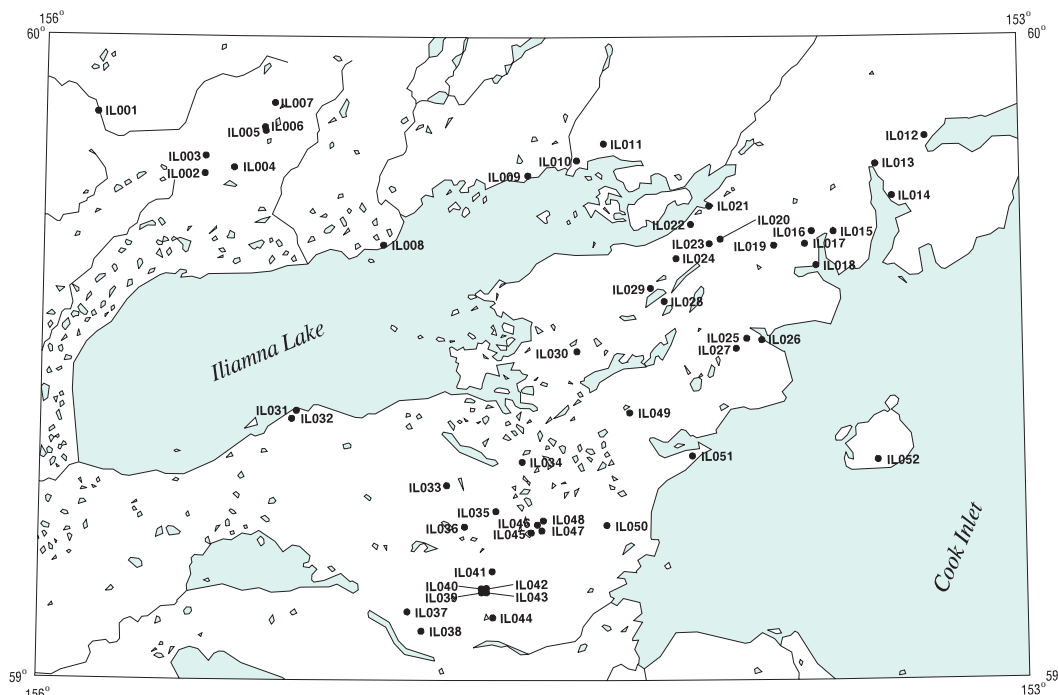


Iliamna quadrangle

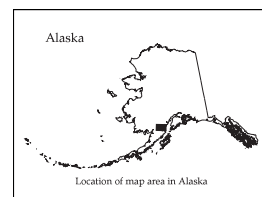
Descriptions of the mineral occurrences shown on the accompanying figure follow. See U.S. Geological Survey (1996) for a description of the information content of each field in the records. The data presented here are maintained as part of a statewide database on mines, prospects and mineral occurrences throughout Alaska.



*Distribution of mineral occurrences in the Iliamna
1:250,000-scale quadrangle, Alaska*

This and related reports are accessible through the USGS World Wide Web site <http://ardf.wr.usgs.gov>. Comments or information regarding corrections or missing data, or requests for digital retrievals should be directed to: Frederic Wilson, USGS, 4200 University Dr., Anchorage, AK 99508-4667, e-mail fwilson@usgs.gov, telephone (907) 786-7448. This compilation is authored by:

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Anchorage, AK



This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards or with the North American Stratigraphic code. Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

OPEN-FILE REPORT 2004-1057

Site name(s): Koktuli River; Koktalee; Kakhtul

Site type: Occurrences

ARDF no.: IL001

Latitude: 59.8806

Quadrangle: IL D-8

Longitude: 155.8415

Location description and accuracy:

This site represents unspecified occurrences of placer gold along the length of the Koktuli River in the Iliamna D-8 and D-7 quadrangles. For this record, it is about at the midpoint of the river in the D-8 quadrangle, near the east end of the boundary between sections 29 and 32, T. 3 S., R. 38 W., Seward Meridian. The occurrences were previously reported by Cobb and Reed (1981 [OFR 81-1343A, B]).

Commodities:

Main: Au

Other:

Ore minerals: Gold

Gangue minerals:

Geologic description:

According to Martin and Katz (1912, p. 133), prospectors reported that all the river bars along the Koktuli River (then spelled Kakhtul or Koktalee) contain flour gold. The main fork of the Koktuli drains the central part of the Cretaceous plutonic complex that contains the Pebble Copper (IL007) and other copper, gold, and iron deposits (IL002-006) in the Iliamna D-7 quadrangle, and an unnamed north fork of the river drains the north part of the complex. The placer gold was probably derived from the erosion of the plutonic complex.

Alteration:

Age of mineralization:

Holocene.

Deposit model:

Placer gold (Cox and Singer, 1986; model 39a).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

39a

Production Status: Undetermined.**Site Status:** Inactive**Workings/exploration:**

Apparently only exploration or prospecting by panning.

Production notes:

None known; possibly small amounts of gold were recovered in prospecting.

Reserves:**Additional comments:****References:**

Martin and Katz, 1912; Cobb and Reed, 1981 (OFR 81-1343A); Cobb and Reed, 1981 (OFR 81-1343A).

Primary reference: Martin and Katz, 1912**Reporter(s):** C.C. Hawley, Hawley Resource Group, Anchorage, Alaska**Last report date:** 06/02/03

Site name(s): 37 Skarn**Site type:** Prospect**ARDF no.:** IL002**Latitude:** 59.7866**Quadrangle:** IL D-7**Longitude:** 155.5094**Location description and accuracy:**

The 37 Skarn prospect is about 0.5 mile south of the Koktuli River at an elevation of about 1,000 feet. The prospect is about 3.8 miles west-northwest of Sharp Mountain near the center of W1/2 sec. 32, T. 4 S., R. 36 W., Seward Meridian. The location of the prospect is shown by Northern Dynasty Minerals (2003) and is accurate within 0.5 mile.

Commodities:**Main:** Cu**Other:** Ag, Au**Ore minerals:** Chalcopyrite, gold?, magnetite**Gangue minerals:** Epidote?, garnet, quartz**Geologic description:**

The 37 Skarn prospect is in granodiorite and calcic metasedimentary rocks near the south contact of an Upper Cretaceous granodiorite batholith (Detterman and Reed, 1980). The deposit consists of pyrite, chalcopyrite, and magnetite in garnet-epidote(?) -quartz skarn. Relatively high gold assays suggest that it may also contain native gold. The prospect is in the southwest part of a sulfide-rich area delineated by a 90-square-kilometer (34.8-square-mile) IP/chargeability anomaly (Northern Dynasty Minerals, 2003). The sulfide-rich area also includes the Pebble Copper (IL007) and 38 Porphyry (IL004) deposits.

The 37 Skarn deposit was discovered in 2002 and has been explored mainly by a few drill holes and by geochemical (soil) and geophysical surveys. The deposit is open to the northeast, where there is a strong copper-gold anomaly in soil, and farther to the east, where there is a magnetic anomaly (Northern Dynasty Minerals, 2003).

Five holes were drilled in 2002 (Northern Dynasty Minerals, 2003), and some intercepts returned significant gold and copper values. Drill hole 37 had a 258-foot intercept which averaged 1 gram of gold per tonne and 0.4 percent copper; this intercept contained a 21.5 foot zone which assayed 3.63 grams of gold per tonne and 1.73 percent copper. The copper-gold soil anomaly northeast of the prospect has not yet (2003) been tested by drilling.

Alteration:

Contact metasomatism: replacement of calcic host rocks by sulfides, magnetite, garnet, quartz, and epidote(?).

Age of mineralization:

Probably Late Cretaceous, about 90 Ma.

Deposit model:

Copper-gold skarn; probably related to porphyry copper-gold deposit (Cox and Singer, 1986; models 18b and 20c).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

18b, 20c

Production Status: None**Site Status:** Active**Workings/exploration:**

The deposit was discovered by Northern Dynasty Minerals during their evaluation of a 34.8-square-mile, sulfide-rich area marked by an IP/chargeability anomaly. They drilled five holes in 2002. The deposit is open to the northeast and east, where there are untested gold-copper-in-soil and magnetic anomalies (Northern Dynasty Minerals, 2003).

Production notes:**Reserves:****Additional comments:****References:**

Detterman and Reed, 1980; Northern Dynasty Minerals, 2003.

Primary reference: Northern Dynasty Minerals, 2003**Reporter(s):** C.C. Hawley, Hawley Resource Group, Anchorage, Alaska**Last report date:** 06/02/03

Site name(s): Unnamed (near hill 1759)**Site type:** Occurrence**ARDF no.:** IL003**Latitude:** 59.8140**Quadrangle:** IL D-7**Longitude:** 155.5071**Location description and accuracy:**

This occurrence is at an elevation of about 1,700 feet on the north side of the Koktuli River. It is on or near hill 1759 in the SW1/4 sec. 20, T. 4 S., R. 36 W., Seward Meridian. The location was reported by Northern Dynasty Minerals (2003); the map site is probably accurate within 0.5 mile.

Commodities:**Main:** Cu**Other:** Ag?, Au?, Mo?**Ore minerals:** Chalcopyrite, molybdenite?, pyrite**Gangue minerals:** Quartz**Geologic description:**

This occurrence is the site of porphyry copper-type mineralization of unknown extent and grade. The area near the occurrence was mapped as undivided volcanic rocks of Tertiary age (Detterman and Reed, 1980). More recent studies suggest that the area may instead be underlain by relatively fine-grained phases of a granodiorite-tonalite batholith of Late Cretaceous (about 90 Ma) age exposed immediately to the north and west of the copper occurrence.

The occurrence is in a north-trending lobe in the southern part of a 90- square-kilometer (34.8-square-mile) area of sulfide mineralization delineated by an IP/chargeability anomaly (Northern Dynasty Minerals, 2003). This anomalous area includes the Pebble Copper deposit (IL007), about 9.5 miles to the northeast; the 38 Porphyry deposit (IL004), 3.5 miles to the east-southeast; and the 37 Skarn deposit (IL002), 1.7 miles to the south.

Assuming that this occurrence is similar to the Pebble Copper deposit, it is probably hosted by porphyritic to equigranular, relatively fine-grained phases of the granodiorite-tonalite batholith. Sulfide minerals almost certainly include pyrite and chalcopyrite and probably molybdenite. Development of secondary potassium feldspar and biotite characterizes the mineralized rocks of the area (Bouley and others, 1995).

Alteration:

Potassic.

Age of mineralization:

Probably Late Cretaceous, about 90 Ma.

Deposit model:

Probably porphyry copper-gold deposit, or possibly porphyry copper-molybdenum deposit (Cox and Singer, 1986; models 20c and 21a).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

20c, 21a?

Production Status: None

Site Status: Active

Workings/exploration:

The occurrence is in a north-trending lobe of sulfide mineralization delineated by regional geophysical surveys conducted by Cominco (Bouley and others, 1995) and Northern Dynasty Minerals (2003). Reconnaissance followup of a geophysical anomaly revealed porphyry copper mineralization at this site, which was staked in 2002 as an extension to the main Northern Dynasty claim block. To date (2003), the prospect has not been drilled.

Production notes:**Reserves:****Additional comments:****References:**

Detterman and Reed, 1980; Bouley and others, 1995; Northern Dynasty Minerals, 2003.

Primary reference: Northern Dynasty Minerals, 2003

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/02/03

Site name(s): 38 Porphyry**Site type:** Prospect**ARDF no.:** IL004**Latitude:** 59.7963**Quadrangle:** IL D-7**Longitude:** 155.4193**Location description and accuracy:**

The 38 Porphyry prospect is in the upper Koktuli River drainage at an elevation of about 1,000 feet; it is about 1.5 miles north-northwest of the peak of Sharp Mountain. The site is in the E1/2SW1/4 sec. 26, T. 4 S., R. 36 W., Seward Meridian. The location is accurate for the approximate center of the prospect.

Commodities:**Main:** Cu**Other:** Ag, Au, Mo?**Ore minerals:** Chalcopyrite, molybdenite?, pyrite**Gangue minerals:** Quartz**Geologic description:**

The 38 Porphyry prospect is a porphyry copper-gold (-molybdenum?) deposit on the southeast flank of a granodiorite-tonalite batholith of Late Cretaceous (about 90 Ma) age (Detterman and Reed, 1980). The deposit is in the south part of an approximately 90-square-kilometer (about 34.8-square-mile) area of sulfide mineralization delineated by an IP/chargeability anomaly (Northern Dynasty Minerals, 2003). Pebble Copper (IL007) and a copper-gold skarn (IL002) are in the same anomalous area.

