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INTRODUCTION

Discovery of the Port Valdez Area

The earliest known printed reference to the Port Valdez area is by Captain James A. Cook, who while on one of his voyages to the Pacific Ocean, partially explored Prince William Sound. While anchored near Bligh Island in May of 1778, Cook sent out two boat parties. One of the parties, under the direction of Gore and Roberts, examined and mapped an arm of Prince William Sound to the north (Valdez Arm and Port Valdez). Twelve years later in 1790, Don Salvador Fidalgo in the "Filipino" visited Port Chalmers on Montague Island. Fidalgo sent out a boat party to the north under the charge of Joseph Whidbey to examine and map the north and west shores of Prince William Sound. Whidbey entered Puerto de Valdez in June, 1794, and made the first map of the inner part of the fjord. No published data are available regarding visits by explorers to the Port Valdez area between 1794 and 1884, although it was rumored that both natives and Russian traders traversed the Chugach Mountains between Port Valdez and the Copper River basin during this time. Rumors of rich gold fields and other natural resources in the Upper Yukon River area and interior of Alaska prompted the United States War Department to send expeditions to gather all general and economic information and to find, if possible, a route from tidewater to the gold districts. In the summer of 1884, the War Department sent an expedition under the command of Lt. W.R. Abercrombie to search for a route across the Chugach Mountains. In September a hurried reconnaissance trip from Port Valdez to the pass occupied by the Corbin Glacier was made. In 1885 another expedition was organized and Lt. H.T. Allen made a reconnaissance trip into the Copper River basin from Port Valdez by way of the Valdez Glacier.

Gold Rush Era

In 1894, news of the rich gold fields in the Yukon Territory started the Klondike Gold Rush. Thousands of gold prospectors headed north with their pack animals (horses, mules, and dogs) and outfits, which consisted of one- to three-year grubstakes. Most of these prospectors traveled by ocean steamship to Skagway and Dyea, the start of the Chilkoot Trail, but some remained on board and continued on to Port Valdez, where they would start their journey to the gold fields of the Copper River region. Auriferous gravels were discovered in the Port Valdez area in 1894 and the first placer claims staked in 1896. In the spring of 1898 three military expeditions were organized to explore the interior of Alaska. The second expedition under the command of Capt. W.R. Abercrombie started at Valdez. F.C. Schrader of the U.S. Geological Survey (USGS) was attached to this expedition as geologist and made the first geological studies of the Port Valdez area (Schrader, 1900). The expedition and a great number of prospectors arrived at Port Valdez on April 19, 1898. With 6 ft of snow on the ground in Valdez, many of the less stout-hearted prospectors decided not to continue and began to dispose of their outfits. Valdez at this time consisted of hundreds of prospectors who had been arriving since February. They stayed in dozens of tents pitched on snow and some half dozen log cabins with a few rough lumber shanties located near a large cottonwood grove. The town was then called Copper City, but at a town meeting a few months later the people decided the place should be called Valdez. Schrader and some of the military expedition made a quick reconnaissance trip to the head of the Valdez Glacier several weeks after their arrival in order to give the many prospectors in Valdez an idea of what they would be up against. The reconnaissance found 300 prospectors camped near the base of the Valdez Glacier and another 500 to 700 prospectors camped on the glacier along the trail between the base and head of the glacier. Between February and July of 1898 it was estimated that 3,000 prospectors entered the Copper River basin via the Valdez and Klutina Glacier routes, known as the "great gateway to the Copper".

Port Valdez Gold Rush Era

During the Klondike gold rush thousands of prospectors made the mad rush over the Valdez Glacier in search of new gold fields in the interior of Alaska. Upon arriving at Port Valdez, most of these prospectors passed in site of the iron-stained quartz-vein outcrops on the north shore of Port Valdez. Twelve years later this area was developed as the Cliff Mine. Streams entering Port Valdez were also known as early as 1894 to contain auriferous gravels. Some of these streams were even being mined in a small way. In spite of these placer-gold showings and quartz veins, most of the prospectors passed up prospecting the Port Valdez area in hopes of finding richer ground in the interior. The few prospectors who remained behind continued to prospect the Port Valdez area and some of them staked quartz veins shortly after 1898. Most of the claims remained undeveloped until it was definitely proven that there were workable gold quartz veins in the area by the start up of the Cliff Mine in 1910. The Cliff Mine proved very profitable and its success greatly stimulated prospecting by local miners and newcomers to the Port Valdez area. As a result, several hundred lode claims were staked and considerable development work was undertaken from 1910 to World War II.

