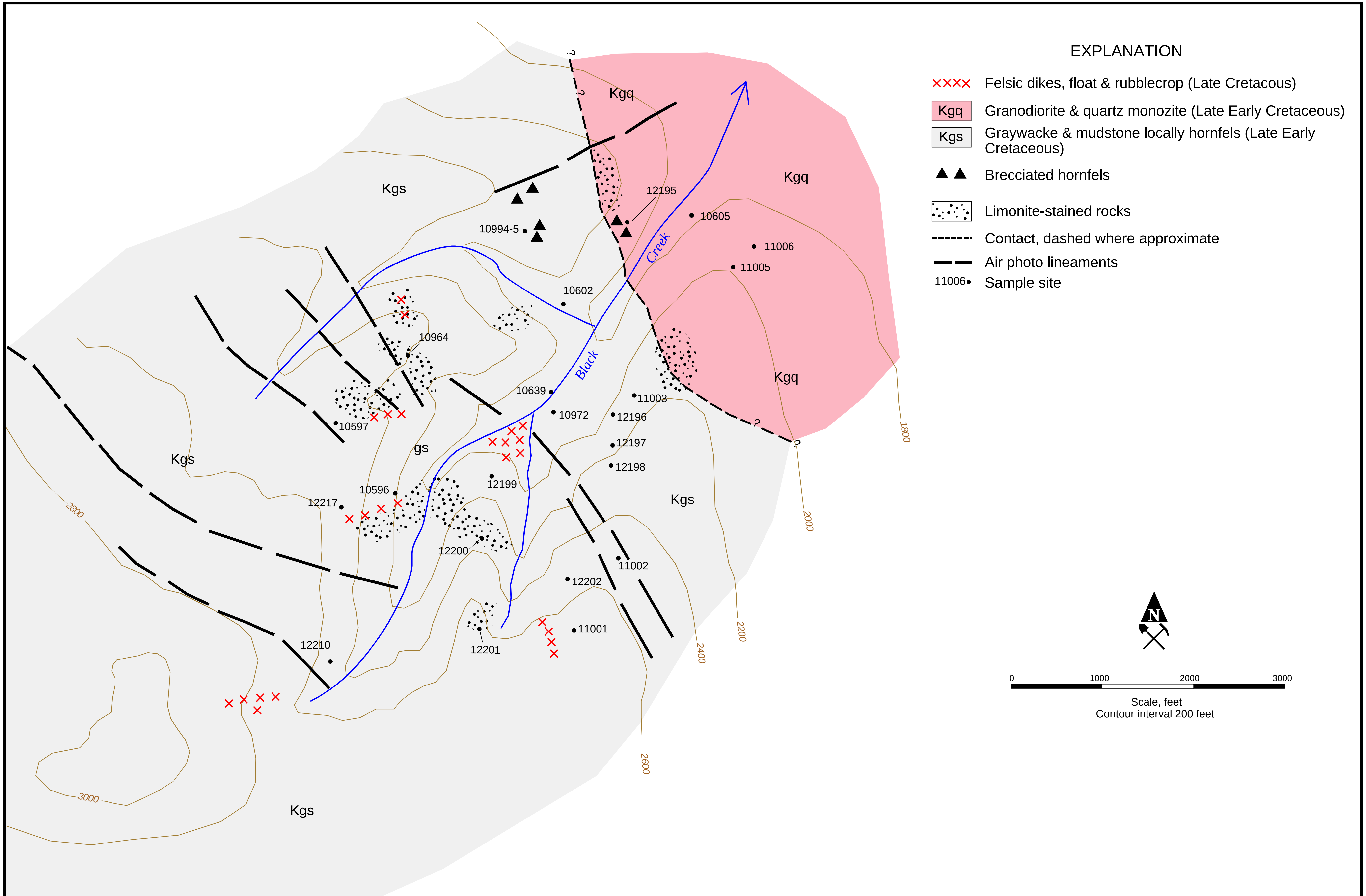
Bureau Investigation:

Rocks at the headwaters of Black Creek were examined to determine possible lode sources for the placer deposits (map no. H8). This drainage is small in extent, confining the area where a potential lode gold source might occur. A series of traverses were made in and around the headwaters of the creek and the various rock types were sampled. Special attention was given to rocks with the highest sulfide contents. Because bedrock outcrops are limited, most samples were collected from rubblecrop or float. A reconnaissance geologic map was made of the area (figure E-2).

The highest gold values were obtained from fine-grained hypabyssal(?) dikes. The rock contains up to 5% combined chalcopyrite/pyrrhotite and is cut by vuggy quartz veinlets. This rock type may also represent a fine-grained intrusive phase at the margin of the Indian Mountain Pluton. A rubblecrop sample (12197, table E-1) collected on the ridge west of the creek, 1.2 miles northeast of Black Creek, contained 717 ppb gold, 4,982 ppm copper, and 12 ppm arsenic. Another sample from an apparent dike, collected 0.2 mile to the south and on the same ridge (11002), contained 611 ppb gold, 3,912 ppm copper, and 50 ppm arsenic.

Roughly east-west oriented felsic dikes and a single exposure of what appears to be porphyritic andesite(?) intrude the sediments and hornfels. The andesite contained trace pyrrhotite and was cut by quartz veinlets. Samples of the andesite contained up to 57 ppb gold (10596). Samples of the felsite contained up to 42 ppb gold (10964). The hornfels and hornfels breccia contain 1-2% disseminated and stringer pyrrhotite and pyrite and minor arsenopyrite, with the highest concentrations of sulfides indicated by limonite-stained colluvium. Samples of the hornfels contained up to 69 ppb gold and 2,676 ppm arsenic (10597). Sulfide concentrations are apparently highest near felsic dikes. It is interesting to note that the highest gold contents were in the intrusive rocks, while the hornfels breccia contained the highest arsenic contents.

Pan concentrate and stream sediment samples were collected from all branches of Black Creek. The highest value obtained from a site not previously mined was 36 ppb gold (10602), collected from the lowest western tributary of the creek (figure E-2). Attempts were made to collect soil samples in three different areas. Finding mineral soil in the colluvium was at times difficult. Samples were collected at 100-foot intervals for 900 feet up the colluvial slopes on the east side and 300 feet up the west side of Black Creek. The highest value obtained was 323 ppb gold from a sample collected on the east side of the creek just above the stream bottom (10972). It is probably representative of the high gold values in the bench placers. Soil samples were taken at about 200-foot intervals following a line just below and



Base map adapted from USGS 1:63,360 scale Hughes A2 quadrangle
Geology modified from Patton and Miller, 1966

Figure E-2. Geology and sample location map of Black Creek.

parallel to the 2,500-foot contour around the canyon headwall (figure E-2). The highest values obtained were 32 ppb gold (12210) and 570 ppm arsenic (12217).

Extensive hornfels and the wide distribution of sulfides along with the presence of felsite dikes indicate that the intrusive-sediment contact may be shallow in this area, dipping at low angle to the south. The rocks at the headwaters of Black Creek could represent a cupola overlying an intrusive body. It is possible that the placer deposits resulted from the erosion of the upper gold-bearing portion of the hydrothermal system.

Resource Estimate: None.

Mineral Development Potential:

Moderate development potential for pluton-related (thermal aureole) gold due to anomalous gold values in contact rocks.

Recommendations:

Drilling of gold anomalies near sediment-intrusive contact on the east side of Black Creek.

References:

Bright, M.J., 1988, A review of the geology and mineral potential in the vicinity of Indian Mountain, near Hughes, Alaska, unpublished report 88-06 for Doyon Ltd., 29 p. [available from Doyon Ltd., Fairbanks, Alaska]

Brooks, A.H., 1914, Mineral resources of Alaska, report on progress of investigations in 1913: U.S. Geological Survey Bulletin 592, p. 383-384.

Central Alaska Gold Company, 1992, 1991 Annual report, Alaska field operations- Doyon Ltd. option, v. I: unpublished report 92-70 for Doyon Ltd., 39 p. [available from Doyon Ltd., Fairbanks, Alaska]

Cobb, E.H., 1975, 1975, Summary of references to mineral occurrences (other than mineral fuels and construction materials) in five quadrangles in west-central Alaska (Hughes, Kotzebue, Melozitna, Selawik, Shungnak): U.S. Geological Survey Open-File Report 75-627, p. 10.