The 38 Porphyry deposit was discovered in 2002 and is still (2003) incompletely explored. It is probably associated with porphyritic to equigranular granodiorite phases of a granodiorite batholith which crops out north of the 38 Porphyry deposit and intrudes Cretaceous or Jurassic flysch. Assuming ore mineralogy similar to that at the Pebble Copper deposit (IL007), the 38 Porphyry deposit contains chalcopyrite and pyrite as the most abundant sulfides, and probably contains molybdenite. Potassic alteration, mainly development of secondary potassium feldspar and biotite, is characteristic of the mineralized rocks in the area.

The 38 Porphyry deposit is aligned east-northeast and its north-south outcrop width is about 2,000 feet. The deposit is delineated mainly on the basis of 13 holes drilled by Northern Dynasty Minerals, Ltd., in the 2002 season. Ten of the holes intersected por-

phyry copper-type mineralization. They indicate that the deposit is at least a mile long and is open at both ends. Two drill holes intersected substantial zones of mineralization. Drill hole 36 intersected 524 feet of rock that contained 0.33 gram of gold per tonne and 0.32 percent copper; the intercept included 124 feet that contained 0.4 percent copper. Drill hole 44 intersected 530 feet of mineralized rock that contained 0.25 gram of gold per tonne and 0.3 percent copper; a 110-foot interval contained 0.4 percent copper.

The intrusive hostrocks are potassic, similar to the hosts of other copper-gold porphyry deposits (Muller and Groves, 1995). Bouley and others (1995) have shown that the rocks were both initially high in potassium and were further enriched in potassium during alteration. A sample of the granodiorite (Bouley and others, 1995, sample 12) plots just below the shoshonite field in a K₂O-SiO₂ diagram. Pre-mineralization biotite pyroxenite in the area plots in the ultrapotassic shoshonite field (Bouley and others, 1995, analyses 10-11).

Alteration:

Potassic.

Age of mineralization:

Probably Late Cretaceous (approximately 90 Ma), assuming contemporaneity with the Pebble Copper deposit (IL007).

Deposit model:

Probably porphyry copper-gold or possibly porphyry copper-molybdenum deposit (Cox and Singer, 1986; models 20c and 21a).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

20c, 21a

Production Status: None**Site Status:** Active**Workings/exploration:**

This porphyry copper-gold (-molybdenum?) deposit was discovered in 2002 by Northern Dynasty Minerals, Ltd., during a reevaluation of the Pebble Copper deposit and exploration of a major IP anomaly. Thirteen holes were drilled in 2002; results include:

	Intercept in total feet	Au in gm/tonne	Cu in percent
Drill hole 36	524	0.33	0.32
	Including 124	0.45	0.40
Drill hole 44	530	0.25	0.30
	Including 110	0.36	0.40

Production notes:

Reserves:

The 38 Porphyry deposit is a copper porphyry resource of more than 500 million tonnes (Northern Dynasty Minerals, 2003).

Additional comments:**References:**

Detterman and Reed, 1980; Bouley and others, 1995; Muller and Groves, 1995; Northern Dynasty Minerals, 2003.

Primary reference: Northern Dynasty Minerals, 2003

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/02/03

Site name(s): 25 Gold (Sill?)**Site type:** Prospect**ARDF no.:** IL005**Latitude:** 59.8536**Quadrangle:** IL D-7**Longitude:** 155.3229**Location description and accuracy:**

The 25 Gold prospect is at an elevation of about 1,000 feet in the headwaters of the Koktuli River. It is about 1.2 miles west-southwest of locally-named Frying Pan Lake, in the NE1/4 sec. 8, T. 4 S., R. 35 W., Seward Meridian. The deposit could extend into the southern part of section 2, same township and range. The location is probably accurate within 0.5 mile (Northern Dynasty Minerals, 2003). The 25 Gold deposit probably is the same as the Sill deposit, discovered by Cominco in about 1987 (Bouley and others, 1995).

Commodities:**Main:** Ag, Au**Other:****Ore minerals:** Gold, pyrite**Gangue minerals:** Quartz**Geologic description:**

The 25 Gold deposit is a volcanic-rock-hosted, epithermal gold deposit (Northern Dynasty Minerals, 2003; Bouley and others, 1995). Gold accompanies relatively sparse pyrite and possibly other sulfide minerals in quartz veins which cut dacite (Bouley and others, 1995, analysis 13, table 2). The dacite analyzed by Bouley and others is fresh, contains phenocrysts of hornblende and zoned plagioclase, and plots in the high alkali field of a K2O-SiO₂ diagram.

The geology near the deposit is complex. In addition to Tertiary volcanic rocks, there are outcrops of biotite pyroxenite and mafic breccias similar to those at the Frying Pan Lake deposit (IL006).

The prospect was drilled by Northern Dynasty Minerals in 2002. Several holes intersected substantial gold mineralization. Hole no. 58 intersected 350 feet averaging 0.3 gram of gold per tonne; hole TC-8 intersected 5 feet averaging 33.9 grams of gold per tonne (about 0.99 ounce); and hole 62 intersected 5.7 feet averaging 19.3 grams of gold per tonne (about 0.56 ounce) (Northern Dynasty Minerals, 2003). A soil survey conducted by Northern Dynasty Minerals showed local values of 500 or more parts per billion gold and delineated a lead-zinc anomaly.

Alteration:

Silicification.

Age of mineralization:

Probably Early Tertiary, the age of the volcanic host rocks.

Deposit model:

Low-sulfide Au-quartz deposit (Cox and Singer, 1986; model 36a).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

36a

Production Status: None**Site Status:** Active**Workings/exploration:**

The deposit, then called Sill, was discovered by Cominco geologists in 1987 and two shallow holes were drilled in 1988; the prospect was deemed worthy of future work. The deposit, subsequently called 25 Gold, was drilled by Northern Dynasty Minerals in 2002. Northern Dynasty also conducted a soil survey of the area; anomalous zones remain to be drilled (Northern Dynasty Minerals, 2003).

Production notes:**Reserves:****Additional comments:****References:**

Bouley and others, 1995; Northern Dynasty Minerals, 2003.

Primary reference: Northern Dynasty Minerals, 2003**Reporter(s):** C.C. Hawley, Hawley Resource Group, Anchorage, Alaska**Last report date:** 04/21/03

Site name(s): Frying Pan Lake**Site type:** Prospect**ARDF no.:** IL006**Latitude:** 59.8592**Quadrangle:** IL D-7**Longitude:** 155.3252**Location description and accuracy:**

This prospect is centered on hill 1760 about 1.3 miles west of lake 943, locally called Frying Pan Lake. The site is in the E1/2 sec. 5, T. 4 S., R. 35 W., Seward Meridian. The location is at the approximate center of the outcrop area of the deposit, which extends outward from the site for as much as a mile. The prospect is location 1 of Detterman and Cobb (1972).

Commodities:**Main:** Fe**Other:** Ti, V**Ore minerals:** Ilmenite, magnetite**Gangue minerals:****Geologic description:**

This prospect is a body of plutonic breccia approximately 1 square mile in outcrop area that consists of angular, magnetite-bearing pyroxenite fragments in a matrix of Tertiary or Cretaceous granodiorite (Reed and Detterman, 1965). Pyroxenite clasts constitute 50-90 percent of the breccia, and magnetite occurs in crystal aggregates as much as 1 inch across. Sixteen samples of breccia collected by Reed and Detterman (1965) contained 16 to 24 percent FeO, about 1.3 percent TiO₂, 0.1 to 3.2 percent P₂O₅, and 0.1 to 0.15 percent V₂O₅. A magnetic concentrate of the material contained about 3.5 percent TiO₂, reflecting the presence of ilmenite or titaniferous magnetite. Samples collected by Fischer (1975) contained about 0.02 percent V₂O₅, less than was reported by Reed and Detterman. Fischer's magnetite-rich concentrate of the pyroxenite contained 40-60 percent iron, 3.1 percent TiO₂, and 0.3-0.5 percent vanadium (Fischer, 1975). Bouley and others (1995) reported considerable amounts of iron in two samples of biotite pyroxenite collected in the prospect area. Their sample 10 (table 2) contained 18.78 percent iron (as Fe₂O₃). The rocks are also highly potassic and are similar to alkali ultramafic rocks in composite plutons elsewhere in the central Alaska Range (Foley and others, 1997).

Alteration:

Age of mineralization:

The pyroxenite is probably Late Cretaceous but probably predates the 90 Ma Pebble Copper deposit (IL007), whose granodiorite hostrock is presumed to be the matrix of the plutonic breccia at the Frying Pan Lake prospect.

Deposit model:

Alaska PGE (Cox and Singer, 1986; model 9).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

9

Production Status: None

Site Status: Inactive

Workings/exploration:

Exploration has been limited to geologic mapping and surface sampling. Sixteen samples assayed by Reed and Detterman (1965) contained 16 to 24 percent FeO, 1.3 percent TiO₂, 0.1 to 3.2 percent P₂O₅, and 0.1 to 0.15 percent V₂O₅. Samples analyzed by Fischer (1975) contained 12 to 19 percent Fe, 1.3 percent TiO₂, and 0.02 percent V₂O₅. A sample analyzed by Bouley contained about 19 percent Fe (Bouley and others, 1995).

Production notes:**Reserves:**

Fischer (1975) estimated a resource of 7 billion tons of magnetite-bearing breccia that contained 7 million tons of vanadium.

Additional comments:**References:**

Reed and Detterman, 1965; Detterman and Cobb, 1972; Fischer, 1975; Cobb, 1976; Detterman and Reed, 1980; Cobb and Reed, 1981 (OFR 81-1343A); Cobb and Reed, 1981 (OFR 81-1343B); Bouley and others, 1995; Foley and others, 1997.

Primary reference: Reed and Detterman, 1965; Fischer, 1975

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/03/03

Site name(s): Pebble Copper**Site type:** Prospect**ARDF no.:** IL007**Latitude:** 59.8971**Quadrangle:** IL D-7**Longitude:** 155.2952**Location description and accuracy:**

The Pebble Copper deposit is at an elevation of about 1,150 feet about 2 miles north of locally named Frying Pan Lake (elevation 943 feet) in the headwaters of the Koktuli River. The site is in the SW1/4 SE1/4 sec. 21, T. 3 S., R. 35 W., Seward Meridian. The location is accurate within a few hundred feet for the center of the outcrop area of this large deposit.

Commodities:**Main:** Au, Cu**Other:** Ag, Mo

Ore minerals: Bornite, chalcocite, chalcopyrite, covellite, digenite, galena, goethite, gold, magnetite, molybdenite, pyrite, sphalerite

Gangue minerals: Quartz

Geologic description:

Pebble Copper is a porphyry copper-gold-molybdenum deposit in the outer part of an Upper Cretaceous (89.7 Ma) tonalite-granodiorite batholith (Detterman and Reed, 1980). The batholith intrudes flysch of Jurassic or Cretaceous age. The west and south parts of the batholith comprise five textural and compositional phases ('the porphyry suite'): biotite diorite, equigranular granodiorite, porphyritic granodiorite, biotite granodiorite, and intrusive breccia. Breccias appear to have developed with each intrusive phase; the largest breccia body is weakly mineralized (Bouley and others, 1995). The highest grade parts of the deposit are associated with porphyritic granodiorite in which plagioclase phenocrysts are replaced by potassium feldspar and sericite, and amphibole is replaced by granular greenish biotite.

The 'porphyry suite' and the sedimentary country rocks at Pebble Copper are variably mineralized depending on host rock composition and proximity to the center of mineralization. Sulfides occur in stockwork veinlets near the core of the deposit, and are disseminated in peripheral phases. Most of the copper- and gold-bearing minerals occur either in hairline veinlets or in larger veins having well-developed potassic vein selvages. Copper sulfides, chiefly chalcopyrite, also occur as disseminations. Molybdenite occurs in late

quartz veinlets that crosscut introduced potassic minerals.

Metallic minerals identified at Pebble Copper include pyrite, chalcopyrite, and molybdenite, along with minor bornite, covellite, chalcocite, digenite, and magnetite. Gold is fine-grained, generally only a few microns in diameter, and generally occurs at or near pyrite-chalcopyrite grain boundaries (Bouley and others, 1995). Galena and sphalerite are reported in quartz veins on the periphery of the deposit.

Alteration minerals include abundant secondary biotite and potassium feldspar and lesser amounts of ferroan dolomite, albite, and quartz. Characteristic accessory minerals are anhydrite, apatite, and rutile.