LODE GOLD-SILVER QUARTZ VEIN DEPOSITS

Host Rock

Gold deposits of the Port Valdez area are located within rocks of the Valdez Group. In this area, Valdez Group rocks consist of slate, argillite, and graywacke, with minor greenstone, conglomerate, and limestone. Schrader (1900) named this group of rocks. The Valdez Group is part of a large accretionary wedge which extends from southeastern Alaska, around Prince William Sound to Kodiak Island. Deposition of the Valdez Group is considered to have been along a continental-slope, submarine-fan and trench environment, which bordered a volcanic island arc system. Deposition of sediments included turbidites, thick beds of siltstone, quartzo-feldspathic sandstone, minor conglomerate, limestone, and chert. These sediments were interbedded with basalt flows and basaltic tuffs. The above sedimentary facies and volcanic rocks were intensely deformed and metamorphosed during accretion. Deformation resulted in intense folding and faulting. The dominant folds trend east-west and are overturned toward the south. Bedding attitudes show consistent moderate to steep northward dips. Foliation generally parallels bedding but has steeper dips (see Updike and Ulery, this volume.)

Vein Deposits

The principal gold deposits of the Port Valdez area occur as fissure veins in fractures, faults, and shear zones along the axes and upper limbs of the overturned anticlinal folds. The veins strike northwest and commonly occur in fractures which crosscut and offset the metamorphic and structural grain. In the Mineral Creek and Valdez Glacier areas two well-defined fissure systems strike N30°-50°W and N70°W to east-west. The fractures that the veins occupy have 3 to 10 ft of right lateral movement that occurred before veining. These veins are commonly offset by or terminate at left lateral bedding/foliation shears. Mineralization is also occasionally found in shear zones along bedding planes. Offset along these shears is approximately 30 to 40 ft at the Hercules Mine. The mineralized vein at the Hercules occurs along the bedding/foliation shear and measurements on mullion structures along the footwall indicate that movement was dominantly strike-slip. Not all fissures are mineralized, and within an individual fissure, quartz veining and mineralization are not continuous along strike or dip. Brecciation of the host rock and slickensiding often accompany the fissuring, and rock fragments often make up a large portion of the vein material. Within the Valdez Group rocks, occurrence and grade of mineralization appear to be unrelated to host rock lithology. The veins are most common in the more disturbed and sheared rock and are not generally found in the less disturbed areas.

Three episodes or periods of quartz veining have occurred in the Port Valdez area. The earliest or oldest veins are usually less than 4 in. thick, irregular, and principally parallel to the regional cleavage. These cleavage-localized and bedding-plane quartz veins were formed as a result of metamorphic

segregation. Silica was generally the most mobile rock-forming constituent during metamorphism. In the Port Valdez area, the metamorphic quartz is white, fine-grained, and tightly frozen to the host rock. Calcite, a common vein constituent, was also deposited with the quartz. Pyrite, the only sulfide mineral observed, is uncommon and found only along the edges of veins and in altered wall rock. These veins are discontinuous and commonly pinch and swell, and are most abundant in the more schistose argillite and slates, and almost absent in the massive graywackes. The youngest (latest) quartz veins occur as thin drusy coatings and filling along late-stage joints. These joints cut and commonly offset the metamorphic and mineralized veins.

Between the oldest and youngest episodes of quartz veining was a period of quartz veining containing gold and silver mineralization. These veins range from several inches to over several feet wide, are discontinuous, podiform, and most frequently occur in joints and faults which crosscut and offset the metamorphic-segregation veins and regional cleavage. These veins are also found in shear zones along bedding planes. These veins are post metamorphic, and are localized along joints and faults which dilated during relaxation of compressive forces and uplift. The veins sometimes have sharp walls, but usually the walls are shattered and sheared due to syn-and-post mineralization movement. The veins commonly contain pulverized fragments of host rock which are cemented in quartz, thus forming an irregular vein network.

The mineralized veins are coarse-grained, vuggy, iron-stained, and consist primarily of quartz, chloritized wall-rock inclusions, calcite, ankerite, albite, oligoclase, zoisite, and chlorite. The veins exhibit well-developed ribbon-and-comb structures. Pyrite is found throughout the veins, but is most commonly associated with wall rock inclusions. Galena, chalcopyrite, arsenopyrite, sphalerite, pyrrhotite, stibnite, and free gold alloyed with silver are found in association with late stage quartz, in microfractures, and in open limonite-stained cavities within weathered portions of the quartz veins. Sometimes the gold is found in intergrowths with the other metallic sulfide minerals. The gold fineness ranges from 465 to 831. The gold quartz ores are free milling when crushed sufficiently. The metallic minerals generally comprise less than three percent of the ore. Mineralization within the veins is discontinuous both along strike and dip, and usually occurs in narrow, steeply-dipping, pipe-like shoots. Distribution of the shoots within the fissures and veins is highly irregular. Impregnation of pyrite and arsenopyrite in the wall rock adjacent to the veins is found in a few places. Other than this, wall-rock alteration is generally absent, indicating that the mineralized veins formed at a temperature within the range of stability of the metamorphic host rocks.