Cobb, E.H., and Miller, T.P., 1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in the Hughes, Kotzebue, Melozitna, Selawik, and Shungnak quadrangles, west-central Alaska, Supplement to Open-File Report 75-627, U.S. Geological Survey Open-File Report 81-847A, p. A5.

Eakin, H.M., 1916, The Yukon-Koyukuk region, Alaska: U.S. Geological Survey Bulletin 631, 88 p. 83-84.

Martin, G.C., and others, 1919, Mineral resources of Alaska, report on progress of investigations in 1917: U.S. Geological Survey Bulletin 692, p. 39.

Miller, T.P., and Ferrians, O.J., Jr., 1968, Suggested areas for prospecting in the central Koyukuk River region, Alaska: U.S. Geological Survey Circular 570, p. 5-6.

Nokleberg, W.J., Bundtzen, T.K., Berg, H.C., Brew, D.A., Grybeck, D., Robinson, M.S., Smith, T.E., and Yeend, W., 1987, Significant metalliferous lode deposits and placer districts in Alaska: U.S. Geological Survey Bulletin 1786, p. 77.

Patton, W.W., Jr., and Miller, T.P., 1966, Regional geologic map of the Hughes quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-459, 1 sheet, scale 1:250,000.

Property Summary

Name(s): Upper Indian River Lode

Map No: H10
MAS No: 0020380005

Deposit Type: Porphyry molybdenum

Commodities: Mo, W

Location:

Quadrangle: Hughes A-2
SE¼ sec. 21, T. 8 N., R. 24 E.
Meridian: Kateel River
Elevation: 1,550 feet
Latitude: 66° 04.311' N.
Longitude: 153° 48.473' W.
Geographic: Reported location associated with placer workings on the upper Indian River, 3.4 miles west of Indian Mountain. The site is on Doyon Ltd. lands.

History:

1942 - Joesting (1942) reported molybdenum mineralization in bedrock exposed by placer operations.

Production: None.

Workings and Facilities:

Placer mining equipment and tailings along 3.5 miles of the upper Indian River are evidence of past operations, but no indications of lode prospecting or mining were found.

Geologic Setting:

The upper Indian River cuts across three rock units (figure E-1). The oldest is Late Jurassic to Early Cretaceous andesitic volcanic rock consisting of crystal-bearing lithic tuff, tuff breccia, and agglomerate intercalated with porphyritic pyroxene andesite and trachyandesite flows. Overlying that unit is a thick sequence of late Early Cretaceous volcanic graywacke and mudstone. These rocks are composed of angular detritus derived primarily from the underlying volcanic rocks. Both units have been intruded by Late Cretaceous granodiorite and quartz monzonite. Intrusion-related thermal effects have created an aureole of epidote and hornblende hornfels around the pluton. Hypabyssal sills and dikes associated with the intrusive rocks exist throughout the contact area; however, only a few have been mapped (Patton and Miller, 1966; Miller and Ferrians, 1968).

Molybdenum mineralization associated with the intrusive(?) rocks was reportedly exposed during placer operations on the Indian River. The prospect was said to contain high-grade ore, but it was not systematically sampled (Joesting, 1942).

Bureau Investigation:

Previous investigations mention reports of molybdenum mineralization occurring along the upper Indian River. However, none have been substantiated. Intrusive rocks along the river were targeted during the present study as they seemed the most logical host for that type of mineralization. The river bed was prospected in the vicinity of the placer tailings, and the few exposures found there were examined. In addition spot checks were made of intrusive float and outcrop in the surrounding area. At the mouth of a northern tributary to the Indian River, 1.4 miles south of hill 1925, an outcrop of quartz monzonite contained numerous narrow quartz-epidote veinlets that showed signs of argillic and potassic alteration. The veinlets trended N. 80° E. No sulfides were observed, and a sample (12204, table E-1) did not contain significant metal values. The veinlets were encountered at several sites farther downriver; however, no molybdenite or other sulfides were observed, and samples were not anomalous in molybdenum. The veinlets did contain an unidentified, soft, acicular, white mineral. A sample (12223) was anomalous in barium, which indicates that the mineral may be barite.

The pluton is enriched in tungsten as indicated by scheelite observed in pan concentrates and placer samples taken in the area. A placer sample (10588), collected just downstream from the mining camp, contained 1,127 ppm tungsten, 225 ppm molybdenum, and 24 ppm gold (map no. H11). This was the only anomalous molybdenum value obtained in the area. Scheelite and powellite(?) were identified in the concentrate. The powellite (calcium molybdate) may be the source of the high molybdenum values in the concentrate.

Resource Estimate: None.

Mineral Development Potential:

Low potential for molybdenum; no signs of molybdenum mineralization were observed.

Recommendations: None.

References:

Berg, H.C., and Cobb, E.H., 1967, Metalliferous lode deposits of Alaska: U.S. Geological Survey Bulletin 1246, p. 226.

Brooks, A.H., and others, 1914, Mineral resources of Alaska, report on progress of investigations in 1913: U.S. Geological Survey Bulletin 592, p. 383.

Joesting, H.R., 1942, Strategic mineral occurrences in interior Alaska: Alaska Department of Mines Pamphlet no. 1, p. 29.

Cobb, E.H., 1972, Metallic mineral resources map of the Hughes quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-458, 1 sheet, scale 1:250,000.

____1973, Placer deposits of Alaska: U.S. Geological Survey Bulletin 1374, p. 144-145.

____1975, Summary of references to mineral occurrences (other than mineral fuels and construction materials) in five quadrangles in west-central Alaska (Hughes, Kotzebue, Melozitna, Selawik, Shungnak): U.S. Geological Survey Open-File Report 75-627, p. 10.

Miller, T.P., and Ferrians, O.J., Jr., 1968, Suggested areas for prospecting in the central Koyukuk River region, Alaska: U.S. Geological Survey Circular 570, p. 5-6.

Property Summary

Name(s): Indian River

Map No: H11
MAS No: 0020380003
Alaska Kardex 038-004
Alaska Kardex 038-014
Alaska Kardex 038-018

Deposit Type: Placer

Commodities: Au, Ag

Location:

Quadrangle: Hughes A-2
SE¼ sec. 21, T. 8 N., R. 24 E.
Meridian: Kateel River
Elevation: 1,530 feet
Latitude: 66° 04.311' N.
Longitude: 153° 48.473' W.
Geographic: Mining has been concentrated near the headwaters of the Indian River, 3 miles east of Indian Mountain. The land is owned by Doyon Ltd. Access is via a 14-mile winter trail from Hughes on the Koyukuk River or a 7-mile all-terrain-vehicle (ATV) trail from the Utopia Creek airstrip. The airstrip is part of a U.S. Air Force installation and is closed to the public. The site is on Doyon Ltd. lands.

History:

1909 - Placer gold was discovered on the Indian River by a native, who related the information to J.C. Felix (Brooks, 1914).

1910 - Felix visited the Indian River site and struck pay dirt late in the summer (Brooks, 1914).

1911 - The first actual placer mining in the area by 10 men on 4 claims (Brooks, 1914).

1912 - A total of 7 claims were worked by about 20 men (Brooks, 1914).

1913 - A total of 35 men were working on 13 claims along the Indian River (Brooks, 1914).

1917 - Only 8 men reported in the district, producing $4,000 of gold (Martin and others, 1919).

1951 - Placer drilling and mining with dragline by Strandberg and Sons. Airstrip and road constructed. Up to 18 men were employed (U.S. Bureau of Mines PIMR, 1951).

1961 - Large scale placer operations by the Strandbergs on the Indian River cease (Cobb, 1975).

1963-65 - Phillip Goetting and George Norton operate a small sluicing operation at the head of Indian River (U.S. Geological Survey, 1965; Alaska Kardex).

Production:(oz Au) (Eakin, 1916; Martin and others, 1919)

1911 - 484	1951 - 4,648	1957 - 1,455
1912 - 1,185	1952 - 2,499	1958 - 1,467
1913 - 1,548	1953 - 3,024	1959 - 1,022
1914 - 1,209	1954 - 3,710	1966 - 39
1915 - 728	1955 - 2,362	1967 - 25
1917 - 193	1956 - 754	
		Total: 26,352 (Records incomplete)

Gold fineness: 943 (Metz and Hawkins, 1981).