The deposit contains more than 1 billion tonnes of material that grades about 0.3 percent copper and 0.34 gram of gold per tonne. A higher grade core zone of about 54 million tonnes averages 0.54 percent copper and 0.46 gram of gold per tonne (Bouley and others, 1995; Youngman, 2003). Cross-section 7 of Bouley and others (1995) suggests that the higher grade core overlies a stock or cupola of the porphyritic granodiorite. Mineralized material typically contains 200-300 parts per million of molybdenum: molybdenite probably would be recovered as a concentrate in a future mining operation.

The deposit is oxidized to a depth of as much as 100 feet. Some secondary chalcocite is developed, but in general the richer ore seems to be related to variations in hypogene rather than supergene mineralization. Gossan of goethite and other oxidized minerals is developed locally, especially over peripheral pyrite-rich parts of the mineral deposit.

Pebble Copper has been restudied since 2001 by Northern Dynasty Minerals. A regional IP program indicates that it is one of several deposits in an open-ended, 90-square-kilometer (34.8-square-mile) IP/chargeability anomalous area (Youngman, 2003). Northern Dynasty Minerals drilled 68 holes totaling 11,000 meters (about 36,100 feet) in the anomalous area in 2002, and identified new deposits described in records IL002, -003, and -004. The nearby Sill or 25 Gold (IL005) epithermal gold deposit was discovered by Cominco during reconnaissance studies of the area, and has been further explored by Northern Dynasty.

The plutonic hostrocks of the Pebble Copper deposit are alkalic (potassic), and are similar to potassium-rich plutons that host copper-gold deposits throughout the world (Bouley and others, 1995; Muller and Groves, 1995).

Alteration:

The dominant pervasive alteration at Pebble Copper is potassic. Secondary biotite has replaced primary mafic minerals and groundmass, and potassium feldspar and biotite have replaced plagioclase (Bouley and others, 1995). Ferroan dolomite, albite, anhydrite, rutile, and quartz were introduced locally. The deposit is oxidized to a depth of 100 feet.

Age of mineralization:

Late Cretaceous. The Pebble Copper deposit occurs near the margin of an Upper Cretaceous (89.7 Ma) tonalite-granodiorite batholith intrusive into Jurassic or Cretaceous flysch (Detterman and Reed, 1980; Bouley and others, 1995).

Deposit model:

Porphyry Cu-Au-(Mo) (Cox and Singer, 1986; model 20c).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

20c

Production Status: None**Site Status:** Active**Workings/exploration:**

Cominco Alaska Exploration began to explore Pebble Copper in 1986. Early exploration was based on color anomalies observed by local pilots. Drilling started in the 1988 season and continued through 1992, when twelve holes were drilled to further delineate the higher grade porphyry zone found in drilling campaigns between 1988 and 1992. The general objectives were to: 1) define the extent of the porphyry system above a cutoff grade of 0.2 percent copper; 2) delineate the grade and shape of the deposit within the 0.2 percent area; and 3) delineate more precisely the size and grade of the higher grade core. Other work included a limited IP survey, environmental monitoring, and bench-scale metallurgical testing (Bouley and others, 1995).

After about a decade of inactivity, work was resumed by Canada-based Northern Dynasty Minerals, Ltd., an affiliated company of the Hunter-Dickinson Group. The Northern Dynasty work began by expanding Cominco's IP survey. This work identified an open-ended, 90-square-km area (about 34.8 square miles) with anomalous IP chargeability response. This area includes the Pebble Copper deposit. In 2002, Northern Dynasty drilled about 11,000 meters (about 36,100 feet), partly at Pebble Copper, but mostly elsewhere in the geophysically anomalous area.

Production notes:**Reserves:**

The inferred mineral resource in the Pebble Copper deposit was calculated by Cominco as 1,000 million tonnes of material averaging 0.3 percent copper and 0.34 gram of gold per tonne (Bouley and others, 1995); a core area contained more than 50 million tons of material grading more than 0.5 percent copper and almost 0.5 gram of gold per tonne (Youngman, 2003).

Subsequent work on the property has increased the resource estimate. Based on all field work through 2002, there is a total of about 6.8 billion pounds of copper and 13 million ounces of gold in a resource of somewhat more than 1 billion tonnes of mineralized material at Pebble Copper. The higher grade core zone has been recalculated as 141 million tonnes grading 0.48 percent copper and 0.67 gram of gold per tonne (Northern Dynasty Minerals, 2003).

Additional comments:

Small quartz-galena-sphalerite veins occur about 0.5 mile south of the Pebble Copper deposit (Bouley and others, 1995).

References:

Detterman and Reed, 1980; Bouley and others, 1995; Muller and Groves, 1995; Young-

man, 2003; Northern Dynasty Minerals, 2003.

Primary reference: Bouley and others, 1995; Northern Dynasty Minerals, 2003

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/02/03

Site name(s): Unnamed (southwest of Newhalen)

Site type: Occurrence

ARDF no.: IL008

Latitude: 59.6769

Quadrangle: IL C-6

Longitude: 154.9576

Location description and accuracy:

This placer occurrence is about 3.7 miles south-southwest of Newhalen village on the north shore of Iliamna Lake. The site is in the NE1/4 section 7, T. 6 S., R. 33 W., Seward Meridian. The location is accurate within a few hundred feet. The site is locality 34 of MacKevett and Holloway (1977).

Commodities:

Main: Au

Other:

Ore minerals: Gold

Gangue minerals:

Geologic description:

Placer gold claims are reported 3.7 miles southwest of Newhalen on a 1.2 mile long creek that flows southeasterly from lake 103 into Lake Iliamna (U.S. Bureau of Mines, 1973; MacKevett and Holloway, 1977). Nothing is known about the deposit or the character of the gold. The nearest exposed bedrocks are volcanic rocks of Tertiary age (Detterman and Reed, 1980).

Alteration:

Age of mineralization:

Holocene?

Deposit model:

Placer gold (Cox and Singer, 1986; model 39a).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

39a

Production Status: None

Site Status: Probably inactive

Workings/exploration:

No known workings.

Production notes:

Reserves:

Additional comments:

References:

U.S. Bureau of Mines, 1973; MacKevett and Holloway, 1977; Detterman and Reed, 1980.

Primary reference: MacKevett and Holloway, 1977

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 03/27/03

Site name(s): Millet; Copper King Ledge; Millet Point

Site type: Prospect

ARDF no.: IL009

Latitude: 59.7850

Quadrangle: IL D-5

Longitude: 154.5141

Location description and accuracy:

The Millet prospect on the Copper King Ledge claims extends from about 950 feet north of the shoreline of Lake Iliamna north for at least 2,500 feet. The approximate mid-point of the linear deposit is in the SW1/4 SW1/4 sec. 31, T. 4 S., R. 31 W., Seward Meridian. The Millet prospect is locality 2 of Detterman and Cobb (1972). The location is accurate within about 500 feet for the center of the prospect area.

Commodities:

Main: Cu

Other: Ag, Au

Ore minerals: Azurite, chalcocite, chalcopyrite, hematite, malachite, neotocite?, pyrite, sphalerite

Gangue minerals:

Geologic description:

The Millet prospect is a skarn deposit developed mainly in the Ursus Member of the Upper Triassic Kamishak Formation (Detterman and Reed, 1980, plate 1, p. 11-14). The Ursus Member consists chiefly of thin-bedded, light-gray limestone. The limestone strikes about north and dips moderately to the east, roughly parallel to its intrusive contact with Tertiary or Cretaceous, medium- to coarse-grained, light-gray quartz diorite. To the south, the diorite and limestone are overlain unconformably by locally brecciated, Tertiary basalt and andesite.

The deposit is about 200-300 feet east of the quartz diorite contact, strikes about north, and consists of layers and lenses of skarn, mineralized limestone, and dikes that are roughly parallel to the quartz diorite contact. The skarn consists of amphibole, garnet, epidote, calcite, quartz, an unidentified amber-color mineral (possibly idocrase), small amounts of hematite, pyrite, and chalcopyrite, and locally other sulfide minerals. Pyrite generally is more abundant than chalcopyrite. Pyrite also is disseminated in the limestone, locally in amounts up to about 10 percent (Rutledge and Mulligan, 1952; Martin and Katz, 1910). Retherford and Hickok (1990) reported chalcocite and minor amounts of sphalerite associated with chalcopyrite in mineralized rock near an old shaft. Oxida-

tion of the deposit extends to a depth of about 8 feet along cracks and fissures. According to Martin and Katz (1910, p. 198), the oxidized ore contains copper carbonates, presumably malachite and azurite, and black copper and iron oxides possibly including neotocite or copper pitch.

Drilling and other sampling by the U.S. Bureau of Mines indicates two bodies, mainly of skarn, that aggregate about 2,500 feet of a total strike length of about 3,500 feet (Rutledge and Mulligan, 1952; Moxham and Nelson, 1952). The southern body is on Copper King Ledge Nos. 1 and 2 claims and is about 525 feet long; it parallels a dike that ranges from 3 to 80 feet thick. The body averages about 19 feet thick and grades about 1.08 percent copper. The northern body is a composite deposit about 735 feet long on the Copper King Ledge Nos. 2 and 3 claims. It comprises two mineralized zones separated by 50 feet of barren, black limestone. The larger zone is almost 30 feet thick and averages 0.64 percent copper. One U.S. Bureau of Mines drill hole (no. 3) intersected about 31 feet grading 1.44 percent copper (Rutledge and Mulligan, 1952).

The original owner of the prospect (Millet) reported that a select sample that contained about 10 percent copper assayed about 0.1 ounce of gold per ton (Martin and Katz, 1910, p. 198). Later investigators found little gold. U.S. Bureau of Mines assays indicate a very low average content of gold and silver in their samples (Rutledge and Mulligan, 1952), and gold values of no more than about 600 parts per billion were reported by Retherford and Hickok (1990).

Alteration:

Replacement of limestone by garnet, amphibole, epidote, and other skarn minerals.

Age of mineralization:

Late Cretaceous or Tertiary; probably nearly synchronous with intrusion of the quartz diorite.

Deposit model:

Cu skarn (Cox and Singer, 1986; model 18b).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

18b

Production Status: Undetermined.**Site Status:** Inactive**Workings/exploration:**

The deposit was first staked in 1906 by Millet, who patented three claims. In 1949 and 1950, the U.S. Bureau of Mines dug 6,229 feet of trenches and diamond drilled six holes totaling 2,298.5 feet (Rutledge and Mulligan, 1952). Mineralized zones contained 0.54 to 1.43 percent copper, up to 0.2 ounce of silver per ton, and less than 0.01 ounce of gold per ton. At the time of the U.S. Bureau of Mines investigation, the property was leased to St. Eugene Mining Company.

Production notes:**Reserves:****Additional comments:****References:**

Martin and Katz, 1910; Martin and Katz, 1912; Brooks, 1913; Brooks, 1914; Smith, 1917; Capps, 1935; Roehm, 1941; Moxham and Nelson, 1952; Wedow and others, 1952; Rutledge and Mulligan, 1952; Berg and Cobb, 1967; Detterman and Cobb, 1972; Cobb, 1976; MacKevett and Holloway, 1977; Detterman and Reed, 1980; Cobb and Reed, 1981 (OFR 81-1343A); Cobb and Reed, 1981 (OFR 81-1343B); Retherford and Hickok, 1990.

Primary reference: Rutledge and Mulligan, 1952

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/03/03

Site name(s): Unnamed (west of Chekok)

Site type: Occurrence

ARDF no.: IL010

Latitude: 59.8084

Quadrangle: IL D-4

Longitude: 154.3639

Location description and accuracy:

This placer occurrence is about 1.5 miles west of the village of Chekok, apparently on a distributary of Canyon Creek. The site is in the NW1/4 section 25, T. 4 S., R. 30 W., Seaward Meridian. The location is accurate within 0.5 mile. The occurrence is locality 35 of MacKevett and Holloway (1977).

Commodities:

Main: Au

Other: Ag

Ore minerals: Gold, silver

Gangue minerals:

Geologic description:

This placer gold occurrence is on an unnamed distributary of Canyon Creek, which drains the north and west flanks of Knutson Mountain. The site was covered by placer gold claims, but little is known of the occurrence (U.S. Bureau of Mines, 1973). The bedrocks in the stream drainage comprise Tertiary and Jurassic volcanic rocks and Mesozoic plutonic rocks (Detterman and Reed, 1980). The nearest known lode deposit is the Knutson (IL011) which is about 3.5 miles northeast of the placer claims.

Alteration:

Age of mineralization:

Holocene.

Deposit model:

Placer gold (Cox and Singer, 1986; model 39a).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

39a

Production Status: None

Site Status: Probably inactive

Workings/exploration:

Exploration probably limited to surface sampling; no known mining.

Production notes:

Reserves:

Additional comments:

Lode claims of unknown mineral type were also reported in the area (MacKevett and Holloway, 1977).