Genesis of Gold Deposits

Stable-isotope and fluid-inclusion studies of mineralized quartz veins in the Port Valdez area by Pickthorn (1982) indicate that the gold deposits are principally of metamorphic origin. The average trace content of gold in the Valdez Group is 0.004 ppm or 0.0000004 percent. During metamorphism, the gold, along with other vein constituents (silica, sulfur, carbon, base metals) can be mobilized through diffusion and/or mass transfer and deposited in suitable structural or chemical traps. In diffusion, the migration of mineral matter is slow and covers only short distances, while in mass transfer, the constituents are transported in a liquid or gas medium over longer distances in less time. Following metamorphism of the Valdez Group sediments, uplift and dilation of the rocks allowed metamorphic waters to circulate deeply along fractures and faults. Hydrothermal convection cells probably began to form because of the latent heat remaining in the metamorphosed sediments. The ore constituents were leached from the metamorphosed sediments and deposited as fissure veins.

MINES AND PROSPECTS IN THE MINERAL CREEK AND VALDEZ GLACIER AREAS

Gold-bearing quartz veins were first staked in the Mineral Creek area in 1910 (Williams-Gentzler property). A staking rush occurred afterwards and in 1911 there were 118 claims and claim groups in the area. A.H. Brooks (1912) of the USGS visited the area in 1911 and described most of the mineral deposits. The last definitive description of the mineral deposits in the area is from USGS work between

1914 and 1918 (Johnson, 1915; Johnson, 1918). Most of the later reports by USGS and Territory of Alaska personnel have been limited to specific mineral properties. Recently the USGS and U.S. Bureau of Mines (BOM) from 1980-82 studied some of the mineral deposits in the area to assess their economic potential and mode of origin (Fechner and Meyer, 1984; Goldfarb and others, 1986; Jansons and others, 1984; Nelson and others, 1984, and Pickthorn, 1982). These studies were part of the USGS RARE II program (Roadless Area Review Evaluation).

Identification of mineral properties in the Mineral Creek area is hampered by snow, which lasts into August; thick brush in lower elevations; and lack of definitive data since 1931. The following properties are those for which data and accurate locations are available. They were identified using old claim maps, prospect maps, and USGS bulletins. The following is a discussion of geology, workings, production history, and identified resources. Prospect locations are shown on Plate 1.

Ibex Prospect

The Ibex prospect is located on the west side of Valdez Glacier at approximately 2500 ft elevation. It is situated approximately 0.5 mi northwest of the Valdez Mining Company prospect. The prospect was located in 1910. No data is available on the property after 1911 (Brooks, 1912). A 200-ft-long adit is present on the property. The country rock at the prospect consists of interbedded Valdez Group schistose graywackes and slates which strike $N75^{\circ}W$ and dip $75^{\circ}NW$. A 4-ft-wide banded-quartz vein, which strikes $N50^{\circ}W$ and dips north, contains pyrite and galena. The vein is reported to average 1 ounce per short ton (oz/st) gold. It is exposed in the adit for the first 100 ft (Brooks, 1912). The vein is believed to be the extension of the vein on the Valdez Mining Company property.

Valdez Mining Company (Donohue) Prospect

The Valdez Mining Company prospect is located on the west side of Valdez Glacier approximately 8 mi from tidewater at 2700 ft elevation. Two adits are present: one at 2600 ft and the other at 2850 ft elevation. The property was located and staked in 1910. In 1913, the Valdez Mining Company's principal officers were Samuel Bloom, Mr. Donahaugh, Mr. Ostrander, and Frank Kerman. Development work was performed from 1911 to 1920. T.H. Donahue and associates acquired the property from the Valdez Mining Company (Shepard, 1926). Assessment work was recorded in 1926 and 1931. The property was restaked in 1982.

The country rock at the prospect consists of interbedded graywackes and argillites. The bedding and schistosity strike $N83^{\circ}$ to $89^{\circ}W$ and dip 75° to $85^{\circ}N$. The upper adit cuts a 3- to 10.5-ft-wide quartz vein that strikes $N40^{\circ}$ to $80^{\circ}W$ and dips 65° to $80^{\circ}SW$. The vein is exposed for approximately 100 ft in the upper adit. The vein is made up of both massive white and ribbon quartz. Well developed quartz crystals are also present. Free gold, galena, and pyrite were noted on the margins of the vein. Gold values are highest in the upper adit, with sample results from 0.003 to 2.15 oz/st gold. The BOM estimated that there are identified resources of 2500 st, which average 0.42 oz/st gold and 0.11 oz/st silver. The lower adit is approximately 400 ft long. The adit follows, for approximately 300 ft, a quartz vein that is 10 in. wide, strikes $N45^{\circ}W$, and dips $68^{\circ}NE$. The workings did not intersect the vein exposed in the upper adit. No gold was noted in the lower adit. Grab samples from the quartz on the property contain up to 100 oz/st gold. Ore samples yielded fineness values of 465 gold and 535 silver.