Workings and Facilities:

Dragline tailings piles, up to 30 feet high, extend for 3.5 miles along the upper Indian River and lower Black Creek (map no. H8). A mining camp with cabins, tool sheds, a placer drill, and thawing equipment is located on the west side of the river, 3 miles west of Indian Mountain. A dragline shovel and large track-mounted washing plant are located at the camp. The washing plant used a trommel to separate out oversized material. A winter airstrip is 0.5 mile downstream from the camp, on the west side of the river.

Geologic Setting:

The upper Indian River cuts across three rock units (figure E-1). The oldest is Late Jurassic to Early Cretaceous andesitic volcanic rock consisting of crystal-bearing lithic tuff, tuff breccia, and agglomerate intercalated with porphyritic pyroxene andesite and trachyandesite flows. Overlying that unit is a thick sequence of late Early Cretaceous volcanic graywacke and mudstone. These rocks are composed of angular detritus derived primarily from the underlying volcanic rocks. Both units have been intruded by Late Cretaceous granodiorite and quartz monzonite of the Indian River Pluton. The pluton contains a construction near the headwaters of the Indian River, which divide it into a north and south lobe. Intrusion-related thermal effects have created an aureole of epidote and hornblende hornfels around the pluton (Patton and Miller, 1966; Miller and Ferrians, 1968).

Hypabyssal felsic sills and dikes associated with the intrusive rocks exist throughout the contact area; however, only a few have been mapped (Patton and Miller, 1966; Miller and Ferrians, 1968). In Black Creek, at the headwaters of the Indian River, the hornfels aureole is nearly 1 mile wide and cut by numerous felsic dikes related to the pluton. This would indicate that a cupola of the pluton may underlie the creek at a shallow depth. The pluton is enriched in tungsten as indicated by scheelite observed in pan concentrates and placer samples taken in the area.

Placers on Indian River are reportedly confined to the modern stream channel, but they also extend for a short distance under the east bank of the stream. The gold-bearing gravel is on the same level as the stream though. The pay gravel is 2 to 6 feet deep with an average width of about 50 feet. Except for the Black Creek area, the placers lie on intrusive bedrock. The richest placers appear to die out on the lower end, where the river cuts volcanic rocks. This would indicate that the source is probably the intrusive rocks that underlie that portion of the river. At the upper end, tailings piles leave the main course of the Indian River at Black Creek and follow that drainage nearly to its headwaters. This indicates that Black Creek was a substantial contributor of gold to the Indian River placers; the source was possibly the hornfels-intrusive contact cut by the former creek.

Boulders from the weathering of colluvial material on the creek banks were a hindrance to economical mining (Brooks, 1914). Dragline operations on the Indian River in the 1950s averaged 0.028 oz/cy gold (U.S. Bureau of Mines PIMRs).

Bureau Investigation:

A placer sample (10588, table E-1) was collected from gravel 3 to 4 feet above bedrock, just downsteam of the old mine camp, on the west side of the creek. The sample did not contain weighable gold, but analysis showed 24.3 ppm gold, 1,127 ppm tungsten, and 225 ppm molybdenum. Scheelite and powellite(?) were identified in the concentrate. The powellite (calcium molybdate) may be the source of the high molybdenum values in the concentrate.

The bed of the Indian River was walked from Black Creek downriver for 3.5 miles and the side streams were sampled. Fine gold was observed in test pans taken from side tributaries, 0.2 (12205) and 0.6 mile (12220) downstream from the mine camp. A placer sample (12226) at the first side stream contained 0.001 oz/cy gold.

Resource Estimate: None.

Mineral Development Potential:

Low potential for placer deposits under colluvium on the margins of the Indian River. Sampling indicates that these deposits would be too low grade to mine.

Recommendations:

Placer drilling to test areas on river margins. This may have already been done, because a cable-tool placer drill is currently onsite.

References:

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Brooks, A.H., 1914, Mineral resources of Alaska, report on progress of investigations in 1913: U.S. Geological Survey Bulletin 592, p. 383-384.

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Martin, G.C., and others, 1919, Mineral resources of Alaska, report on progress of investigations in 1917: U.S. Geological Survey Bulletin 692, p. 39.

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Patton, W.W., Jr., and Miller, T.P., 1966, Regional geologic map of the Hughes quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-459, 1 sheet, scale 1:250,000.

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U.S. Bureau of Mines, 1908-1959, Permanent Individual Mine Records (PIMR) for placer mines in Alaska: U.S. Bureau of Mines unpublished reports.

U.S. Geological Survey Research 1965, Chapter A, Professional Paper 525, p. A102.

Property Summary

Name(s): Pocahontas Creek

Map No: H12
MAS No: 0020380019

Deposit Type: Placer

Commodities: Au

Location:
Quadrangle: Hughes A-2
NE¼ sec. 15, T. 7 N., R. 23 E.
Meridian: Kateel River
Elevation: 1330 feet
Latitude: 66° 00.50' N.
Longitude: 153° 59.50' W.
Geographic: A tributary of the Koyukuk River, draining the western Indian Mountains.

History:

~1916 - Eakins (1916) reports prospecting on Pocahontas Creek.

Production: None.

Workings and Facilities: None.

Geologic Setting:

Pocahontas Creek drains the southern lobe of the Indian Mountain pluton, a Late Cretaceous medium-grained hornblende-biotite granodiorite and quartz monzonite body (figure E-1). The lower portion of the creek cuts across the contact between the pluton and Early Cretaceous andesitic volcanic rocks that are widely altered to dark-green hornfels (Patton and Miller, 1966; Patton and others, 1978). An airborne radiometric anomaly is reported to occur near the headwaters of Pocahontas Creek at latitude 66° 03' N., longitude 153° 55' W. (U.S. Geological Survey, 1955).

Bureau Investigation:

An aerial reconnaissance found no indications of mining or prospecting activity on the creek. No gold was detected in test pans from point bars in the canyon narrows, 1.5 miles downstream from Pocahontas Hot Springs. A pan concentrate sample (10618, table E-1) contained moderate amounts of magnetite and 23 ppb gold. A pan concentrate sample (12266) collected in granitic terrain near the creek headwaters was not anomalous in any metals. The reported radiometric anomaly was not followed up.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential, as there are no indications of gold in the creek.

Recommendations: None.

References:

Cobb, E.H., 1972, Metallic mineral resources map of the Hughes quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-458, 1 sheet, scale 1:250,000.

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U.S. Geological Survey, 1955, Radioactivity anomalies reported in Alaska: Department of the Interior memorandum dated August 19, 1955, 2 p.

Property Summary

Name(s): Lower Indian River Lode

Map No: H13
MAS No: 0020380006

Deposit Type: Epithermal veins

Commodities: Zn

Location:

Quadrangle: Hughes A-2
NE¼ sec. 14, T. 7 N., R. 24 E.
Meridian: Kateel River
Elevation: 1,100 feet
Latitude: 66° 0.660' N.
Longitude: 153° 44.569' W.
Geographic: On an unnamed western tributary of the Indian River, 2 miles upstream from Utopia Creek. The site is accessible via an all-terrain-vehicle (ATV) trail that starts at the Utopia Creek airstrip and goes up the west side of the Indian River.

History:

1909 - Placer gold was discovered on Indian River by a native, who told J.C. Felix the following year (Brooks, 1914).

1968 - Miller and Ferrians (1968) collected samples of highly altered, fine-grained intrusive rocks that were anomalous in gold, silver, and zinc.

Production: None.

Workings and Facilities: None.

Geologic Setting:

The south side of Indian Mountain is composed of Late Jurassic to Early Cretaceous andesitic volcanic rocks consisting of crystal-bearing lithic tuff, tuff breccia, and agglomerate intercalated with porphyritic pyroxene andesite and trachyandesite flows. These rocks have been intruded by Late Cretaceous granodiorite and quartz monzonite. Hypabyssal sills and dikes exist throughout the contact area; however, only a few have been mapped (figure E-1) (Patton and Miller, 1966).

Both the intrusive and volcanic rocks are oxidized, highly altered, and contain disseminated pyrite and sphalerite. Analytical results show anomalous amounts of lead, zinc, copper, molybdenum, silver, and gold (Miller and Ferrians, 1968).