References:

U.S. Bureau of Mines, 1973; MacKevett and Holloway, 1977; Detterman and Reed, 1980.

Primary reference: MacKevett and Holloway, 1977

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/03/03

Site name(s): Knutson; Knudsen

Site type: Prospect

ARDF no.: IL011

Latitude: 59.8346

Quadrangle: IL D-4

Longitude: 154.2809

Location description and accuracy:

This prospect is at an elevation of about 1,300 feet on the west flank of Knutson Mountain about two miles north of Knutson Bay (Martin and Katz (1910, 1912). The site is in the NE1/4 sec. 17, T. 4 S., R. 29 W., Seward Meridian, and is probably accurate within 0.5 mile. The site is locality 3 of Detterman and Cobb (1972).

Commodities:

Main: Au, Cu

Other: Ag

Ore minerals: Gold, unidentified copper-bearing minerals and silver-bearing minerals?

Gangue minerals: Quartz

Geologic description:

This prospect consists of two quartz veins that cut quartz monzonite of Cretaceous age (Detterman and Reed, 1980). A 3- to 8-foot-thick quartz vein contains sparse and irregularly distributed gold, along with copper- and probably silver-bearing minerals. A similar but thinner vein was reported within about 0.25 mile, in an unknown direction, from the main vein (Martin and Katz, 1910,1912; Berg and Cobb, 1967).

The exact location of this deposit, and its production, grade, and nature of ore are unknown or uncertain. The prospect was sometimes described as a copper deposit (Brooks, 1913).

Alteration:

Age of mineralization:

Cretaceous or younger.

Deposit model:

Polymetallic vein? (Cox and Singer, 1986; model 22c).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

22c?

Production Status: None

Site Status: Inactive

Workings/exploration:

A 40-foot tunnel was driven in 1912 (Brooks, 1913, p. 39).

Production notes:

Reserves:

Additional comments:

References:

Martin and Katz, 1910; Martin and Katz, 1912; Brooks, 1913; Detterman and Cobb, 1972; Wedow and others, 1952; Berg and Cobb, 1967; MacKevett and Holloway, 1977; Detterman and Reed, 1980; Cobb and Reed, 1981 (OFR 81-1343A); Cobb and Reed, 1981 (OFR 81-1343B).

Primary reference: Martin and Katz, 1912

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/03/03

Site name(s): Unnamed (near Marsh Creek)**Site type:** Occurrences**ARDF no.:** IL012**Latitude:** 59.8443**Quadrangle:** IL D-1**Longitude:** 153.2902**Location description and accuracy:**

The approximate location of these two small occurrences is in upper Marsh Creek at an elevation of about 1,000 feet. It is about 0.5 mile south of the boundary of Lake Clark National Park and about 1.25 miles west of Chinitna Bay. The site is in the approximate center of E1/2 NE1/4 sec. 7, T. 4 S., R. 23 W., Seward Meridian. The location is accurate within about 0.5 mile, and is taken from Detterman and Hartsock (1966). The Marsh Creek occurrences are included in location 10 of Detterman and Cobb (1972), but the site apparently is mislocated on their map.

Commodities:**Main:** Cu**Other:** Fe**Ore minerals:** Azurite, chalcopryrite, magnetite, malachite**Gangue minerals:****Geologic description:**

There are two closely-spaced mineral deposits in upper Marsh Creek: a copper occurrence and an iron occurrence (Detterman and Hartsock, 1966). The copper occurrence is a 6- to 12- inch-[long?] vein of chalcopryrite and oxidized copper minerals in Triassic(?) marble. Weak azurite-malachite stain extends outward 20 to 30 feet to either side of the vein. The iron occurrence consists of a small concentration of magnetite in possibly Lower Jurassic Talkeetna Formation metasedimentary and volcanic rocks in a fault block that also contains Jurassic granitic rocks (Detterman and Hartsock, 1966). The copper vein apparently is high grade but Detterman and Hartsock did not sample it because of its small size.

The marble host of the copper deposit may correlate with the Bruin Limestone Member of the Upper Triassic Kamishak Formation (Detterman and Reed, 1980). The Bruin Limestone is massive to thin-bedded, light- to dark-gray limestone, interbedded with banded green and white chert. The Talkeetna Formation(?) host of the magnetite deposit generally consists of andesite flows, agglomerate, tuff, volcanic breccia, and minor sedimentary rocks.

Alteration:**Age of mineralization:**

The copper deposit is Triassic or younger; the magnetite deposit is probably Jurassic.

Deposit model:

The copper deposit is possibly a polymetallic vein; the magnetite deposit is probably Fe skarn (Cox and Singer, 1986, models 22c and 18d).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

22c, 18d

Production Status: None**Site Status:** Inactive**Workings/exploration:**

The occurrences were found during regional geologic mapping; the copper vein apparently is high grade, but it was not sampled because of its small size (Detterman and Hartsock, 1966).

Production notes:**Reserves:****Additional comments:****References:**

Detterman and Reed, 1964; Detterman and Hartsock, 1966; Detterman and Cobb, 1972; Detterman and Reed, 1980.

Primary reference: Detterman and Hartsock, 1966**Reporter(s):** C.C. Hawley, Hawley Resource Group, Anchorage, Alaska**Last report date:** 06/03/03

Site name(s): Unnamed (east of Iniskin River)**Site type:** Occurrence**ARDF no.:** IL013**Latitude:** 59.8015**Quadrangle:** IL D-2**Longitude:** 153.4436**Location description and accuracy:**

This occurrence is at an elevation of about 1,000 feet about halfway between the Iniskin River and Roscoe Glacier. The site is in the NW1/4 sec. 29, T. 4 S., R. 24 W., Seward Meridian. The location is accurate within 0.5 mile. The occurrence is location 9 of Detterman and Cobb (1972).

Commodities:**Main:** Cu**Other:****Ore minerals:** Copper sulfides**Gangue minerals:****Geologic description:**

Unidentified copper sulfides occur in tactite(?) near the contact between Jurassic or older metamorphic rocks (Kakhonak Complex) and Jurassic quartz monzonite and diorite (Detterman and Reed, 1964, 1980). The Kakhonak Complex consists of schist, gneiss, quartzite, marble, phyllite, argillite, and slate, which are exposed chiefly as roof pendants in the Jurassic plutons.

Alteration:

Development of tactite in calcareous rocks(?).

Age of mineralization:

Probably Jurassic. The tactite(?) developed in bedrock of the Kakhonak Complex during emplacement of the Jurassic plutons.

Deposit model:

Cu skarn? (Cox and Singer, 1986; model 18b).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):
18b?

Production Status: None

Site Status: Inactive

Workings/exploration:

Exploration apparently consists only of regional geologic mapping (Detterman and Reed, 1964, 1980).

Production notes:

Reserves:

Additional comments:

References:

Detterman and Reed, 1964; Berg and Cobb, 1967; Detterman and Cobb, 1972; Detterman and Reed, 1980; Cobb and Reed, 1981 (OFR 81-1343A); Cobb and Reed, 1981 (OFR 81-1343B).

Primary reference: Detterman and Reed, 1964

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/03/03

Site name(s): Unnamed (east of upper Iniskin Bay)

Site type: Occurrence

ARDF no.: IL014

Latitude: 59.7519

Quadrangle: IL D-2

Longitude: 153.3938

Location description and accuracy:

This occurrence is at an elevation of about 200 feet in an east tributary to Iniskin Bay. It is in the SE1/4 sec. 8, T. 5 S., R. 24 W., Seward Meridian. The location is accurate within 0.5 mile. This occurrence is location 11 of Detterman and Cobb (1972).

Commodities:

Main: Ag?, Au?, Fe

Other: Ti

Ore minerals: Magnetite

Gangue minerals:

Geologic description:

This occurrence consists of small bodies of magnetite-bearing skarn in calcic rocks of the Lower Jurassic Talkeetna Formation about two miles from a Jurassic granitic pluton (Detterman and Reed, 1980). The Talkeetna Formation consists generally of andesite flows, agglomerate, tuff, volcanic breccia, and minor sedimentary rocks (Detterman and Hartsock, 1966).

Alteration:

Formation of skarn in calcic rocks.

Age of mineralization:

Probably Jurassic, during waning stages of intrusion of Jurassic granitic rocks.

Deposit model:

Fe skarn (Cox and Singer, 1986; model 18d).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

18d

Production Status: None

Site Status: Inactive

Workings/exploration:

Exploration probably consists only of regional geologic mapping (Detterman and Hartsock, 1966).

Production notes:

Reserves:

Additional comments:

References:

Detterman and Hartsock, 1966; Detterman and Cobb, 1972; Detterman and Reed, 1980.

Primary reference: Detterman and Hartsock, 1966

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/03/03

Site name(s): Phoenix**Site type:** Prospect**ARDF no.:** IL015**Latitude:** 59.6971**Quadrangle:** IL C-2**Longitude:** 153.5749**Location description and accuracy:**

This prospect is at an elevation of about 2,100 feet about 2 miles northeast of Williamsport on Iliamna Bay. It is in the NE1/4 SW1/4 sec. 32, T. 5 S., R. 25 W., Seward Meridian. The location is probably accurate within 0.5 mile. It is locality 26 of Detterman and Cobb (1972).

Commodities:**Main:** Fe**Other:** Ti**Ore minerals:** Magnetite**Gangue minerals:****Geologic description:**

This prospect is in an area underlain mainly by Lower or Middle Jurassic quartz diorite containing small roof pendants of mafic and ultramafic rocks (Detterman and Reed, 1980). The mafic and ultramafic rocks include gabbro, hornblende gabbro, hornblendite, and pyroxenite. The deposit consists of veins, disseminations, and irregular pods or lenses of magnetite in the mafic and ultramafic rocks. The deposit possibly is large but low grade (Berg and Cobb, 1967).

Alteration:**Age of mineralization:**

Jurassic.

Deposit model:

Magnetite deposit in mafic and ultramafic igneous rocks; possible affinity with Alaska PGE (Cox and Singer, 1986, model 9).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

9?

Production Status: None

Site Status: Inactive

Workings/exploration:

Berg and Cobb (1967) reported that the locality had been staked; there is no record of any workings.

Production notes:

Reserves:

Additional comments:

In addition to nine Phoenix claims, other claims in this area include the Bell 1-4, Heliport 1-9, D Cross 1-2, Smile 1-7, and Strip 1-3 (McFaul and others, 2000).

References:

Berg and Cobb, 1967; Detterman and Cobb, 1972; Detterman and Reed, 1980; McFaul and others, 2000.

Primary reference: Detterman and Reed, 1980

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/08/03

Site name(s): Unnamed (east-southeast of Summit Lakes)

Site type: Occurrence

ARDF no.: IL016

Latitude: 59.6975

Quadrangle: IL C-2

Longitude: 153.6421

Location description and accuracy:

This occurrence is at an elevation of about 2,100 feet on or near hill 2110, about 1 mile east-southeast of Summit Lakes. It is in the SE1/4 sec. 35, T. 5 S., R. 26 W., Seward Meridian. The occurrence is locality 33 of MacKevett and Holloway (1977), and is accurate within about 1 mile.

Commodities:

Main: Cu

Other:

Ore minerals: Chalcopyrite?, malachite?

Gangue minerals:

Geologic description:

This occurrence is based on mining claims located for copper (U.S. Bureau of Mines, 1973; MacKevett and Holloway, 1977). The area of claims is probably underlain by Jurassic quartz diorite (Detterman and Reed, 1980). The occurrence probably consists of small concentrations of copper minerals such as chalcopyrite or the oxidized copper carbonate, malachite.

Alteration:

Age of mineralization:

Jurassic or younger (Detterman and Reed, 1980).

Deposit model:

Porphyry copper? (Cox and Singer, 1986; model 17).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

17?

Production Status: None

Site Status: Probably inactive

Workings/exploration:

The area has been geologically mapped in reconnaissance (Detterman and Reed, 1980).
No workings are known at the site.

Production notes:

Reserves:

Additional comments:

References:

U.S. Bureau of Mines, 1973; MacKevett and Holloway, 1977; Detterman and Reed, 1980.

Primary reference: Detterman and Reed, 1980

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/08/03

Site name(s): Copper King; Keyes; Black Prince; Grubstakers Incorporated

Site type: Prospect

ARDF no.: IL017

Latitude: 59.6781

Quadrangle: IL C-2

Longitude: 153.6634

Location description and accuracy:

The Copper King prospect is at an elevation of about 1,250 feet, about 1.25 miles west-southwest of Williamsport on Iliamna Bay. The prospect is near the west end of the boundary between secs. 2 and 11, T. 6 S., R. 26 W., Seward Meridian. The location is accurate for the center of the prospect area, which probably extends from about 1,000 feet to 1,500 feet in elevation. It is location 7 of Detterman and Cobb (1972).