Valdez Bonanza Prospect

The Valdez Bonanza prospect is located on the divide between Mineral Creek and Valdez Glacier at approximately 4,350 ft elevation. A.H. Brooks (1912) was the last recorded visitor to the property. The prospect consists of a 2- to 5-ft-wide, 50-ft-long quartz vein, which is exposed on the surface. The vein strikes east-west to $N75^{\circ}E$. The vein is parallel to the cleavage of the slate country rock. Minor gold and pyrite are present in the quartz. A 100-ft-long adit was driven along the vein. The vein is 2 to 24 in. wide in the adit and pinches out after 50 ft. Another vein is exposed in a crosscut.

Blue Ribbon Prospect

The Blue Ribbon Prospect is located near the head of East Fork Creek, an east tributary to Mineral Creek, at 3,200 ft elevation. Otto Erickson and Otto Parks staked the prospect. A.H. Brooks (1912) visited and described the property in 1911 and development work was reported in 1913. The prospect contains a quartz vein up to 14 in. wide striking east-west that can be traced for 1000 ft. The vein is parallel to the foliation of the slates. The west end of the vein appears to be pinched out, but the fissure is continuous. The vein at its widest point contains 8 in. of ribbon quartz, which in turn contains considerable amounts of free gold, and 4 to 6 in. of white quartz, which carries pyrite but no free gold.

Ethel, Cash, Williams-Gentzler, Fine Chance Prospect

This prospect is located on the east side of Mineral Creek between East Fork and Glacier Creek at 3,800 ft elevation. The prospect was located in 1910. This was the first property to bring recognition to the Mineral Creek valley because of the high-grade gold-bearing vein material. The prospect was originally located by the Reinken brothers and later was known as the Williams and Gentzler prospect. In 1914, an arrastre mill, with a capacity of 2 tons per 24 hr, was installed. By 1915, the underground developments consisted of an upper adit and two crosscut adits. The Ethel Mining Company took over the Williams-Gentzler claim group in 1926. William Quitsch owned the prospect, known as the Fine Chance lode in 1955.

Johnson (1915) described the property. The upper adit is 30 ft long and stoped to the surface. One crosscut adit consists of 25 ft of crosscut, then 30 ft of drift along the vein. The adit also has a winze and a stope was started to connect the crosscut adit with the upper adit. A 45-ft-long crosscut adit was located west of the other adits. The country rock at the property is vertically dipping slates and graywackes striking $N75^{\circ}E$. The main quartz vein is 1 to 20 in. wide, strikes $N60^{\circ}$ to $70^{\circ}W$, and dips $65^{\circ}N$ to vertical. Minerals in the vein include pyrite, chalcopyrite, gold, pyrrhotite, sphalerite, galena, limonite, and malachite. An examination by the BOM in 1980 found an adit with 240 ft of workings. A grab sample from a quartz vein contained 0.24 oz/st gold and 6.8 oz/st silver. There is no recorded production or reserve figures for the property. Work on the property was reported until 1955.

Little Giant Mine Group

The Little Giant Mine group is a conglomeration of many properties located in the same area of Mineral Creek: The Mountain King, July, Rose, Rose Quartz, Star, Quitsch, Giant Nos. 1-3, Independent, Missing Link, and Eldorado. The group is located at the foot of the glacier in Glacier Creek, an eastern tributary of Mineral Creek at approximately 3,000 ft elevation.

Claims were staked in 1911. Production was in 1914, 1917, 1929-34, 1937, 1939, 1948, and 1955. Three hundred thirteen tons were mined, with 367 oz of gold and 152 oz of silver recovered. Pilgrim (1930) was the last person to fully describe the Little Giant, Rose, and Eldorado properties. The Little Giant Mine workings consist of a short open cut and three adits. The open cut is along a 1- to 12-in.-wide quartz vein striking $N82^{\circ}W$ and dipping $66^{\circ}N$. The vein parallels the cleavage of the slates. The vein contains pyrite, pyrrhotite, sphalerite, galena, and gold. A crosscut adit is present 100 ft higher than the open cut. Lenses of quartz over 40 ft wide and 1 in. to 3 ft thick are present. A grab sample taken at the Little Giant Mine site by BOM contained 0.36 oz/st gold and 1.4 oz/st silver. Approximately 2,500 ft west of these workings, at 1,790 ft elevation, a 290-ft-long adit is present. A 1.5- to 2-ft-wide quartz vein is cut in the adit. The quartz contains minor pyrite. Approximately 1,180 ft west of the portal of this adit and at an elevation of 926 ft, a 220-ft-long adit is present. The country rock is slate, whose cleavage strikes east-west and dips vertical. Many quartz veins that parallel the cleavage of the slate and cross the cleavage are present in the adit.

The Rose vein lies about 750 ft south of the Little Giant on the south side of Glacier Creek. The country rock is an east-west striking, nearly vertical-dipping graywacke. The vein on the surface strikes

N85°E and dips 73°N. Three adits are on the property. One adit at 2,500 ft elevation trends S5°E for 180 ft until the vein is cut, then a drift follows vein for 100 ft east and 40 ft west. A 30-ft-high stope is present on the east drift. The vein in this adit is 6 to 18 in. wide, strikes N78°E and dips 76°NW. Pyrite and small amounts of galena are present. The second adit is 200 ft higher in elevation and is 50 ft long. It trends the same as the first adit, but did not hit the vein. The third adit is 75 ft above the second and driven 30 ft below the surface outcrop of the vein. The adit is 42 ft long. The vein is 0.5 to 1.5 ft wide and carries free gold. The vein was said to have carried an average of 1.5 oz/st gold (Pilgrim, 1930).