Bureau Investigation:

Float exposed in the bed of an ATV trail consisted of andesite that had undergone silicic and argillic alteration. The rock was limonite stained and contained minor disseminated pyrite and trace galena. A select float sample (10633, table E-1) contained 8,290 ppb gold, 1,771 ppm lead, 998 ppm zinc, and 794 ppm copper. Similar rock was found in outcrop, approximately 500 feet east, at the confluence of the unnamed tributary and the Indian River. A sample from this site (12157) contained 87 ppb gold and 1765 ppm lead. During two traverses on the ridge west of the trail, BLM geologist were unable to locate similarly mineralized rocks. In addition samples contained up to 1,948 ppm barium (12188). The occurrences at Utopia Creek (map no. M1) and hill 1342 (map no. H14) were also anomalous in barium.

Resource Estimate: None.

Mineral Development Potential:

One sample was highly anomalous in gold and the area showed no signs of prospecting; consequently, there is moderate potential for epithermal gold deposits.

Recommendations:

Trench and re-sample vegetated areas near mineralized float and bedrock exposures.

References:

Cobb, E.H., 1972, Metallic mineral resources map of the Hughes quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-458, 1 sheet, scale 1:250,000.

____1975, Summary of references to mineral occurrences (other than mineral fuels and construction materials) in five quadrangles in west-central Alaska (Hughes, Kotzebue, Melozitna, Selawik, Shungnak): U.S. Geological Survey Open-File Report 75-627, p. 10.

Miller, T.P., and Ferrians, O.J., Jr., 1968, Suggested areas for prospecting in the central Koyukuk River region, Alaska: U.S. Geological Survey Circular 570, p. 5-6.

Patton, W.W., Jr., and Miller, T.P., 1966, Regional geologic map of the Hughes quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-459, 1 sheet, scale 1:250,000.

Property Summary

Name(s): Hill 1342

Map No: H14
MAS No: 0020380029

Deposit Type: Hot springs epithermal veins

Commodities: Au, Ag, Cu

Location:

Quadrangle: Hughes A-2
NE¼ sec. 13, T. 7 N., R. 24 E.
Meridian: Kateel River
Elevation: 1,220 feet
Latitude: 66° 00.605' N.
Longitude: 153° 42.693' W.
Geographic: Approximately 4.2 miles south of Indian Mountain and 0.2 mile northeast of hill 1342.

History:

1967 - Miller and Ferrians (1968) collected samples of highly altered, fine-grained, pyritiferous intrusive rocks along the west bank of the Indian River.

1990-92 - Central Alaska Exploration Corporation did reconnaissance sampling and mapping in the Indian Mountains (Central Alaska Gold Company, 1992).

Production: None.

Workings and Facilities: One trench(?).

Geologic Setting:

The south side of Indian Mountain is composed of Late Jurassic to Early Cretaceous andesitic volcanic rocks consisting of crystal-bearing lithic tuff, tuff breccia, and agglomerate intercalated with porphyritic pyroxene andesite and trachyandesite flows. These rocks have been intruded by Late Cretaceous granodiorite and quartz monzonite. Hypabyssal sills and dikes exist throughout the contact area; however, only a few have been mapped (figure E-1) (Patton and Miller, 1966).

Both the intrusive rocks and the altered andesite contain disseminated pyrite and sphalerite. Analytical results also show anomalous amounts of lead, zinc, copper, molybdenum, silver, and gold (Miller and Ferrians, 1968). As a result of the weathering pyrite, the soils are too acidic to support vegetation.

Bureau Investigation:

A 250- by 350-foot exposure of reddish-orange andesite and volcanic agglomerate rubblecrop and float stands out as a conspicuous color anomaly. The andesite has undergone silicification as indicated by abundant quartz veinlets and the bleached appearance of fresh rock surfaces. The silicificed rock locally contains up to 5% disseminated pyrite. The presence of gossaneous pyrite boxworks would indicate a higher sulfide content in the subsurface. Trace amounts of greenish scorodite and streaks of a dark gray unidentified mineral were detected. Select samples of the pyritiferous float contained up to 21.12 ppm gold, 21.6 ppm silver, 692 ppm copper, 439 ppm barium, 232 ppm ppm molybdenum, 232 ppm zinc, 221 ppm lead, and 67 ppm arsenic (10508-10511, 12231-12233, table E-1). The gold value is highly anomalous and inconsistent with gold values in other samples collected at the site. The mineralization is probably the result of hydrothermal activity occurring during the late stages of the emplacement of the intrusive rocks. A fault cutting the overlying andesite may have tapped these fluids and provided structural control for emplacement of the sulfides. Some of the hydrothermal activity seems quite fresh and the occurrence may be the site of recent hot springs activity. This site is similar to epithermal vein occurrences in lower Indian River (map no. H13) and the Indian River trend (map no. M2) as all sites are anomalous in barium.

Resource Estimate: None.

Mineral Development Potential:

Moderate development potential for lode gold due to anomalous gold values in samples. However, analytical results show gold values to be very spotty.

Recommendations: Grid soil survey over area, followed by drilling if anomalies are detected.

References:

Central Alaska Gold Company, 1992, 1991 Annual report, Alaska field operations- Doyon Ltd. option, v. I: unpublished report 92-70 for Doyon Ltd, 39 p. [available from Doyon Ltd., Fairbanks, Alaska]

Miller, T.P., and Ferrians, O.J., Jr., 1968, Suggested areas for prospecting in the central Koyukuk River region, Alaska: U.S. Geological Survey Circular 570, p. 5-6.

Patton, W.W., Jr., and Miller, T.P., 1966, Regional geologic map of the Hughes quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-459, 1 sheet, scale 1:250,000.

Property Summary

Name(s): Gen Creek

Map No: H15
MAS No: 0020380008
Alaska Kardex 038-007

Deposit Type: Placer

Commodities: Au

Location:

Quadrangle: Hughes A-1 — NE¼ sec. 18, T. 7 N., R. 27 E.
Meridian: Kateel River — Elevation: 850 feet
Latitude: 66° 0.828' N. — Longitude: 153° 02.280' W.
Geographic: Approximately 5 miles southwest of Lake Todatonen.

History:

1957 - G. Norton staked 2 placer claims on Gen Creek (Kardex).

Production: None.

Workings and Facilities: None.

Geologic Setting:

The bedrock consists of surficial Cretaceous graywacke and mudstone. The graywacke is poorly sorted, locally calcareous, and interbedded with dark gray to olive mudstone. Although graywacke composition is variable, it generally contains an abundance of feldspar and volcanic rock debris (Patton and Miller, 1966). Bedrock exposure is poor.

Bureau Investigation:

Several square miles were investigated from the air at the Gen Creek site; however, no evidence of mining or prospecting was observed. One pan concentrate and one stream sediment sample were collected (10619-10620, table E-1). The sample results were not considered anomalous.

Resource Estimate: None.

Mineral Development Potential:

Low mineral development potential due to lack of geochemical anomalies and unfavorable geology.

Recommendations: None.

References:

Patton, W.W., Jr., and Miller, T.P., 1966, Regional geologic map of the Hughes quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigation Map I-459, 1 sheet, scale 1:250,000.

Table E-1. Selected results from samples collected in the Hughes quadrangle.

Explanation

Sample site

core	drill core
drum	55 gallon drum
dump	mine dump
flt	float
otc	outcrop
rub	rubblecrop
tail	mine tailings
trn	trench

Placer gold: size classification

v. fine	< 0.5 mm
fine	0.5 - 1.0 mm
coarse	1 -2 mm
v. coarse	> 2 mm

Abbreviations:

Ck	creek
confl	confluence
Mtn	mountain
R	river

Footnotes:

Bold numbers indicate multiple erratic results, which were averaged.

Results for Au are reported in ppb unless other units are stated.