Commodities:

Main: Cu, Fe

Other: Ag, Au

Ore minerals: Azurite, chalcopyrite, magnetite, malachite, marcasite, pyrite, pyrrhotite

Gangue minerals: Epidote, garnet, quartz

Geologic description:

This prospect consists mainly of epidote-garnet-quartz skarn containing magnetite, chalcopyrite, pyrite, pyrrhotite, marcasite, and the oxidized copper minerals azurite and malachite. The deposit is in carbonate masses which occur as roof pendants and isolated lenses in Jurassic quartz diorite (Martin and Katz, 1910, 1912; Jasper, 1955; Detterman and Reed, 1980). The host rocks are part of the Permian(?) to Jurassic Kokhonak Complex composed of schist, gneiss, phyllite, and marble (Detterman and Reed, 1980).

The maximum width of mineralization reported by Jasper (1955) is 70 feet; most zones are much thinner. According to Jasper, magnetite and chalcopyrite, accompanied by quartz and subordinate pyrite, replace limestone; garnet-magnetite skarn is developed locally; and some granitic(?) rock has been epidotized. The chalcopyrite is locally oxidized to malachite and azurite. Marcasite, reported by Jasper (1955), possibly formed by late hypogene replacement of pyrrhotite and pyrite.

Samples of magnetite- and pyrite-rich rock collected by Jasper (1955, p. 5) assayed up to a detectable trace of gold, 0.96 ounce of silver per ton, and 0.89 percent copper. The prospect owners reported higher copper values in selected samples of material (Jasper, 1955), but in deposits too small to mine (Berg and Cobb, 1967).

Alteration:

Marble roof pendants and isolated lenses in quartz diorite are silicified and pyritized. Some masses have been altered to garnet and magnetite rock. Epidote skarn locally formed in marble and in the intrusion(?). Oxidation of copper.

Age of mineralization:

Probably Jurassic.

Deposit model:

Cu skarn?, Fe skarn? (Cox and Singer, 1986; models 18b, 18d).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

18b?, 18d?

Production Status: None**Site Status:** Inactive**Workings/exploration:**

The prospect was located by Charles Keys in 1905. Martin and Katz (1910) reported two prospect pits near the contact of hornblende quartz diorite and greenstone. By 1912, Martin and Katz (1912) reported nine claims on the steep slope. The prospect was apparently inactive and abandoned until about 1955, when Grubstakers, Inc., filed four claims on the property. Jasper (1955) examined the property and concluded that it did not warrant any further work. His channel samples yielded up to trace amounts of gold, 0.96 ounce of silver per ton, and 0.89 percent copper.

Production notes:**Reserves:****Additional comments:****References:**

Martin and Katz, 1910; Martin and Katz, 1912; Jasper, 1955; Detterman and Reed, 1964; Berg and Cobb, 1967; Detterman and Cobb, 1972; Cobb, 1976; MacKevett and Holloway, 1977; Detterman and Reed, 1980.

Primary reference: Martin and Katz, 1912; Jasper, 1955**Reporter(s):** C.C. Hawley, Hawley Resource Group, Anchorage, Alaska**Last report date:** 06/08/03

Site name(s): Diamond Point**Site type:** Prospect**ARDF no.:** IL018**Latitude:** 59.6447**Quadrangle:** IL C-2**Longitude:** 153.6294**Location description and accuracy:**

This prospect is near sea level on Diamond Point between Cottonwood and Iliamna Bays. The location is probably accurate within 1,000 feet; it corresponds to number 8 of Detterman and Cobb (1972).

Commodities:**Main:** Ag, Au, Cu**Other:** Sn**Ore minerals:** Pyrite**Gangue minerals:****Geologic description:**

The country rocks in the area of Diamond Point include Jurassic quartz monzonite, andesite of the Jurassic Talkeetna Formation, and undivided Tertiary(?) volcanic rocks (Detterman and Reed, 1980). The contact between the quartz monzonite and the andesite is steep and strikes north-northeast. It is roughly parallel to a fault that separates the Talkeetna Formation from basalt of the Triassic Cottonwood Bay Formation.

Martin and Katz (1912) described an 8- to 12-foot-wide shear zone on the Iliamna Bay side of the prospect and about a 100-foot-wide shear zone on the Cottonwood Bay side. The 100-foot-wide zone contains narrow veins and stringers of pyrite. Martin and Katz (1910, 1912) reported that rocks assayed privately contained about 0.1 ounce of gold per ton. Detterman and Reed (1964) characterized the occurrence at Diamond Point as an association of gold, silver, and copper along with other metals. Their sample 118, collected on or near Diamond Point, contained 100 parts per million (ppm) copper and 15 ppm tin. Samples that they collected to the north on Iliamna Bay (nos. 122 & 123) contained 150 ppm copper and as much as 20 ppm tin.

Alteration:**Age of mineralization:**

Probably Jurassic.

Deposit model:

Polymetallic vein? (Cox and Singer, 1986; model 22c).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

22c?

Production Status: None

Site Status: Inactive

Workings/exploration:

At least one claim was staked on Diamond Point on or before 1909 (Martin and Katz, 1910). It may have been prospected with shallow pits and trenches which are no longer visible. Detterman and Reed (1964) recognized mineralization in the area, but appear to have collected only one sample (no. 118) at or near the original prospect site.

Production notes:

Reserves:

Additional comments:

References:

Martin and Katz, 1910; Martin and Katz, 1912; Detterman and Reed, 1964; Berg and Cobb, 1967; Detterman and Cobb, 1972; Detterman and Reed, 1980.

Primary reference: Martin and Katz, 1912; Detterman and Reed, 1964

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/08/03

Site name(s): Unnamed (west of Williamsport)**Site type:** Occurrence**ARDF no.:** IL019**Latitude:** 59.6757**Quadrangle:** IL C-3**Longitude:** 153.7583**Location description and accuracy:**

This occurrence is at an elevation of about 2,400 feet about 4.75 miles west-southwest of Williamsport on Iliamna Bay. The site is in the SE1/4 sec. 6, T. 6 S., R. 26 W., Seward Meridian. The location is accurate within about 0.5 mile. The occurrence is locality 25 of Detterman and Cobb (1972), and is briefly described by MacKevett and Holloway (1977).

Commodities:**Main:** Fe**Other:** Ti**Ore minerals:** Magnetite**Gangue minerals:****Geologic description:**

This occurrence comprises magnetite-bearing Jurassic mafic and ultramafic rocks that apparently are preserved as roof pendants in, or border phases of, a Jurassic quartz diorite batholith (Detterman and Reed, 1980). The mafic and ultramafic rocks include gabbro, hornblende gabbro, hornblendite, and pyroxenite. Magnetite occurs in veins, disseminations, and irregular lenses or pods. The deposit is similar to those at IL021, IL025, and IL027; it is probably large but relatively low grade (Berg and Cobb, 1967).

Alteration:**Age of mineralization:**

Early or Middle Jurassic.

Deposit model:**Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):****Production Status:** None

Site Status: Inactive

Workings/exploration:

Berg and Cobb (1967) reported that the occurrence had been staked, but there are no reports of any workings.

Production notes:

Reserves:

Additional comments:

References:

Berg and Cobb, 1967; Detterman and Cobb, 1972; MacKevett and Holloway, 1977; Detterman and Reed, 1980.

Primary reference: Detterman and Reed, 1980

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/06/03

Site name(s): Duryea; Duryea & McNeil; Ida G; Silver Bell; War Eagle; Silver Creek; Hi-Hope; Bear Creek

Site type: Prospect

ARDF no.: IL020

Latitude: 59.6858

Quadrangle: IL C-3

Longitude: 153.9227

Location description and accuracy:

The Duryea prospect is at an elevation of about 2,000 feet at the head of an unnamed north fork of Silver Creek. It is about 3.5 miles up the Native Trail that connects Meadow Lake with the old Iliamna village site. The prospect is mainly in the NW1/4 SW1/4 sec. 5, T. 6 S., R. 27 W., Seward Meridian, but it may extend west into section 6. The location is probably accurate within 0.5 mile. The Duryea prospect is number 6 of Detterman and Cobb (1972).

Commodities:

Main: Ag, Au, Pb, Zn

Other: Cu

Ore minerals: Arsenopyrite, chalcopyrite, galena, limonite, manganese iron oxide, pyrite, sphalerite

Gangue minerals:

Geologic description:

The country rocks at the Duryea prospect are the Upper Triassic Bruin Limestone Member of the Kamishak Formation, and greenstone that conformably underlies(?) the limestone (Detterman and Reed, 1980). The Bruin Limestone strikes northeast and consists mainly of massive- to thin-bedded, light- to dark-gray limestone interbedded with banded green and white chert. The limestone and greenstone are intruded by a myriad of vertical dikes that crosscut the formation and by larger dikes and sills that parallel the strike of the limestone (Martin and Katz, 1910, 1912).

The mineral occurrences apparently are vein and replacement deposits in limestone. Exposures and shallow pits aligned about N45E suggest a fault-controlled mineralized zone about 5,000 feet long, marked by gossan of manganese iron oxide and limonite. The most abundant ore minerals below the oxidized zone appear to be sphalerite, galena, pyrite, and minor amounts of chalcopyrite. Brooks (1913) was told of arsenopyrite on the property. Martin and Katz (1912) reported owner's claims of samples assaying 80 to 196 ounces of silver per ton, about 1 ounce of gold per ton, 35 to 50 percent lead, and 15 to

20 percent zinc.

Alteration:

Skarn-like replacement of limestone. Oxidation of sulfide minerals.

Age of mineralization:

Late Triassic or younger.

Deposit model:

Zn-Pb skarn? (Cox and Singer, 1986; model 18c).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

18c?

Production Status: None

Site Status: Inactive

Workings/exploration:

Claims were first located in about 1901-02 (Martin and Katz, 1910). Brooks (1913) reported that two tunnels were driven and intersected ore at a depth of 150 feet. Development work, including plans for a test shipment, trail improvements, and underground development, probably continued through 1922 (Brooks, 1914, 1915, 1923; Brooks and Capps, 1924). Moxham and Nelson (1952) reported that the underground workings had caved prior to their investigation in 1949, and Butherus and others (1981) could find no certain evidence of the deposits at the Duryea, although they reported mineralization in the area.

Production notes:**Reserves:****Additional comments:****References:**

Martin and Katz, 1910; Martin and Katz, 1912; Brooks, 1913; Brooks, 1914; Brooks, 1915; Brooks, 1923; Brooks and Capps, 1924; Capps, 1935; Bain, 1946; Moxham and Nelson, 1952; Wedow and others, 1952; Berg and Cobb, 1967; Detterman and Cobb, 1972; Cobb, 1976; MacKevett and Holloway, 1977; Detterman and Reed, 1980; Butherus and others, 1981.

Primary reference: Martin and Katz, 1912

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/06/03

Site name(s): Unnamed (north of mouth of Iliamna River)

Site type: Occurrence

ARDF no.: IL021

Latitude: 59.7374

Quadrangle: IL C-3

Longitude: 153.9567

Location description and accuracy:

This occurrence is at an elevation of about 150 feet about 0.3 mile southwest of benchmark Pile (762 elevation) and 0.5 mile north of the mouth of Iliamna River. The occurrence is near the center of the E1/2 SE1/4 sec. 13, T. 5 S., R. 28 W., Seward Meridian. The location is accurate within about 0.5 mile. The occurrence is number 27 of Detterman and Cobb (1972).

Commodities:

Main: Fe

Other: Ti

Ore minerals: Magnetite

Gangue minerals:

Geologic description:

This occurrence consists of magnetite in Jurassic mafic-ultramafic rocks that may be a roof pendant in a Jurassic quartz diorite batholith (Detterman and Reed, 1980). The mafic-ultramafic rocks consist of gabbro, hornblende gabbro, and pyroxenite. Magnetite occurs in veins, disseminations, and lenticular pods. The occurrence is large but low grade (Berg and Cobb, 1967).

Alteration:

Age of mineralization:

Jurassic, the age of the host rock.

Deposit model:

Magnetite deposit in mafic-ultramafic igneous rock; some affinity to Alaskan PGE (Cox and Singer, 1986, model 9).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

9

Production Status: None

Site Status: Inactive

Workings/exploration:

Berg and Cobb (1967) reported that the occurrence had been staked.

Production notes:

Reserves:

Additional comments:

References:

Berg and Cobb, 1967; Detterman and Cobb, 1972; Detterman and Reed, 1980.