The Eldorado vein lies about 2,000 ft north of the Little Giant vein. This is the old Mountain King property. Four adits are present. The upper adit, at an elevation of 3,070 ft, intersects a vein after 10 ft. The vein is 12 to 16 in. wide, strikes N80°W and dips steeply to the northeast. The country rock is graywacke. The adit is caved. The second adit is 40 ft lower in elevation, is driven N50°E and intersects the vein 72 ft from the portal. A drift follows the vein for 80 ft to the east and 40 ft to the west. A stope to the first adit is present. Pyrite, galena, chalcopyrite, sphalerite, and free gold are present in the vein. The third adit is located 40 ft below the second adit. The adit trends N2°E and intersects the vein 98 ft from the portal. The vein strikes N82° to 88°E. A drift follows the vein 33 ft to the east and 133 ft to the west. The BOM examined the Mountain King property in 1980. This adit was probably examined. A 65-ft-long north-south trending crosscut with approximately 100 ft of easterly trending drift was found at 3,000 ft elevation. A 1.5-ft-wide, N80°W trending, 55°SE dipping vein was in the drift. A sample from the vein contained 1.35 oz/st gold and 5.8 oz/st silver. The fourth adit is located 115 ft below the third adit. The adit trends N27°E and is 220 ft long. The adit did not intersect the vein.

Ore from the upper workings of the Little Giant and Rose Properties was processed on site by an Ellis Mill with 4 ton per 24 hr capacity driven by an overshot water wheel. The ore from the Mountain King property was processed at a mill that was installed at the junction of Brevier and Glacier Creeks along Mineral Creek in 1913. The ore was brought halfway down the slope to the mill by go-devils and the rest of the way by double-ended sleds lowered by an engine attached to an aerial tram.

Mountain View, North Star Claim, Hickey Prospect

This property is located at 1,800 ft on the east side of Mineral Creek opposite the mouth of Brevier Creek. The Mountain View claim of the Mineral Creek Mining Company was staked in 1911. In 1914, the property was restaked by Ross Hickey. The property was restaked in 1915 as the North Star. The Chugach Mining Company had the property in 1931. Johnson (1915) described the property. Forty feet of stripping and an adit are present on the property. The country rock is graywacke, with the schistosity striking N75°E and dipping 70°NW. The quartz vein is 1 to 36 in. wide, strikes N60° to 75°W and dips 80°SW. The vein contains pyrite and minor galena. Values up to 10 oz/st gold were reported by the management from outcrop, but the best sample taken in 1911 assayed approximately 0.6 oz/st gold (unpublished data from 1911, available at BOM office). The adit consists of 100 ft of crosscut, with approximately 150 ft of drift on a vein. The quartz in the adit contains minor pyrite, with recorded values up to 0.6 oz/st gold (1911 description of property, available at BOM office).

Mineral King Prospect

The Mineral King Prospect is located on the south side of Brevier Creek approximately 0.25 mi above its mouth. Johnson (1915) reported that a 1-ft-wide vertically dipping quartz vein striking N40°E is present. An adit reported on the property is caved.

Chesna Prospect

The Chesna prospect (Chena Claim in one publication) is located approximately 0.75 mi north of Brevier Creek on a west tributary to Mineral Creek between 1,150 and 1,425 ft elevation. Three adits were reported in 1911. Johnson (1915) was the last to report on the property. The lower adit at 1,150 ft elevation is 180 ft long and was driven N40°W along 2- to 3-in.-wide quartz stringers. The veins contain

minor pyrite. The upper two adits trend east-west. The upper adit is driven on a 4-ft-wide shear zone, which contains a 2-ft-wide quartz vein. The vein pinches to a stockwork within 50 ft of the portal. Pyrite was noted in the quartz vein. Values up to 6 oz/st gold were recorded from vein samples. A network of veins is exposed in the creek bed, south of the upper adit. Assays up to 30 oz/st gold were recorded (unpublished report available at BOM office). There is no information of the middle adit.

Mineral Creek Development Company

There is no data on this property. It might be the Buster claim (Johnson, 1915). The Buster claim is located on the west side of Mineral Creek near the south foot of Johnson Glacier, at 3,000 ft elevation. Workings include a 10-ft-deep winze and a 200-ft adit. The country rock is sheared argillite and graywacke. The schistosity strikes $N85^{\circ}W$ and dips 60° to $65^{\circ}N$. The outcrop of the vein strikes $N65^{\circ}W$, dips $75^{\circ}NE$, and is 23 ft wide. At the portal of the adit, a vein is exposed that is 1 to 24 in. wide, 30 ft long, strikes $N80^{\circ}W$ and dips $60^{\circ}NE$. Ninety feet from the end of the vein is a 45-ft-long, 1- to 18-in.-wide quartz vein that strikes $N75^{\circ}W$ and dips $65^{\circ}NE$. The winze is on this vein. Pyrite and free gold were observed.