Sample type

cont	continuous chip
grab	grab sample
pan	pan concentrate
plac	placer concentrate
rand	random chip
rep	representative chip
sed	sediment sample
sel	select
slu	sluice concentrate
soil	soil sample
spac	spaced chip

Sample description

abu	abundant
alt	altered, alteration
amph	amphibole
ank	ankerite
apy	arsenopyrite
az	azurite
ba	barite
bio	biotite
blk	black
bn	bornite
box	boxwork texture
brn	brown
ca	calcite
calc	calcareous
carb	carbonate
cc	chalcocite
cgl	conglomerate
ch	chlorite
chm	chromite
comp	composite
cpy	chalcopyrite
cst	cassiterite
cv	covellite
diss	disseminated
ep	epidote
feld	feldspar
ft	foot (12 inches)
fuch	fuchsite
gar	garnet
gd	granodiorite
gn	galena
gwy	graywacke
hbl	hornblende
hem	hematite
hfls	hornfels
hydro	hydrothermal
in	inch
intr	intrusive
lim	limonite
ls	limestone
mag	magnetite

Sample description

mal	malachite
mar	marcasite
mdst	mudstone
meta	metamorphic
MnO	manganese oxide
mod	moderate
monz	monzonite
musc	muscovite
oz/cyd	ounces per cubic yard
oz/t	ounces per ton
pct	percent
po	pyrrhotite
porph	porphyry
ppb	parts per billion
ppm	parts per million
psuedo	psuedomorph
py	pyrite
qtz	quartzite
qz	quartz
sch	scheelite
sco	scorodite
ser	sericite
serp	serpentinized
sid	siderite
silic	siliceous
sl	sphalerite
slts	siltstone
ss	sandstone
stb	stibnite
tet	tetrahedrite
tm	tourmaline
tr	trace
v	very
val	valentinite
vis	visible
vlets	veinlets
volc	volcanic
w/	with
xcut	crosscutting
xln	crystalline
xls	crystals

Elements

Ag	silver
Al	aluminum
As	arsenic
Au	gold
Ba	barium
Bi	bismuth
Ca	calcium
Cd	cadmium
Co	cobalt
Cr	chromium
Cu	copper
Fe	iron
Ga	gallium
Hg	mercury
K	potassium
La	lanthanum
Li	lithium
Mg	magnesium
Mn	manganese
Mo	molybdenum
Na	sodium
Nb	niobium
Ni	nickel
Pb	lead
Pd	palladium
Pt	platinum
Sb	antimony
Sc	scandium
Sn	tin
Sr	strontium
Ta	tantalum
Te	tellurium
Th	thorium
Ti	titanium
U	uranium
V	vanadium
W	tungsten
Y	yttrium
Zn	zinc
Zr	zirconium

Table E-1. Selected results from samples collected in the Hughes quadrangle.

Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Pt ppb	Pd ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	Bi ppm	As ppm	Sb ppm	Mn ppm	Ba ppm	Sn ppm	W ppm
H 1	10898	Helpmejack Hills	rub	sel	greenstone w/ <1% po, lim	<1			<0.2	119	<2	60	2	<5	<5	<5	852	351	<20	<20
H 2	10899	Helpmejack Ck		sed		2			<0.2	16	7	73	<1	<5	6	<5	410	79	<20	<20
H 2	10900	Helpmejack Ck		pan		54	<5	<1	<0.2	19	7	76	4	<5	10	<5	2118	57	<20	<20
H 2	10934	Helpmejack Ck	otc	grab	greenstone w/ no sulfides	<1			<0.2	26	3	103	2	<5	<5	<5	297	41	<20	<20
H 3	11494	Lost Pipe		sed		<5			<0.2	23	9	80	2	<5	10	<5	502	32	<20	<20
H 3	11495	Lost Pipe		pan	mod fine mag	<5	12	8	<0.2	18	12	63	1	<5	6	<5	1053	81	<20	<20
H 3	11496	Lost Pipe		pan	2 v fine, 1 fine Au	1732	7	11	<0.2	20	7	62	3	<5	6	<5	995	78	<20	<20
H 4	10935	Rockybottom Ck		plac	6 v fine, flat Au	0.0003 oz/cyd	<5	4	<0.2	40	4	69	<1	<5	9	<5	818	170	<20	<20
H 5	10624	Discovery Ck		pan	3 pan comp, 1 fine Au, mag	<5			<0.2	9	12	38	1	<5	10	<5	1701	167	<20	<20
H 5	10625	Discovery Ck		sed		<5			<0.2	17	4	67	<1	<5	6	<5	552	87	<20	<20
H 6	10621	Red Mtn lode site	rub	rand	latite porph w/ <1% po, lim	25			<0.2	55	5	38	3	<5	20	<5	253	151	<20	<20
H 6	10622	Red Mtn lode site	otc	rand	qtz or v fine intr(?) w/ 1% po	13			<0.2	86	<2	63	<1	<5	9	<5	562	121	<20	<20
H 6	10623	Red Mtn lode site	flt	grab	latite porpyry	13			<0.2	63	5	51	3	<5	19	<5	269	106	<20	<20
H 7	10539	Fish Ck		pan	4 pan comp, mod mag	309			<0.2	19	16	63	6	<5	33	<5	1198	102	<20	36
H 7	10540	Fish Ck		sed		<5			<0.2	24	7	87	<1	<5	8	<5	469	169	<20	<20
H 7	12227	Red Mtn placer site		pan	1 fine, 12 v fine Au	3848	<5	<1	<0.2	19	13	45	2	<5	7	<5	2009	57	<20	<20
H 8	10589	Black Ck		plac	abu coarse Au, sch & zircon	0.835 oz/cyd			0.4	127	12	63	16	100	813	<5	705	107	<20	445
H 8	10590	Black Ck		plac	abu fine Au, sch & zircon	0.061 oz/cyd			7.0	65	10	64	17	139	249	<5	784	117	<20	557
H 8	10598	Black Ck		pan		6			<0.2	49	15	95	1	<5	362	<5	689	196	<20	<20
H 8	10599	Black Ck		sed		<5			<0.2	49	10	87	1	<5	149	<5	708	186	<20	<20
H 8	10600	Black Ck		sed		<5			<0.2	53	7	60	2	<5	42	<5	501	146	<20	<20
H 8	10601	Black Ck		pan		6			<0.2	26	9	32	3	<5	19	<5	286	63	<20	<20
H 8	10602	Black Ck		pan	1 fine Au, mod mag	36			<0.2	142	5	35	7	<5	98	<5	559	125	<20	<20
H 8	10603	Black Ck		sed		<5			<0.2	210	<2	72	9	<5	89	<5	621	181	<20	<20
H 8	10638	Black Ck		plac	abu fine Au, sch & zircon	0.230 oz/cyd			15.6	35	82	70	37	489	174	<5	1063	30	30	>2000
H 8	10950	Black Ck		sed		12			<0.2	40	15	85	<1	<5	80	<5	459	176	<20	<20
H 8	10951	Black Ck		pan	minor mag, possible sulfides	8	<5	2	<0.2	37	9	90	2	<5	92	<5	763	203	<20	<20
H 8	10953	Black Ck		sed		12			<0.2	39	12	86	<1	<5	97	<5	534	185	<20	<20
H 8	10954	Black Ck		pan	no mag	14	<5	<1	<0.2	34	7	120	2	<5	69	<5	861	276	<20	<20
H 8	10960	Black Ck		sed		11			<0.2	38	6	76	2	<5	62	<5	617	213	<20	<20
H 8	10965	Black Ck		sed		13			<0.2	22	6	68	1	<5	86	<5	458	146	<20	<20
H 8	10966	Black Ck		pan	tr mag, no vis Au	29	6	<1	<0.2	42	3	81	2	<5	112	<5	730	289	<20	<20
H 8	11022	Black Ck		pan	from colluvium, abu fine mag	1014	<5	2	<0.2	38	5	52	7	112	46	<5	523	86	<20	79
H 8	12189	Indian R, upper		sed		<5			<0.2	24	6	44	<1	<5	7	<5	292	239	<20	<20
H 8	12190	Indian R, upper		pan	minor fine mag, no vis Au	7	<5	<1	<0.2	19	30	32	2	<5	88	<5	400	201	<20	<20
H 8	12251	Black Ck		pan	abu fine mag	1566	<5	<1	<0.2	69	3	45	3	<5	24	<5	483	199	<20	<20
H 9	10501	Black Ck	flt	grab	arkosic ss w/ <1% sulfides	<5			<0.2	21	6	53	2	<5	9	<5	505	157	<20	<20

Table E-1. Selected results from samples collected in the Hughes quadrangle.

Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Pt ppb	Pd ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	Bi ppm	As ppm	Sb ppm	Mn ppm	Ba ppm	Sn ppm	W ppm
H 9	10502	Black Ck	flt	grab	coarse ss w/ py, po	<5			<0.2	60	9	53	3	<5	6	<5	396	76	<20	<20
H 9	10503	Black Ck	flt	sel	brecciated hfls w/ py, po	<5			<0.2	62	6	60	<1	<5	9	<5	669	108	<20	<20
H 9	10529	Black Ck	otc	sel	fine grained monz intr	<5			<0.2	39	9	44	2	<5	6	<5	313	340	<20	<20
H 9	10530	Black Ck	rub	grab	hfls w/ po, py, lim	6			<0.2	277	6	46	3	<5	7	<5	596	30	<20	<20
H 9	10531	Black Ck	flt	sel	hfls w/ <5% po, py, lim	9			<0.2	50	3	40	2	<5	20	<5	476	28	<20	<20
H 9	10532	Black Ck	otc	rand	hfls w/ <2% po, py, lim	<5			<0.2	61	3	83	1	<5	6	<5	1002	70	<20	<20
H 9	10533	Black Ck	flt	grab	hfls w/ 2% po, py, gypsum	<5			<0.2	33	3	51	1	<5	110	<5	392	218	<20	<20
H 9	10534	Black Ck	flt	sel	hfls w/ <3% po, py, lim	<5			<0.2	57	3	48	1	<5	23	<5	456	124	<20	<20
H 9	10591	Black Ck	flt	grab	hfls near intr contact w/ py, cpy	<5			<0.2	406	3	55	1	<5	1198	<5	338	81	<20	<20
H 9	10592	Black Ck	otc	sel	hfls w/ 1-2 % py, po	<5			<0.2	97	7	104	3	<5	10	<5	673	353	<20	<20
H 9	10593	Black Ck	rub	grab	hfls w/ diss and stringer po	<5			<0.2	81	10	81	5	<5	82	6	500	318	<20	<20
H 9	10594	Black Ck	flt	grab	dioritic intr w/ 1 % po, lim	<5			<0.2	40	11	84	2	<5	18	<5	602	222	<20	<20
H 9	10595	Black Ck	flt	grab	felsic volc(?) w/ diss py, fine hbl	<5			<0.2	5	9	17	<1	<5	181	<5	102	93	<20	<20
H 9	10596	Black Ck	flt	grab	porphyritic andesite w/ po	57			<0.2	88	5	67	2	<5	564	<5	617	384	<20	<20
H 9	10597	Black Ck	flt	grab	hfls breccia w/ <1 % py, lim	69			<0.2	76	10	43	4	<5	2676	<5	366	192	<20	<20
H 9	10604	Black Ck	flt	grab	coarse arkosic ss w/ 10% py	<5			<0.2	161	9	39	3	<5	15	<5	299	86	<20	<20
H 9	10605	Black Ck	flt	sel	hfls w/ qz veins, <5% py	12			3.3	2121	8	31	10	473	20	7	207	124	<20	<20
H 9	10639	Black Ck	flt	sel	qz vlet w/ 10 % py, cpy	21			3.3	1485	5	49	3	<5	<5	<5	404	323	<20	<20
H 9	10952	Black Ck	flt	sel	blk hfls w/ py	1			<0.2	152	8	62	2	<5	108	<5	562	255	<20	<20
H 9	10957	Black Ck	tail	sel	gray hfls w/ 1% po, tr cpy	2			<0.2	92	<2	32	2	<5	27	<5	411	240	<20	<20
H 9	10958	Black Ck	flt	sel	diorite(?) w/ 5% po, lim	5			<0.2	343	<2	39	2	<5	42	<5	728	60	<20	<20
H 9	10959	Black Ck	flt	sel	hfls mdst w/ 2% po	4			0.2	363	<2	51	3	<5	595	<5	691	70	<20	<20
H 9	10961	Black Ck	flt	sel	hfls mdst w/ py & po	8			0.3	189	<2	43	2	<5	60	<5	521	46	<20	40
H 9	10962	Black Ck	rub	sel	hfls mdst, gwy breccia w/ 3% py	<1			<0.2	196	<2	16	2	<5	8	<5	245	62	<20	<20
H 9	10963	Black Ck	rub	sel	latitic dike w/ po(?), bio, qz, feld	<1			<0.2	10	4	23	3	<5	6	<5	246	308	<20	<20
H 9	10964	Black Ck	rub	ran	aplite w/ green mineral (ch ?)	42			<0.2	8	7	19	<1	<5	537	<5	117	80	<20	<20
H 9	10967	Black Ck	flt	sel	brn hfls w/ xcut qz, diss po	6			0.2	120	<2	37	<1	<5	223	<5	413	293	<20	<20
H 9	10968	Black Ck	rub	sel	blk hfls w/ diss po(?)	<1			<0.2	38	<2	46	2	<5	40	<5	455	409	<20	<20
H 9	10971	Black Ck	flt	ran	dark gray hfls w/ 1% po, lim	4			<0.2	77	4	98	8	<5	1311	<5	553	120	<20	<20
H 9	10972	Black Ck soil line		soil		323			<0.2	79	7	72	2	<5	49	<5	326	183	<20	<20
H 9	10973	Black Ck soil line		soil		41			<0.2	111	4	63	2	<5	27	<5	604	273	<20	<20
H 9	10974	Black Ck soil line		soil		38			<0.2	104	4	61	2	<5	26	<5	543	242	<20	<20
H 9	10975	Black Ck soil line		soil		15			<0.2	77	4	55	3	<5	22	<5	432	187	<20	<20
H 9	10976	Black Ck soil line		soil		8			<0.2	32	4	73	1	<5	<5	<5	219	85	<20	<20
H 9	10977	Black Ck soil line		soil		10			0.3	34	4	42	2	<5	6	<5	100	199	<20	<20
H 9	10978	Black Ck soil line		soil		7			<0.2	47	5	47	2	<5	10	<5	104	124	<20	<20
H 9	10979	Black Ck soil line		soil		8			0.2	41	7	54	3	<5	16	<5	253	185	<20	<20

Table E-1. Selected results from samples collected in the Hughes quadrangle.

Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Pt ppb	Pd ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	Bi ppm	As ppm	Sb ppm	Mn ppm	Ba ppm	Sn ppm	W ppm
H 9	10980	Black Ck soil line		soil		7			<0.2	25	5	25	1	<5	8	<5	58	113	<20	<20
H 9	10981	Black Ck soil line		soil		6			<0.2	132	6	55	2	<5	14	<5	207	197	<20	<20
H 9	10982	Black Ck soil line		soil		7			<0.2	35	7	70	1	<5	85	<5	351	179	<20	<20
H 9	10983	Black Ck soil line		soil		9			0.2	13	6	59	1	<5	31	<5	204	106	<20	<20
H 9	10984	Black Ck soil line		soil		9			0.2	9	3	32	<1	<5	10	<5	48	68	<20	<20
H 9	10985	Black Ck soil line		soil		5			<0.2	62	7	54	3	<5	33	<5	307	88	<20	<20
H 9	10986	Black Ck soil line		soil		10			<0.2	141	9	76	3	<5	58	<5	414	117	<20	<20
H 9	10990	Black Ck	rub	ran	porphyritic andesite	9			<0.2	7	3	38	2	<5	169	<5	464	178	<20	<20
H 9	10991	Black Ck	flt	sel	qz-feldspar breccia	3			<0.2	48	8	34	3	<5	151	<5	503	64	<20	<20
H 9	10992	Black Ck	flt	ran	felsic dike w/ tr po (?), lim	<1			<0.2	27	3	48	2	<5	12	<5	781	178	<20	<20
H 9	10993	Black Ck	flt	sel	dark gry hfls w/ 1-2% diss py	<1			<0.2	72	<2	29	2	<5	9	<5	459	224	<20	<20
H 9	10994	Black Ck	flt	sel	brecciated hfls w/ 1% cpy	31			2.3	1442	<2	43	3	<5	5	<5	435	242	<20	<20
H 9	10995	Black Ck	rub	sel	brecciated hfls w/ 1% cpy	16			2.4	1661	<2	46	2	<5	6	<5	423	219	<20	<20
H 9	10996	Black Ck	flt	sel	gwy w/ <1% diss py	6			<0.2	157	<2	40	1	<5	5	<5	713	107	<20	<20
H 9	10997	Black Ck	flt	sel	dark gray hfls w/ 1% diss po	<1			<0.2	38	<2	71	1	<5	5	<5	1104	209	<20	<20
H 9	10998	Black Ck	flt	sel	hfls w/ 1% po, xcut qz, lim	1			<0.2	40	2	84	2	<5	<5	<5	986	132	<20	<20
H 9	11001	Black Ck	rub	sel	hfls w/ 1% diss cpy, lim, MnO	1			<0.2	164	14	45	<1	<5	10	<5	312	86	<20	<20
H 9	11002	Black Ck	flt	sel	gwy w/ diss cpy, lim, MnO	611			6.4	3912	7	84	3	<5	50	<5	639	31	<20	<20
H 9	11003	Black Ck	rub	rep	gwy w/ diss cpy, lim, MnO	10			<0.2	242	4	48	4	<5	11	<5	322	79	<20	<20
H 9	11004	Black Ck	flt	sel	hfls w/ 5% cpy, lim, MnO	4			<0.2	129	<2	29	3	<5	5	<5	232	51	<20	<20
H 9	11005	Black Ck	rub	sel	hypabyssal dike w/ 2% cpy	16			0.8	888	3	15	9	<5	9	<5	152	56	<20	<20
H 9	11006	Black Ck	flt	sel	hfls w/ cpy, lim, MnO	9			0.5	1336	<2	38	5	<5	111	<5	597	322	<20	<20
H 9	11021	Black Ck	flt	sel	hfls w/ tr po, py	2			<0.2	48	3	48	2	<5	24	<5	453	141	<20	<20
H 9	11023	Black Ck	flt	sel	blk hfls w/ cpy	2			<0.2	98	7	39	4	<5	71	<5	559	64	<20	<20
H 9	11024	Black Ck	flt	sel	hfls w/ diss cpy(?)	2			<0.2	89	<2	32	1	<5	15	<5	465	138	<20	<20
H 9	11025	Black Ck	flt	sel	gwy w/ diss cpy	<1			<0.2	14	2	34	3	<5	6	<5	510	180	<20	<20
H 9	11026	Black Ck	flt	sel	qz-hfls breccia w/ no sulfides	<1			<0.2	24	2	38	1	<5	59	5	392	182	<20	<20
H 9	11027	Black Ck	rub	sel	hfls w/ 1% diss cpy	4			<0.2	37	<2	56	1	<5	254	<5	621	419	<20	<20
H 9	12146	Black Ck soil line		soil		9			<0.2	38	6	63	1	<5	22	<5	406	147	<20	<20
H 9	12147	Black Ck soil line		soil		11			<0.2	16	9	61	1	<5	21	<5	225	138	<20	<20
H 9	12148	Black Ck soil line		soil		<5			<0.2	16	11	43	2	<5	23	<5	171	157	<20	<20
H 9	12149	Black Ck soil line		soil		26			<0.2	16	6	34	2	<5	18	<5	101	122	<20	<20
H 9	12150	Black Ck soil line		soil		9			<0.2	10	4	29	2	<5	11	<5	60	97	<20	<20
H 9	12178	Black Ck soil line		soil		<5			<0.2	12	3	55	2	<5	14	<5	87	60	<20	<20
H 9	12179	Black Ck soil line		soil		<5			<0.2	7	3	42	2	<5	<5	<5	53	75	<20	<20
H 9	12180	Black Ck soil line		soil		7			<0.2	62	6	68	2	<5	30	<5	494	129	<20	<20
H 9	12181	Black Ck soil line		soil		10			2.0	184	331	93	4	<5	36	<5	352	190	<20	<20

Table E-1. Selected results from samples collected in the Hughes quadrangle.

Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Pt ppb	Pd ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	Bi ppm	As ppm	Sb ppm	Mn ppm	Ba ppm	Sn ppm	W ppm
H 9	12182	Black Ck soil line		soil		9			<0.2	58	8	189	2	<5	129	<5	836	143	<20	<20
H 9	12183	Black Ck soil line		soil		12			<0.2	48	11	79	2	<5	120	<5	435	170	<20	<20
H 9	12184	Black Ck soil line		soil		<5			<0.2	17	7	66	2	<5	54	<5	249	77	<20	<20
H 9	12185	Black Ck	flt	sel	meta gwy w/ finely diss po, ep	6			<0.2	58	5	57	1	<5	139	<5	417	145	<20	<20
H 9	12194	Black Ck	rub	sel	hfls mdst xcut by qz w/ 1% cpy	<5			0.3	1363	3	36	7	<5	7	<5	302	651	<20	<20
H 9	12195	Black Ck	rub	sel	hypabyssal intr w/ <1% po, lim	<5			0.4	428	4	22	1	<5	<5	<5	203	253	<20	<20
H 9	12196	Black Ck	rub	sel	fine-grained intr w/ 2% po, cpy	12			<0.2	231	6	12	<1	<5	13	<5	148	28	<20	<20
H 9	12197	Black Ck	rub	sel	diorite w/ <1% cpy, 2-5% po	717			4.3	4982	8	134	2	<5	12	<5	252	119	<20	<20
H 9	12198	Black Ck	rub	sel	diorite xcut by qz w/ py, po, box	10			<0.2	89	<2	38	2	<5	30	<5	301	224	<20	<20
H 9	12199	Black Ck	rub	rand	fine-grained diorite w/ 2% py, po	34			0.5	389	10	38	5	<5	26	<5	358	193	<20	<20
H 9	12200	Black Ck	otc	rand	hfls, fine-grain diorite w/ 3% po	11			0.4	339	4	58	2	<5	16	<5	785	50	<20	<20
H 9	12201	Black Ck	rub	sel	hfls w/ 2-5% py, abu lim	13			0.5	214	64	255	<1	<5	17	<5	77	114	<20	<20
H 9	12202	Black Ck	rub	sel	arkosic gwy w/ <1% po, tr cpy	11			0.3	259	8	50	5	<5	26	<5	547	103	<20	<20
H 9	12203	Black Ck	rub	sel	diorite w/ 1-2% po	19			0.3	251	3	33	2	<5	55	<5	380	29	<20	<20
H 9	12204	Indian R, upper	otc	sel	granite w/ ep, K-feld vlets	13			<0.2	5	<2	24	<1	<5	6	<5	252	210	<20	<20
H 9	12205	Indian R, upper trib		pan	1 coarse Au, abu mag	<5	<5	<1	<0.2	13	13	46	22	<5	13	<5	777	104	<20	106
H 9	12206	Indian R, upper trib		sed		8			<0.2	7	4	37	2	<5	<5	<5	401	199	<20	<20
H 9	12207	Black Ck soil line		soil		9			<0.2	13	5	42	2	<5	57	<5	169	76	<20	<20
H 9	12208	Black Ck soil line		soil		9			<0.2	56	9	125	2	<5	200	<5	768	215	<20	<20
H 9	12209	Black Ck soil line		soil		15			<0.2	49	13	106	2	<5	198	<5	769	218	<20	<20
H 9	12210	Black Ck soil line		soil		32			0.3	118	13	151	<1	<5	69	<5	870	239	<20	<20
H 9	12211	Black Ck soil line		soil		<5			<0.2	36	11	102	2	<5	87	<5	622	117	<20	<20
H 9	12212	Black Ck soil line		soil		15			<0.2	61	9	181	1	<5	225	<5	650	146	<20	<20
H 9	12213	Black Ck soil line		soil		23			<0.2	92	17	106	2	<5	948	<5	527	186	<20	<20
H 9	12214	Black Ck soil line		soil		6			<0.2	27	10	66	2	<5	229	<5	404	81	<20	<20
H 9	12215	Black Ck soil line		soil		30			<0.2	33	5	54	1	<5	163	<5	315	172	<20	<20
H 9	12216	Black Ck soil line		soil		<5			<0.2	28	6	70	2	<5	98	<5	734	231	<20	<20
H 9	12217	Black Ck soil line		soil		16			<0.2	50	8	85	1	<5	570	<5	552	231	<20	<20
H 9	12218	Black Ck soil line		soil		7			<0.2	66	6	196	3	<5	247	<5	426	224	<20	<20
H 9	12219	Black Ck soil line		soil		6			<0.2	23	7	69	2	<5	113	<5	462	101	<20	<20
H 9	12228	Black Ck soil line		soil		7			<0.2	28	7	80	4	<5	163	<5	376	113	<20	<20
H 9	12229	Black Ck soil line		soil		7			<0.2	21	4	92	2	<5	86	<5	456	125	<20	<20
H 9	12230	Black Ck soil line		soil		19			<0.2	20	5	64	2	<5	108	<5	315	143	<20	<20
H 10	10507	Indian R	flt	sel	andesite w/ lim, MnO	<5			<0.2	33	3	45	1	<5	6	<5	546	83	<20	<20
H 10	10546	Indian R	flt	grab	andesite w/ qz vlets, ep, lim	<5			<0.2	38	6	38	1	<5	5	<5	546	38	<20	<20
H 10	10632	Indian R	flt	sel	andesite brecc w/ lim	<5			<0.2	30	7	48	1	<5	8	<5	565	37	<20	<20
H 10	12226	Indian R, upper trib		plac	3 fine, 10 v fine Au; mag, sch, Zr	0.001 oz/cyd	<5	1	<0.2	<1	23	53	13	<5	<5	<5	796	128	<20	152

Table E-1. Selected results from samples collected in the Hughes quadrangle.

Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Pt ppb	Pd ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	Bi ppm	As ppm	Sb ppm	Mn ppm	Ba ppm	Sn ppm	W ppm
H 10	10948	Indian R	flt	sel	andesite w/ lim	16			0.2	36	508	396	1	<5	27	<5	514	357	<20	<20
H 10	10949	Indian R	flt	sel	vuggy, lim rock	13			0.5	46	737	218	<1	<5	6	<5	684	728	<20	<20
H 10	12186	Indian R, West trib	flt	sel	felsic intr w/ box, abu lim	80			1.7	77	901	203	1	<5	73	<5	326	194	<20	<20
H 10	12187	Indian R, West trib	flt	sel	med-grained felsic intr w/ box	60			0.7	33	284	136	<1	<5	33	<5	191	150	<20	<20
H 10	12220	Indian R, upper		pan	1 fine, 2 v fine Au; abu mag	27.41 ppm	<5	<1	2.6	13	31	22	13	<5	<5	<5	303	132	<20	32
H 10	12221	Indian R, upper		sed		<5			<0.2	31	6	43	4	<5	<5	<5	417	286	<20	<20
H 10	12222	Indian R, upper		pan	1 v fine Au, abu mag	92	<5	2	<0.2	15	29	43	13	<5	7	<5	545	185	<20	26
H 10	12223	Indian R, upper	otc	rand	qz monzonite xcut by qz w/ ba	27			<0.2	188	5	27	4	<5	<5	<5	209	350	<20	<20
H 10	12224	Indian R		pan	minor mag	20	<5	1	<0.2	43	11	56	2	<5	6	<5	645	186	<20	<20
H 10	12225	Indian R		sed		<5			<0.2	43	9	71	<1	<5	6	<5	591	247	<20	<20
H 10	12234	Indian R	otc	rand	andesite	21			<0.2	81	3	70	2	<5	<5	<5	910	111	<20	<20
H 10	12235	Indian R		pan		16	<5	<1	<0.2	54	11	62	2	<5	6	<5	599	163	<20	<20
H 11	10588	Indian R, upper		plac	1 fine and 20 v fine Au	24.32 ppm			<0.2	48	13	48	225	<5	24	<5	655	95	<20	1127
H 12	10618	Pocahontus Ck		pan	3 pan comp, mod mag	23			<0.2	4	15	47	2	<5	18	<5	530	29	<20	<20
H 12	12266	Pocahontus Ck		pan	mod mag, no vis Au	10	<5	<1	<0.2	20	14	18	4	<5	10	<5	263	132	<20	<20
H 13	10506	Indian R	flt	sel	andesite	<5			<0.2	50	<2	63	<1	<5	<5	<5	632	109	<20	<20
H 13	10543	Indian R	flt	grab	andesite w/ mag, qz, lim	<5			<0.2	76	5	64	<1	<5	8	<5	590	158	<20	<20
H 13	10544	Indian R	flt	grab	andesite w/ mag, qz, ep, lim	<5			<0.2	61	4	58	1	<5	<5	<5	422	23	<20	<20
H 13	10545	Indian R	flt	grab	andesite w/ lim, ep (?)	<5			<0.2	30	7	58	1	<5	<5	<5	732	81	<20	<20
H 13	10630	Indian R	flt	sel	vuggy andesite w/ qz vlets, lim	<5			<0.2	74	3	55	2	<5	9	<5	786	214	<20	<20
H 13	10631	Indian R	flt	sel	andesite/ andesite breccia w/ lim	<5			<0.2	16	3	34	1	<5	7	<5	631	47	<20	<20
H 13	10633	Indian R	flt	sel	felsic intr w/ py, gray metallic(?)	8290			11.5	794	1771	998	2	<5	27	<5	49	161	<20	<20
H 13	10634	Indian R		pan	no vis Au, no mag	<5			<0.2	30	18	66	<1	<5	9	<5	571	106	<20	<20
H 13	10635	Indian R		sed		<5			<0.2	33	11	80	<1	<5	7	<5	496	223	<20	<20
H 13	10947	Indian R	flt	sel	green andesite w/ qz vein	<1			<0.2	58	3	26	2	<5	<5	<5	364	35	<20	<20
H 13	12156	Indian R, West trib	otc	sel	rusty, vuggy intr w/ py box	31			0.9	40	37	102	1	<5	17	<5	256	1324	<20	<20
H 13	12157	Indian R, West trib	otc	sel	silic intr w/ box, abu lim	87			1.4	269	1765	486	2	<5	18	<5	538	903	<20	<20
H 13	12158	Indian R, West trib	otc	sel	clay-altered intrusive w/ lim	12			2.3	54	15	85	1	<5	<5	<5	106	106	<20	<20
H 13	12159	Indian R, West trib		pan	tr mag, no vis Au	15	<5	<1	0.4	41	97	235	3	<5	12	<5	1866	836	<20	<20
H 13	12160	Indian Mtns, Peak 3415	rub	sel	andesite w/ 5% diss mag, lim	10			0.2	32	10	84	2	<5	23	<5	712	112	<20	<20
H 13	12188	Indian R, West trib	flt	sel	med-grained felsic intr w/ box	91			9.2	207	1638	316	9	<5	105	<5	132	1948	<20	<20
H 14	10508	Hill 1342	flt	sel	vein qz w/ py, lim, box	30			0.8	15	44	10	74	<5	<5	<5	21	104	<20	<20
H 14	10509	Hill 1342		soil	red-brn soil	28			0.4	158	110	232	<1	<5	17	<5	144	246	<20	<20
H 14	10510	Hill 1342	otc	sel	volc agglomerate w/ lim	10			<0.2	281	<2	207	<1	<5	<5	5	64	86	<20	<20
H 14	10511	Hill 1342	flt	sel	vein qz w/ 5% py, lim, sco(?)	593			21.6	692	221	78	7	7	67	<5	26	16	<20	<20
H 14	12231	Hill 1342	flt	sel	silic rock w/ 3-5% py, abu lim	94			3.5	31	175	52	232	<5	18	<5	22	23	<20	<20
H 14	12232	Hill 1342	flt	sel	silic rock w/ 2% py, abu lim	11			0.3	8	17	10	8	<5	<5	<5	7	94	<20	<20

Table E-1. Selected results from samples collected in the Hughes quadrangle.

Map no.	Field no.	Location	Sample Site	Sample Type	Sample Description	Au ppb	Pt ppb	Pd ppb	Ag ppm	Cu ppm	Pb ppm	Zn ppm	Mo ppm	Bi ppm	As ppm	Sb ppm	Mn ppm	Ba ppm	Sn ppm	W ppm
H 14	12233	Hill 1342	flt	sel	silic rock w/ py, box, abu lim	21.12 ppm			9.4	121	319	46	17	6	14	5	31	439	<20	<20
H 15	10619	Gen Ck		sed		<5			<0.2	23	8	90	<1	<5	7	<5	415	183	<20	<20
H 15	10620	Gen Ck		pan		<5			<0.2	51	22	139	<1	<5	16	<5	1065	179	<20	<20

Photos (clockwise, from upper left corner):

1) The Nolan Creek mining camp in 1909. The Nolan drainage has produced at least 147,000 oz of placer gold (map no. W96). U.S. Geological Survey photo.

2) The results of placer mining by Silverado Gold Mines Ltd. at Nolan Creek in 1994. The largest nugget weighs 7 oz.

3) BLM volunteer Mark Johnson collecting a placer sample at Black Creek (map no. H8).

4) BLM field crew with Nolan Creek miners and their dog during the 2000 field season.

5) Gold nugget weighing 41.35 oz (unofficially the 10th largest in Alaska) recovered by Silverado Gold Mines Ltd. at Nolan Creek.

6) BLM geologist Robert Klieforth examines mafic volcanic rocks with Heart Mountain as a backdrop.

7) BLM volunteer Dan Kurtak on Twelvemile Mountain along the Middle Fork Koyukuk River.