Primary reference: Detterman and Reed, 1980

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/06/03

Site name(s): Durand; Durant**Site type:** Prospect**ARDF no.:** IL022**Latitude:** 59.7088**Quadrangle:** IL C-3**Longitude:** 154.0136**Location description and accuracy:**

The Durand (Durant) prospect is at an elevation of about 500 feet on the north-facing slope above Durants Cove in Pile Bay. The site is in the SE1/4 sec. 27, T. 5 S., R. 28 W., Seward Meridian. The location is number 4 of Detterman and Cobb (1972), and is accurate within 0.5 mile.

Commodities:**Main:** Cu**Other:** Fe**Ore minerals:** Azurite, chalcopyrite, magnetite, malachite, pyrite**Gangue minerals:** Quartz**Geologic description:**

The country rock at the Durand prospect is the Upper Triassic Cottonwood Bay Greenstone, which consists chiefly of porphyritic and amygdaloidal basalt flows and minor mafic intrusive rock (Detterman and Reed, 1980). The prospect is a 10-foot-wide quartz vein that strikes N80E and dips 45N; it contains disseminated masses of pyrite and chalcopyrite, locally oxidized to azurite and malachite (Martin and Katz, 1912). A small magnetite body that crops out near the vein has been staked (Cobb, 1976). Martin and Katz (1912, p.123) suggested that two quartz veins in greenstone about 2 miles to the south might be extensions of the veins at the Durand prospect. Dioritic intrusions of Jurassic age are exposed northeast and southwest of the Triassic greenstone (Detterman and Reed, 1980), and Jurassic intrusions could underlie the Durand prospect area at shallow depth.

Alteration:

Oxidation of copper.

Age of mineralization:

The Durand vein is Late Triassic or younger. The magnetite deposit is probably Jurassic.

Deposit model:

Polymetallic vein? (Cox and Singer, 1986; model 22c). The magnetite deposit is possibly Alaska PGE (Cox and Singer, 1986; model 9).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

22c?, 9?

Production Status: None

Site Status: Inactive

Workings/exploration:

Martin and Katz (1912) reported shallow exploration pits on two claims in the prospect area.

Production notes:

Reserves:

Additional comments:

References:

Martin and Katz, 1912; Detterman and Cobb, 1972; Cobb, 1976; Detterman and Reed, 1980.

Primary reference: Martin and Katz, 1912

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/05/03

Site name(s): Dutton; Dutton, Goodro, and Thomas

Site type: Prospect

ARDF no.: IL023

Latitude: 59.6789

Quadrangle: IL C-3

Longitude: 153.9567

Location description and accuracy:

This prospect is at an elevation of about 2,000 feet 2.5 miles northeast of Meadow Lake. It is at the head of an unnamed south-flowing tributary to Silver Creek, in the SE1/4 SE1/4, sec. 1, T. 6 S., R. 28 W., Seward Meridian. The location is probably accurate within 0.5 mile for the approximate center of a group of claims that extends as much as 2.5 miles. The Dutton prospect is locality 5 of Detterman and Cobb (1972).

Commodities:

Main: Cu

Other: Ag, Au, Fe, Mo

Ore minerals: Arsenopyrite, azurite, chalcopyrite, chrysocolla, limonite, magnetite, malachite, molybdenite, pyrite, pyrrhotite

Gangue minerals: Calcite, epidote, garnet, quartz

Geologic description:

The Dutton prospect is a skarn deposit along the contact of the Triassic Cottonwood Bay Greenstone and Kamishak Formation limestone. The deposit is on the north flank of a Jurassic quartz diorite batholith whose north contact can be traced for at least 12 miles (Detterman and Reed, 1980). The deposit consists of 'garnet rock,' magnetite- and garnet-magnetite rock, and, at the greenstone-limestone contact, epidotized rocks enriched in chalcopyrite, pyrite, calcite, quartz, and amphibole. Martin and Katz (1912) suggested that most of the mineralization was in the limestone. Butherus and others (1981) proposed that the greenstone was more highly mineralized.

Butherus and others (1981) described rocks exposed in the Dutton adit, which was open at the time of their investigation. The rocks exposed along the southeast-trending adit, commencing at a fault, consisted of buff to light gray limestone about 105 feet thick, followed by 60 feet of massive garnet-magnetite rock containing some unreplaced limestone. The garnet-magnetite rock grades into a 90-foot-thick zone of epidotized rock containing fracture fillings of magnetite, quartz, and calcite. Farther southeast is 200 feet of propylitically-altered diorite in sharp contact with 200 feet of light-gray limestone. In general, pyrite and subordinate chalcopyrite, pyrrhotite, and magnetite occur in fracture-

fillings in skarn; molybdenite has also been reported (Martin and Katz, 1912). The sulfide minerals are locally oxidized to malachite, azurite, chrysocolla, and limonite.

Metal contents in samples collected in 1981 were relatively low (Butherus and others, 1981). A selected sample from a pit northeast of the adit contained 0.80 percent copper and 9.6 parts per million silver; the rock contained visible pyrite, arsenopyrite, chalcopyrite, and chrysocolla. A selected sample of manganiferous limonite gossan collected southeast of the adit assayed 0.5 percent lead and 36 parts per million silver. A representative sample of a 60-foot-thick garnet-magnetite layer contained about 225 parts per million copper.

Substantially higher assays were reported by Martin and Katz (1910, 1912), who sampled when the prospect was active. Their assays ranged from 4 to 6 percent copper, 6 to 13.5 percent lead, up to 2 ounces of silver per ton, and less than 0.5 ounce of gold per ton.

Studies by both Martin and Katz (1910, 1912) and Butcherus and others (1981) indicated substantial widths of altered and mineralized rock. Martin and Katz (1912) reported an average mineralized width of about 200 feet and a maximum of 400 feet. They also reported that mineralization along the claims is best in two zones: one 3,000 feet long and one 1,000 feet long. Within these zones, the mineralization is discontinuous. Butcherus and others (1981) recognized sufficient mineralization and alteration to propose prospecting the 12-mile-long contact zone of the nearby Jurassic batholith.

Alteration:

Propylitic alteration of diorite; development of skarn in both limestone and greenstone. Oxidation of iron and copper minerals.

Age of mineralization:

Probably Jurassic.

Deposit model:

Cu skarn, Fe skarn? (Cox and Singer, 1986; model 18b, 18d).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

18b, 18d?

Production Status: None**Site Status:** Inactive**Workings/exploration:**

The Dutton prospect was discovered in 1901 and explored intensively until about 1910. Some claims (as the 12-claim Karen group) were patented. One adit was still open in 1981.

Production notes:**Reserves:**

Additional comments:**References:**

Martin and Katz, 1910; Martin and Katz, 1912; Berg and Cobb, 1967; Detterman and Cobb, 1972; Cobb, 1976; Detterman and Reed, 1980; Butherus and others, 1981.

Primary reference: Martin and Katz, 1912; Butherus and others, 1981

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/06/03

Site name(s): Unnamed (north of Meadow Lake)**Site type:** Occurrence**ARDF no.:** IL024**Latitude:** 59.6559**Quadrangle:** IL C-3**Longitude:** 154.0587**Location description and accuracy:**

This occurrence is about halfway between Meadow Lake and Pile Bay in the headwaters of a northeast tributary to Upper Copper Lake. It probably is at an elevation of about 1,000 feet in the SW1/4 NW1/4 sec. 16, T. 6 S., R. 28 W., Seward Meridian. The accuracy of the occurrence is uncertain (see Geologic description). The site is location 24 of Detterman and Cobb (1972).

Commodities:**Main:** Fe**Other:** Ti**Ore minerals:** Magnetite**Gangue minerals:****Geologic description:**

A Cretaceous or Tertiary granodiorite batholith or large stock intrudes the Triassic Cottonwood Bay Greenstone near this occurrence (Detterman and Reed, 1980). Up to about 5 percent magnetite is disseminated in the greenstone within about 100 to 200 feet of its contact with the granodiorite. The deposit is probably large but low grade (Berg and Cobb, 1967). Location 24 of Detterman and Cobb (1972) appears to be in granodiorite mapped by Detterman and Reed (1980); instead it probably is in Cottonwood Bay Greenstone, somewhat to the east.

Alteration:**Age of mineralization:**

Probably Triassic or younger.

Deposit model:**Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):**

Production Status: None

Site Status: Inactive

Workings/exploration:

Berg and Cobb (1967) reported that the occurrence had been staked, but there is no report of any workings.

Production notes:

Reserves:

Additional comments:

References:

Berg and Cobb, 1967; Detterman and Cobb, 1972; Detterman and Reed, 1980.

Primary reference: Detterman and Reed, 1980

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/06/03

Site name(s): Unnamed (summit of The Cone)

Site type: Occurrence

ARDF no.: IL025

Latitude: 59.5313

Quadrangle: IL C-3

Longitude: 153.8437

Location description and accuracy:

This occurrence is centered on the 3,028-foot summit of The Cone west of Ursus Cove. The occurrence is in the NE1/4 sec. 34, T. 7 S., R. 27 W., Seward Meridian, and the location is accurate within about 0.5 mile. The occurrence is number 31 of MacKevett and Holloway (1977).

Commodities:

Main: Fe

Other: Ti

Ore minerals: Magnetite?

Gangue minerals:

Geologic description:

This occurrence consists of magnetite(?) in Jurassic quartz diorite (Detterman and Reed, 1980). Immediately north and west of The Cone, the quartz diorite intrudes the Permian (?) to Jurassic Kakhonak metamorphic complex and Upper Triassic Cottonwood Bay Greenstone. Locally, the quartz diorite includes phases as mafic as diorite. Numerous claims were staked in the area, but there is no information about the claims other than that they appear to have been located for a magnetic iron deposit.

Alteration:

Age of mineralization:

Jurassic or younger (Detterman and Reed, 1980).

Deposit model:

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

Production Status: None

Site Status: Probably inactive

Workings/exploration:

Exploration probably is limited to reconnaissance geologic mapping and collecting surface samples. Numerous claims were staked in the area (U.S. Bureau of Mines, 1973; MacKevett and Holloway, 1977).

Production notes:

Reserves:

Additional comments:

References:

U.S. Bureau of Mines, 1973; MacKevett and Holloway, 1977; Detterman and Reed, 1980.

Primary reference: Detterman and Reed, 1980

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/07/03

Site name(s): Unnamed (head of Ursus Cove)**Site type:** Occurrence**ARDF no.:** IL026**Latitude:** 59.5289**Quadrangle:** IL C-3**Longitude:** 153.7978**Location description and accuracy:**

The location of this occurrence at the head of Ursus Cove is uncertain. Detterman and Cobb (1972, no. 15) reported a copper occurrence about in the SW1/4 NE1/4 sec. 1, T. 8 S., R. 27 W., Seward Meridian, and cite Detterman and Reed (1964) as their source. Detterman and Reed (1964), however, show a copper occurrence near sea level at the mouth of an unnamed creek entering Ursus Cove in the SW1/4 sec. 31, T. 7 S., R. 26 W., and no location in section 1, as pointed out by Cobb (1976, p. 29). For this record, the site is about as shown by Detterman and Reed (1964).

Commodities:**Main:** Cu**Other:****Ore minerals:** Copper sulfides**Gangue minerals:****Geologic description:**

Strata exposed near this reported occurrence are layered volcanic and sedimentary rocks in north-northeast-trending open folds that are cut by north-northeast-striking faults (Detterman and Reed, 1980). The strata include limestone-rich units of the Upper Triassic Kamishak Formation, and andesitic volcanic rocks and minor sedimentary rocks of the Middle Jurassic Talkeetna Formation. Detterman and Reed (1964) reported copper sulfides along the south shore of Ursus Cove, but because Detterman and Reed's location is uncertain, the host rocks are unknown.

Alteration:**Age of mineralization:****Deposit model:****Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):**

Production Status: None

Site Status: Inactive

Workings/exploration:

Reconnaissance geologic mapping (Detterman and Reed, 1964, 1980).

Production notes:

Reserves:

Additional comments:

References:

Detterman and Reed, 1964; Detterman and Cobb, 1972; Cobb, 1976; Detterman and Reed, 1980.

Primary reference: Detterman and Reed, 1964

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/07/03

Site name(s): Unnamed (southwest of The Cone)

Site type: Occurrence

ARDF no.: IL027

Latitude: 59.5160

Quadrangle: IL C-3

Longitude: 153.8761

Location description and accuracy:

This occurrence is at an elevation of about 2,000 feet, about 1.5 miles southwest of the 3,028-foot summit of The Cone. The occurrence is near the center of the W1/2 NE1/4 sec. 4, T. 8 S., R. 27 W., Seward Meridian. The occurrence is the same as number 23 of Detterman and Cobb (1972), and is accurate within about 0.5 mile.