Hercules Mine

The Hercules Mine is located on the north slope of Brevier Creek at 3,500 ft elevation. By 1916, the underground workings included 2 adits. Johnson (1915) described the workings. The strike and dip of the schistosity of the country rock is $N80^{\circ}W$, 60° to $70^{\circ}NE$. The vein crops out for 50 to 70 ft, with a width of 18 to 30 in. The quartz vein contains pyrite, gold, galena, sphalerite, pyrrhotite, chalcopyrite, chlorite and calcite. One adit consists of 115 ft of crosscuts and two shallow winzes. Sampling by the Mineral Creek Development Company in 1912 showed values of 0.3 to 7 oz/st gold (O. Roberts, 1913, unpublished report available at BOM office). The USGS mapped and sampled the adit in 1979. Twenty-five samples contained from less than 0.5 to 1.5 ppm gold. The second adit is approximately 100 ft below the first adit. The adit consists of a 200-ft-long crosscut, with 40 to 50 ft of drifts. Production figures are combined with the Millionaire property, which is located approximately 1 mi north of the Hercules outside of this study area. The combined production was 269 oz of gold and 44 oz of silver from 372 tons.

Big Four Mine

The Big Four Mine consists of a group of claims at the head of Brevier Creek between 3,800 and 5,260 ft elevation. The workings consist of an adit and two shafts at 5,260 ft elevation and an adit at 3,800 ft elevation. The mine was located in 1911 by Cook, Price, McIntosh, and Fritz. It was worked until 1941. Recorded production has been 846 oz of gold and 371 oz of silver from 951 tons of ore (Fechner and Meyer, 1984). Fineness values of the gold ranged from 537 to 878. At 5,260 ft, there is 200 ft of workings, which were caved in 1980. The country rock is slate that strikes $N75^{\circ}E$ and dips $75^{\circ}NW$. The vein is 1 to 5 ft wide, strikes $N55^{\circ}$ to $80^{\circ}E$, dips 70° to $80^{\circ}NW$, and is traceable for 200 ft. The BOM examined this working in 1980. Samples from veins contained up to 3.98 oz/st gold and 1 oz/st silver. Johnson (1915) described the lower workings. There is an adit with 180 ft of workings at the lower elevation. One vein is exposed in the adit for 20 ft. It is 6 to 36 in. wide, strikes east-west to $N70^{\circ}W$ and dips 60° to $80^{\circ}N$. A 12-in.-wide quartz vein that strikes $N40^{\circ}W$ and dips $70^{\circ}NW$ is cut at the face of the adit. The gold-bearing quartz contains pyrite, sphalerite, and galena.

Forty-five Prospect

This prospect is on the south side of Brevier Creek at 2,500 ft elevation. Johnson (1915) was the last person to describe the property. The country rock is graywacke that strikes $N80^{\circ}E$ and dips $70^{\circ}NW$. An adit was driven on a fracture striking $N45^{\circ}W$ and dipping $70^{\circ}NE$ that contains 0.5 to 6 in. of quartz. The quartz contains pyrite, galena, sphalerite, chalcopyrite, and free gold.

High Grade Prospect

The High Grade prospect consisted of claims that ran east-west across Mineral Creek approximately 6 mi upstream from the mouth of the creek. The property was staked in 1911. In 1915, the property was owned by Charles Wetzler. Two adits were reported on the property. Johnson (1915) reported that the ore-bearing ground was 15 to 150 ft wide and 3 claims in length. The adit on the west side of the creek consists of a 30-ft-long crosscut and an 80-ft-long drift. A few quartz stringers in graywacke strike $N80^{\circ}W$ and dip $67^{\circ}NE$. Five samples taken across the mineralized zone in 1915 contained trace to 0.84 oz/st gold (1915 letter from Edwin Eckern, Alaska Division of Mining files). The adit on the east side of the creek is 70 ft long. Small quartz stringers, which are parallel to the schistosity of the slates, are exposed in the adit. Five samples taken across the mineralized zone in 1915 contained trace to 0.80 oz/st gold (Eckern letter, 1915). Pyrite, galena, gold, quartz, and calcite are present in the quartz veins.

McIntosh Prospect

The McIntosh prospect is on the west slope of Mineral Creek at 450 ft elevation. The prospect was staked in 1911. Brooks (1912) was the last person to report on the property. Stripping and open-cut are present. The country rock consists of graywacke striking $N75^{\circ}E$. A 3-ft-wide shear zone with quartz strikes $N70^{\circ}W$.

Lucky Strike Prospect

There is no data on the Lucky Strike prospect other than a map location (Plate 1).