Commodities:

Main: Fe

Other: Ti

Ore minerals: Magnetite

Gangue minerals:

Geologic description:

This occurrence consists of magnetite in Jurassic quartz diorite that locally contains granodiorite and diorite phases (Detterman and Reed, 1980). The magnetite occurs as disseminations, veins, and lenses. The occurrence is possibly large but low grade (Berg and Cobb, 1967).

Alteration:

Age of mineralization:

Probably Jurassic, the age of the host rocks.

Deposit model:

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

Production Status: None

Site Status: Inactive

Workings/exploration:

Berg and Cobb (1967) reported that the occurrence had been staked. No workings are known at the site.

Production notes:**Reserves:****Additional comments:****References:**

Berg and Cobb, 1967; Detterman and Cobb, 1972; Detterman and Reed, 1980.

Primary reference: Detterman and Reed, 1980

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/08/03

Site name(s): Unnamed (southeast of Upper Copper Lake)

Site type: Occurrence

ARDF no.: IL028

Latitude: 59.5894

Quadrangle: IL C-3

Longitude: 154.0959

Location description and accuracy:

This occurrence is at an elevation of about 1,000 feet on the north slope of the divide between Upper Copper Lake and Boot Lake. It is about in the center of the S1/2 NE1/4 sec. 7, T. 7 S., R. 28 W., Seward Meridian. The location is accurate within about 0.5 mile. The site is locality 13 of Detterman and Cobb (1972).

Commodities:

Main: Au?, Mo

Other: Cu?

Ore minerals: Chalcopyrite?, molybdenite, pyrite

Gangue minerals:

Geologic description:

This occurrence is near the contact between granitic plutons of Tertiary and Cretaceous or Tertiary age (Read, 1967; Detterman and Reed, 1980). It consists of pyritized, argillized, and sericitized(?) granitic intrusive rock in a 400-foot-long exposure along a fault-controlled, unnamed northerly-flowing stream. The granitic rocks are cut by a mafic dike. The altered rocks contain disseminated flakes of molybdenite. Copper and molybdenum occur in anomalous concentrations in stream-sediment samples collected below the occurrence (Reed, 1967), suggesting that the occurrence also contains chalcopyrite. Reed's rock samples, however, did not detect the gold reported by Detterman and Cobb (1972). The fault that controls the exposure may be a splay of a shear zone extending northeastward through the Meadow Lake valley (Reed, 1967).

Alteration:

Pyritization and argillic and sericitic(?) alteration.

Age of mineralization:

Probably Tertiary.

Deposit model:

Porphyry Cu-Mo (Cox and Singer, 1986; model 21a).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):
21a

Production Status: None

Site Status: Inactive

Workings/exploration:

Exploration consists of reconnaissance geologic mapping and rock and stream-sediment sampling. Reed's (1967) stream-sediment samples were anomalous for copper and molybdenum, but his rock samples did not detect the gold reported by Detterman and Cobb (1972).

Production notes:

Reserves:

Additional comments:

References:

Reed, 1967; Detterman and Cobb, 1972; Detterman and Reed, 1980.

Primary reference: Reed, 1967

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/06/03

Site name(s): Unnamed (north of Upper Copper Lake)

Site type: Occurrence

ARDF no.: IL029

Latitude: 59.6100

Quadrangle: IL C-4

Longitude: 154.1378

Location description and accuracy:

This occurrence is at an elevation of about 800 feet on an unnamed north tributary of Upper Copper Lake. The site is in the NE1/4 SW1/4 sec. 36, T. 6 S., R. 29 W., Seward Meridian. The location is accurate within about 0.5 mile. It is locality 12 of Detterman and Cobb (1972).

Commodities:

Main: Cu, Mo

Other: Ag

Ore minerals: Chalcopyrite?, molybdenite, pyrite

Gangue minerals:

Geologic description:

An unnamed north tributary to Upper Copper Lake drains a Tertiary, pyrite-rich granitic pluton that also contains disseminated flakes of molybdenite and chalcopyrite(?) (Reed, 1967). Stream-sediment samples collected by Reed in the area contained anomalous concentrations of copper, molybdenum, and silver, but he apparently did not analyze the mineralized intrusive rock. The granitic rock is extensively argillized and possibly sericitized.

Alteration:

Granitic host rock is extensively argillized and possibly sericitized. Reed (1967) noted extensive 'hydrogen metasomatism.'

Age of mineralization:

Tertiary.

Deposit model:

Porphyry Cu-Mo? (Cox and Singer, 1986; model 21a).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

21a?

Production Status: None

Site Status: Inactive

Workings/exploration:

Exploration in the area is limited to reconnaissance geologic mapping and collection of stream-sediment and possibly outcrop samples (Reed, 1967). Stream-sediment samples contained anomalous concentrations of copper, molybdenum, and silver.

Production notes:

Reserves:

Additional comments:

References:

Reed, 1967; Detterman and Cobb, 1972; MacKevett and Holloway, 1977; Cobb and Reed, 1981 (OFR 81-1343A); Cobb and Reed, 1981 (OFR 81-1343B).

Primary reference: Reed, 1967

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/06/03

Site name(s): Fog Lake**Site type:** Prospect**ARDF no.:** IL030**Latitude:** 59.5116**Quadrangle:** IL C-4**Longitude:** 154.3639**Location description and accuracy:**

This record represents an approximately 4,000-foot-long mineralized area along locally-named Fog Creek, a northwest-flowing tributary of Fog Lake (Fog Pond on some older maps). The site is in the approximate center of the area, in the NE1/4 SW1/4 sec. 3, T. 8 S., R. 30 W., Seward Meridian. The location is accurate within 0.1 mile for the center of the prospect area. The prospect is number 14 of Detterman and Cobb (1972) and number 12 of Reed (1967).

Commodities:**Main:** Au, Cu**Other:** Ag, Zn**Ore minerals:** Azurite, chalcopyrite, gold, malachite, pyrite, sphalerite**Gangue minerals:** Calcite, quartz**Geologic description:**

The Fog Lake prospect is mainly in volcanic rocks exposed in the canyon of locally-named Fog Creek, a southeast tributary of Fog Lake.

The volcanic rocks and subordinate interbedded sedimentary rocks unconformably overlie Jurassic plutonic rocks at shallow depth (Retherford and Klemmick, 1999). From their base up, the strata are: (1) plutonic- cobble conglomerate of probable early Tertiary age; (2) green polymict conglomerate of probable early Tertiary age that possibly correlates with the upper conglomerate member of the Copper Lake Formation (Detterman and Reed, 1980); (3) dacite/dacite breccia of probable late Eocene to early Oligocene age; (4) dacite/quartz porphyry breccia similar in age to unit 3; (5) laharic flow breccia; (6) quartz-porphyry tuff breccia of probable late Eocene to early Oligocene age; (7) rhyo-dacite crystal tuff; and (8) argillized dacite. The volcanic rocks are cut by dacite dikes 2 to 20 feet in width (Retherford and Klemmick, 1999). Depending on their original composition, the volcanic rocks are widely propylitized and locally sericitized, silicified, and argillized. The dacite/dacite breccia of unit 3 may be coeval with intrusive rocks exposed about 6 miles east of Fog Lake that have been dated at about 36 Ma (Detterman and Reed, 1980).

The Fog Lake deposit consists of gold- and sulfide-bearing quartz-calcite veins and sulfide disseminations (Butherus and others, 1981; Moller and others, 1982; Freeman and Farnham, 1983; Retherford and Klemmick, 1999). Pyrite and chalcopyrite are disseminated in all of the volcanic rocks but are most abundant in units 1 through 5. Swarms of sulfide veinlets up to an inch or so thick occur in northeast, northwest, and east-west fracture sets. Maximum vein density is about 8 per foot. Sulfides, mainly pyrite and chalcopyrite, along with subordinate olive-colored sphalerite, form small masses in quartz-calcite gangue. Azurite and malachite occur locally in gossan. Gold appears to correlate with sulfide content, and probably is free milling; it can be panned along about 2,200 feet of Fog Creek. Rock samples locally contain more than 1 ounce of gold per ton (Reed, 1967; Retherford and Klemmick, 1999). The deposit has been explored by shallow trenches. The maximum gold content in various samples from the trenches was 1.5 parts per million, and the maximum copper content was 11 percent (Freeman and Farnham, 1983). A gold-in-soil anomaly along Fog Creek is about one-half mile long and 700 feet wide. An exceptional soil sample contained 18.8 parts per million gold. Gold in soil correlates moderately well with copper and zinc.

The Fog Lake deposit apparently is aligned northwesterly, subparallel to a fault along Fog Creek nearly coincident with the axis of a syncline. The deposit locally may extend east to northeast along cross faults or dacite dikes.

Alteration:

Extensive propylitic alteration in the darker volcanic rocks; local argillic, sericitic, and silicic alteration. Oxidation of iron and copper minerals.

Age of mineralization:

Possibly about 36 Ma, the age of intrusive rocks about six miles east of Fog Lake.

Deposit model:

Epithermal gold-copper deposit, possibly grading downward into porphyry copper-gold deposit (Cox and Singer, 1986; models 25b and 20c).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

25b, 20c?

Production Status: None**Site Status:** Inactive**Workings/exploration:**

The deposit was discovered in 1967 by B. L. Reed of the U.S. Geological Survey. Reed collected samples that contained anomalous copper and silver and as much as 37.7 parts per million gold (Reed, 1967). The prospect was subsequently staked by St. Eugene Mining Company, but abandoned without significant work. It was explored by Resource Associates of Alaska (RAA) for several years (Butherus and others, 1981; Moller and others, 1982; Freeman and Farnham, 1983). Soil samples were collected on a grid totaling more than 24,000 lineal feet (Butherus and others, 1981). Soil sampling was followed by de-

tailed geologic mapping along Fog Creek, by trenching, and by magnetic and VLF surveys (Moller and others, 1982). More trenches then were excavated (Freeman and Farnham, 1983). Although drilling was recommended in several reports, the property has not been drilled to date (2003).

Production notes:

Reserves:

Additional comments:

The work on the property is summarized in a report prepared for Bristol Bay Native Corporation (Retherford and Klemmick, 1999).

References:

Reed, 1967; Detterman and Cobb, 1972; Detterman and Reed, 1980; Butherus and others, 1981; Moller and others, 1982; Freeman and Farnham, 1983; Retherford and Klemmick, 1999.

Primary reference: Moller and others, 1982; Retherford and Klemmick, 1999

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/06/03

Site name(s): Aukney**Site type:** Prospect**ARDF no.:** IL031**Latitude:** 59.4188**Quadrangle:** IL B-6**Longitude:** 155.2201**Location description and accuracy:**

The Aukney prospect is near lake level on the south shore of Lake Iliamna north of Big Mountain, about 1.7 miles west-southwest of Eagle Bluff. For this record, it is on the shoreline of the lake, in the NW1/4 sec. 8, T. 9 S., R. 35 W., Seward Meridian. The accuracy is uncertain; the prospect could be about a mile farther west-southwest, in the Iliamna B-7 quadrangle (see Geologic description).

Commodities:**Main:** Au?**Other:****Ore minerals:** Gold?, jarosite, limonite, pyrite**Gangue minerals:****Geologic description:**

Rocks tentatively mapped as Jurassic Talkeetna Formation strike east-northeast and are exposed in outcrops along Lake Iliamna north of Big Mountain, a volcanic massif of Tertiary age (Reed and Detterman, 1980). Rocks exposed along the shoreline to the west-southwest are undivided Tertiary volcanic rocks.

Martin and Katz (1910, p. 198) described the rocks at the Aukney prospect as tuffaceous and cherty beds containing finely disseminated pyrite. The beds strike northeast and dip 75SE to vertical. If these rocks are the Talkeetna Formation as mapped by Detterman and Reed (1980), this record's location of the site is probably accurate. If the strata are Tertiary, however, the claim could be about a mile to the west-southwest.

The deposit was prospected by blasting the shoreline cliffs (Martin and Katz, 1910, 1912). The cliffs are stained yellow, probably by jarosite, a common component of limonite formed by the oxidation of pyrite-rich deposits.

Alteration:

Pyritization of tuff and chert.

Age of mineralization:

Jurassic or Tertiary, depending on the age of the volcanic hostrock.

Deposit model:

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

Production Status: None

Site Status: Inactive

Workings/exploration:

The Aukney claim was located on October 16, 1908 (Martin and Katz, 1910; 1912).
The only work reported was blasting the shoreline cliff face.

Production notes:

Reserves:

Additional comments:

References:

Martin and Katz, 1910; Martin and Katz, 1912; Cobb, 1976; Detterman and Reed, 1980.