Olson and Wood Prospect

The Olson and Wood prospect is located on the east side of Mineral Creek, in the Wood Creek valley at approximately 1,500 ft elevation. It was located and staked in 1911 and development was recorded in 1914. Johnson (1915) was the last person to report on the property. The country rock consists of interbedded slates and graywackes. Iron-stained quartz stringers, up to 1 ft wide are in a 4-ft-wide, $N25^{\circ}W$ -trending, $70^{\circ}NE$ -dipping fracture zone. A 200-ft-long crosscut adit was reported.

Tiger Prospect

The Tiger prospect is located along Wood Creek at 1,900 ft elevation. It was located and staked in 1911 and development was recorded until 1914. A 10-ft-long adit was reported in 1914, but was caved when the Bureau of Mines visited the prospect. Stringers of quartz in 2 ft of slaty gouge are present.

Hecla Prospect

The Hecla Prospect is located on Wood Creek at 2,000 ft elevation, next to the Tiger Prospect. It was located and staked in 1911, with development work until 1914. Two adits, 76 and 65 ft long, were reported on the property (Johnson, 1915). The upper adit is along a 6-ft-wide 150-ft-tall quartz vein. The lower adit is 300 ft from the upper adit and is along another parallel quartz vein. A shattered zone of quartz stringers and slate is between the two adits. Pyrite was noted in the slates and quartz. No adits were found during the BOM visit. They were probably caved.

Golden Dollar Prospect

The Golden Dollar prospect is purportedly located on the south side of Wood Creek at 2,000 ft elevation. The only reference to the claim was by Brooks in 1912. Brooks reported a 2- to 3-ft-wide quartz vein.

Alaskan, Nick Mischko Prospect

The Alaskan prospect is located on the south side of Wood Creek between 2,140 and 2,500 ft elevation. It was staked in 1911, with development work continuing until 1914. In 1940, it was restaked by Nick Mischko. Six veins were reported by Pilgrim (1930) and are summarized as follows. The first vein is at 2,140 ft elevation approximately 600 ft south of Wood Creek. The graywacke host rock strikes $N67^{\circ}E$ and dips $67^{\circ}SE$. The vein is 0.5 to 3 in. wide, strikes $N25^{\circ}W$ and dips $78^{\circ}NE$. A 10-ft-long open cut is present. The BOM found a 5-ft-long adit at this location in 1982. A 5-ft-wide chip sample taken across the face contained 0.06 ppm gold and 3.1 ppm silver. The second vein is on a bench 860 ft north of the first vein (Pilgrim, 1930). The vein is 6 ft wide, is exposed for 100 ft, and contains no visible sulfides. The third vein is approximately 700 ft southeast of the first vein at 2,430 ft elevation. A 20-ft-wide shear zone is present in graywacke and contains 0.5 to 2 in. quartz stringers. The stringers strike $N68^{\circ}E$ and have a vertical dip. The BOM found a 14-ft-long adit at this location in 1982. No quartz veins were present in the adit. The fourth vein is exposed on a bluff approximately 300 ft southeast of the third vein at 2,480 ft elevation. The vein is iron-stained, 30 in. wide, several hundred feet long, strikes $N43^{\circ}W$, and dips $45^{\circ}NE$. A 60-ft-deep shaft is present. Mischko reported that the vein contained 1.6 oz/st gold and 0.7 oz/st silver at the bottom of the shaft. A grab sample of pyrite- and galena-bearing quartz taken by the BOM in 1982 from the dump near the shaft contained 0.75 oz/st gold and 0.4 oz/st silver. A sample from the vein at the shaft contained 5.54 ppm gold and 15.4 ppm silver. The fifth vein crops out at the edge of a rocky bluff at 2,430 ft elevation approximately 270 ft southeast of the shaft on the fourth vein. This is probably an offset extension of the fourth vein. The vein is up to 5 ft wide and contains pyrite. A 5-ft-deep pit is present. The sixth vein is at 2,550 ft elevation approximately 100 ft south of the fifth vein. The vein is 24 in. wide, strikes $N48^{\circ}$ to $55^{\circ}W$, dips 70° to $85^{\circ}NE$, and is traceable for over 800 ft. The graywacke country rock strikes $N68^{\circ}E$. The BOM sampled three open cuts on the fifth and sixth veins. Samples contained 0.06 to 0.09 ppm gold and 0.2 to 1.1 ppm silver. More open cuts are present on the property, but were not sampled.

Queen of Sheba Prospect

The Queen of Sheba prospect is located in the upper valley of Wood Creek at 2,650 ft elevation. The prospect was located and staked in 1911 and work continued until 1914. The country rock is interbedded slates and graywacke. A 1- to 8-ft-wide quartz vein that strikes $N55^{\circ}W$, dips $65^{\circ}NE$, and is exposed for 60 ft along strike is present. A 30-ft-long adit is driven along the vein. An 8-ft-wide chip sample taken by the BOM in 1982 from the face of the adit contained 0.03 ppm gold and 0.1 ppm silver. A 15-ft-long open cut is located 20 ft above the adit. A 4-ft-wide chip sample taken by the BOM contained 1.11 ppm gold and 5.1 ppm silver. A grab sample from the dump contained galena, pyrite, and chalcocite. The sample contained 1 oz/st gold and 2 oz/st silver.

Devinney and Dolan Prospect

The Devinney and Dolan prospect is located on the mountain slope facing Valdez Arm approximately 1 mi west of the mouth of Mineral Creek at 1,200 ft elevation. It was staked by T.J. Devinney and W.H. Dolan in 1929. Pilgrim (1930) was the last person to report on the property. The country rock is slaty graywacke that strikes $N65^{\circ}$ to $80^{\circ}E$ and dips 45° to $60^{\circ}NW$. Two adits are present. The upper adit is at 1,158 ft elevation and is 38 ft long. The vein strikes $N12^{\circ}W$ and is 4 to 24 in. wide. The vein consists of white crumbled quartz containing brecciated country rock, pyrite, galena, and some gold. The lower adit is 250 ft lower in elevation than the upper adit. The adit is at least 238 ft long and contains a raise. The vein in this adit is split with the east vein striking $N12^{\circ}W$ and the west vein striking $N60^{\circ}W$. No production figures are available, but work was done on the property in 1980. The BOM attempted to find the property in 1981, but was unable to locate it because of heavy brush.

PLACER GOLD DEPOSITS

Genesis of Placer Deposits

Placer gold deposits in the Port Valdez area are derived from eroded gold bearing quartz veins. Intense glacial scouring in the area has produced a rugged landscape. Most of the glacially eroded sediments were deposited beyond the Port Valdez area. Glacial, glaciofluvial, and colluvial deposits occur primarily in the valleys. Streams and rivers in the area are heavily laden with glacially eroded sediments. Fluvial deposition is gradually thickening (aggrading). The Port Valdez fjord is gradually infilling from fluvial fan and delta deposition on Mineral Creek, Valdez Glacier Stream, and Lowe River. These fluvial processes tend to disseminate rather than concentrate heavy elements. Most of the gold entrapped in the thickening deposits has not had a chance to become fluvially eroded and redeposited as a placer concentrate.

Placer gold has been found in Mineral Creek, Valdez Glacier Stream, Lowe River, Solomon Gulch, and several other smaller drainages in the Port Valdez area. The fluvial gravels of Lowe River and Solomon Gulch were drilled around 1916. Records of the drilling data were not available to assess the placer gold potential of these drainages. Following drilling, however, very little additional work was ever done in these drainages.

Mineral Creek Placer Deposits

Mineral Creek has the best placer gold potential in the Port Valdez area. The gravel thickness and depth to bedrock range 12 to 20 ft. Previous drilling indicates that the gold content of the gravels is 0.0123 to 0.014 oz/yd³. Mineral Creek is about 8.5 mi long and has a drainage area of 30 sq mi. The stream drops 1,000 ft in these 8.5 mi. It receives several glacially fed tributaries in its headwater area. Mineral Creek Valley is a narrow U-shaped trough. The floor of the valley consists of several semi-flat fluvial-gravel areas separated by stream-cut rock canyons. The major upstream fluvial gravel area is about 0.5 mi long and occurs where Brevier Creek enters Mineral Creek (map units Qf and Qfi of Combellick, this volume). A small amount of gold has been produced by sluicing operations in this area. Fluvial deposits resting upon elevated bedrock near the stream bank and just upstream from the Smith Mill contained approximately 50 gold fleck colors (less than 0.05 in. diameter) in a single pan concentrate sample collected by the Alaska Division of Geological & Geophysical Surveys in 1985. Gold has also been found in the fluvial deposits along lower Mineral Creek from approximately the East Fork Tributary to the bridge. A pan concentrate sample of upper gravels collected near McIntosh contained 10 gold fleck colors.

POSSIBLE FAVORABLE AREAS FOR FUTURE DEVELOPMENT

The Hercules and Millionaire prospects are most favorable for high grade and low tonnage development. Data compiled by BOM indicates that production occurred from these prospects between 1916 and 1938 with 372 tons of ore mined and 269 oz of gold and 44 oz of silver recovered. Inferred resources for these prospects are 450 tons of ore with 22.5 average ppm gold per ton and 9.1 average ppm silver per ton.

The Valdez Mining Company prospects (Donohue prospects) are most favorable for average grade and higher tonnage development. No production data are available for these prospects but inferred resources are 2,500 tons of ore with 13 ppm average gold per ton and 3.33 ppm average silver per ton.

The gold placer potential for Mineral Creek is low to moderate. The fluvial gravels near McIntosh were drilled in 1914 and reported to contain 0.012 to 0.014 oz/yd³ of gold. The pan concentrate samples collected in Mineral Creek represents 0.5 percent of a cubic yard and the surface gravels near McIntosh contained approximately 10 colors in the pan.

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