Primary reference: Martin and Katz, 1910

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/08/03

Site name(s): Unnamed (northwest slope of Big Mountain)

Site type: Prospect

ARDF no.: IL032

Latitude: 59.4063

Quadrangle: IL B-6

Longitude: 155.2343

Location description and accuracy:

This prospect is about 1.25 miles north-northwest of the peak of Big Mountain (VABM 2161). The prospect is at an elevation of about 650 feet in the SE1/4 sec. 7, T. 9 S., R. 35 W., Seward Meridian. The location is accurate within about 1 mile, and corresponds to locality 29 of MacKevett and Holloway (1977).

Commodities:

Main: Au

Other:

Ore minerals: Gold

Gangue minerals: Quartz?

Geologic description:

Big Mountain is composed of Tertiary basalt and andesite flows, tuff, and volcanic rubble and breccia (Detterman and Reed, 1980). Near the prospect, the rocks are cut by faults that strike northeast. Lode claims were staked at this site before 1973 (U.S. Bureau of Mines, 1973). The limited information available suggests that the Tertiary volcanic rocks are cut by gold-bearing quartz(?) veins (MacKevett and Holloway, 1977).

Alteration:

Age of mineralization:

Tertiary.

Deposit model:

Epithermal low-sulfide gold-quartz(?) veins (Cox and Singer, 1986, model 36a).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

36a?

Production Status: None

Site Status: Probably inactive

Workings/exploration:

Claims were located during or before 1973 (U.S. Bureau of Mines, 1973). No substantial work has been done at the site.

Production notes:

Reserves:

Additional comments:

References:

U.S. Bureau of Mines, 1973; MacKevett and Holloway, 1977.

Primary reference: MacKevett and Holloway, 1977

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/08/03

Site name(s): Golden Fleece (Emerald Lake)**Site type:** Prospect**ARDF no.:** IL033**Latitude:** 59.3031**Quadrangle:** IL B-5**Longitude:** 154.7608**Location description and accuracy:**

The Golden Fleece (or Emerald Lake) prospect is about 2 miles west of Emerald Lake. For this record, the prospect is about at the midpoint of the south boundary of sec. 13, T. 10 S., R. 33 W., Seward Meridian. The location is accurate for the center of the mineralized area.

Commodities:**Main:** Au**Other:** Ag, Cu**Ore minerals:** Limonite**Gangue minerals:** Clay minerals, quartz**Geologic description:**

This prospect consists of several quartz veins that cut the Oligocene to Pliocene Gibraltar Lake volcanic formation. From the base up, the formation consists of rhyolite lithic-crystal tuff, andesite flows, and rhyolitic ash-flow tuff (Detterman and Reed, 1980; Butherus and others, 1981). The formation is underlain by older Tertiary tuff and overlain by the mesa-forming Intricate Basalt. Butherus and others (1981) propose that the source of the Gibraltar Lake volcanic rocks may be a vent on hill 2349 about 2.5 miles south of the prospect.

Butherus and others (1981) mapped eight vuggy, coxcomb-quartz veins in rubble crop on the upper ash-flow tuff member of the Gibraltar Lake formation. The wall rocks of the veins are intensely argillized. The veins do not contain visible gold or sulfides, but the quartz is coated with limonite, suggesting the presence of at least small amounts of pyrite or other sulfides before weathering. Samples of highly altered ash-flow tuff in the wall-rocks of the veins assayed 0.1 to 0.9 parts per million (ppm) gold, and two samples contained anomalous amounts of silver and copper (Butherus and others, 1981). Pan concentrates of soils in the prospect area contained as much as 7.6 ppm gold. Pan concentrates collected along the incised, north-trending canyon in sec. 13 that drains the prospect area locally assayed as much as 7.8 ppm gold (Anderson and others, 1979).

Anderson and others (1979) and Butherus and others (1981) believe that this deposit is

similar to the one at the KUY prospect (IL035), namely that both are epithermal, low-sulfide gold systems.

Alteration:

Silicification of tuff; locally intense argillization of wall rock near veins. Locally conspicuous oxidation of deposit.

Age of mineralization:

Tertiary (Pliocene?).

Deposit model:

Low-sulfide gold-quartz veins (Cox and Singer, 1986; model 36a).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

36a

Production Status: None**Site Status:** Probably inactive**Workings/exploration:**

The prospect area is marked by a strong color anomaly developed on the intensely altered rocks. The prospect was discovered by geologists of Resource Associates of Alaska (RAA), who collected rock, soil, and stream- sediment samples (Anderson and others, 1979; Butherus, 1981).

Samples of highly altered ash-flow tuff in the wallrocks of the veins assayed 0.1 to 0.9 parts per million (ppm) gold, and two samples contained anomalous amounts of silver and copper (Butherus and others, 1981). Pan concentrates of soils in the prospect area contained as much as 7.6 ppm gold. Pan concentrates collected along the incised, north-trending canyon in sec. 13 that drains the prospect area locally assayed as much as 7.8 ppm gold (Anderson and others, 1979).

Production notes:**Reserves:****Additional comments:****References:**

Anderson and others, 1979; Detterman and Reed, 1980; Butherus and others, 1981.

Primary reference: Butherus and others, 1981**Reporter(s):** C.C. Hawley, Hawley Resource Group, Anchorage, Alaska**Last report date:** 06/18/03

Site name(s): Unnamed (north of Dream Creek)

Site type: Prospect

ARDF no.: IL034

Latitude: 59.3398

Quadrangle: IL B-5

Longitude: 154.5309

Location description and accuracy:

This prospect is north of Dream Creek, about 2.5 miles east of Gibraltar Lake. It is at an elevation of about 500 feet in the NE1/4 sec. 5, T. 10 S., R. 31 W., Seward Meridian. The site, which is locality 28 of MacKevett and Holloway (1977), is accurate within about 1 mile.

Commodities:

Main: Fe

Other: Ti

Ore minerals: Magnetite?

Gangue minerals:

Geologic description:

This prospect appears to be in a batholith of Jurassic, medium- to coarse-grained, quartz diorite and subordinate diorite and granodiorite, containing roof pendants of metamorphic rocks (Detterman and Reed, 1980). Tertiary basalt and andesite is exposed west of the prospect.

Lode claims, probably for iron, were staked at this site (U.S. Bureau of Mines, 1973; MacKevett and Holloway, 1977). The deposit probably consists of disseminations and veinlets of magnetite in relatively mafic phases of the batholith.

Alteration:

Age of mineralization:

Probably Jurassic.

Deposit model:

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

Production Status: None

Site Status: Probably inactive

Workings/exploration:

Claims were located during or before 1973 (U.S. Bureau of Mines, 1973). There is no record of any workings.

Production notes:

Reserves:

Additional comments:

References:

U.S. Bureau of Mines, 1973; MacKevett and Holloway, 1977; Detterman and Reed, 1980.

Primary reference: MacKevett and Holloway, 1977

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/09/03

Site name(s): KUY**Site type:** Prospects**ARDF no.:** IL035**Latitude:** 59.2631**Quadrangle:** IL B-5**Longitude:** 154.6110**Location description and accuracy:**

The KUY prospects are about five miles south of the east end of Gibraltar Lake. They are in, and on the east and west flanks of, the incised north-trending canyon of informally-named Katrina Creek, in the SE1/4 sec. 35, T. 10 S., R. 32 W., Seward Meridian. Mineralization related to the KUY deposit may extend into the SW1/4 sec. 36, same township, and into the NE1/4 sec. 2, T. 11 S., R. 32 W.. For this record, the location is at an elevation of about 1,300 feet in the canyon, and is accurate for the center of this large and complex mineralized system.

Commodities:**Main:** Au, Cu, Mo**Other:** Ag, Zn**Ore minerals:** Chalcopyrite, gold, gold and silver tellurides?, magnetite, molybdenite, pyrite**Gangue minerals:** Clay, quartz**Geologic description:**

The KUY prospects explore deposits potentially valuable for gold and copper-molybdenum. The geologic setting of the prospects has been interpreted in two ways: From 1979 until 1984, Resource Associates of Alaska (RAA) mapped the country rocks as Cretaceous or Tertiary andesite and dacite flows that locally dip 50 degrees. As interpreted by RAA, the flows are cut by an irregular zone of breccia as much as 2,500 feet across composed mostly of fragments of dacite tuff that forms the center of a caldera about 8,000 feet across (Butherus and others, 1981). Retherford and Hickok (1990) subsequently proposed that the volcanic rocks are intruded by a Cretaceous or Tertiary quartz diorite stock, and that the breccia is a diatreme immediately north of the stock.

About 60 percent of the breccia is pervasively altered and contains 3 to 5 percent sulfides, mostly pyrite and subordinate chalcopyrite. The breccia is locally cut by quartz-magnetite veins, vuggy gold-bearing quartz veins, and pyritic clay veins. Silicification and intense argillization are probably superimposed on widespread propylitization. Retherford and Hickok (1990) proposed that there is a core zone of potassium silicate alteration and a zone of sericitic alteration between stock and diatreme (breccia).

In 1978, rich gold- and silver-bearing quartz veins were found by RAA in informally named Katrina Creek canyon at about 1,600 feet elevation. The RAA-named Discovery vein strikes NNE and dips about 55 SE; the subsequently discovered Amethyst vein strikes WNW and dips about 70 SW (Anderson and others, 1979). A sample of the Discovery vein assayed about 106 ounces of gold and 103 ounces of silver per ton (Anderson and others, 1979; Butherus and others, 1981). The gold occurs in masses about 2 mm across; gold and silver tellurides are also reported. The rich veins are about 10 inches or less thick and traceable for a maximum distance of about 200 feet. The auriferous part of the deposit was drilled in 1980 with little success, leading to the interpretation that the veins are in discontinuous gash fissures. There reportedly were core recovery problems and the rich veins remain an intriguing target. Two other types of gold-bearing veins are reported: pyritic clay veins that assay as much as 0.37 ounce of gold per ton, and quartz-pyrite-magnetite veins.

Exploration since 1980 suggests that a porphyry copper-molybdenum(-gold) system might underlie the highly altered volcanic complex. Freeman and Farnham (1983) reported that samples from the Hercules and Minerva trenches contained up to 495 parts per million (ppm) copper and 45 ppm molybdenum. One sample from Minerva 1 trench contained 1.23 ppm gold. Butherus (1984) followed up Freeman and Farnham's work with more trenches in the same area. His samples from the Minerva 3 trench contained as much as 1,175 ppm copper, 193 ppm lead, and 307 ppm zinc, and generally elevated values of molybdenum.

Reports since 1981 have proposed deep drilling to test the porphyry target, but to date (2003), apparently no deep holes have been drilled. Those reports suggest that the rich gold veins are near the top of the mineralized system (Butherus, 1981; Freeman and Farnham, 1983; Butherus, 1984).

Alteration:

Widespread propylitic alteration (chlorite, magnetite, and epidote) followed by argillization (kaolinite), and silicification (Butherus and others, 1981). Retherford and Hickok (1990) mapped a core zone of potassium silicate alteration extending outward through sericite alteration to peripheral propylitic alteration.

Age of mineralization:

Probably Late Cretaceous or Early Tertiary.

Deposit model:

Epithermal low-sulfide gold-quartz veins; possibly overlying a porphyry copper-molybdenum system (Cox and Singer, 1986; models 36a and 21a).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

36a, 21a?

Production Status: None**Site Status:** Probably inactive

Workings/exploration:

Rich gold veins were discovered in 1978 by geologists of Resource Associates of Alaska (Anderson and others, 1979). Other veins were found in 1979, and the prospect was drilled in 1980, but the drill holes did not encounter rich ore. In addition to the drilling, the deposit has been trenched. Freeman and Farnham (1983) reported that samples from the Hercules and Minerva trenches contained up to 495 parts per million (ppm) copper and 45 ppm molybdenum. One sample from Minerva 1 trench contained 1.23 ppm gold. Butherus (1984) followed up Freeman and Farnham's work with more trenches in the same area. His samples from the Minerva 3 trench contained as much as 1,175 ppm copper, 193 ppm lead, and 307 ppm zinc, and returned generally elevated values of molybdenum. The exploration work by Freeman and Farnham (1983) and Butherus (1984) has focused on the possibility of an underlying porphyry copper-molybdenum(-gold) deposit. Reports since 1981 have proposed deep drilling to test the porphyry target, but to date (2003), apparently no deep holes have been drilled.

Production notes:**Reserves:****Additional comments:****References:**

Anderson and others, 1979; Butherus and others, 1981; Freeman and Farnham, 1983; Butherus, 1984; Retherford and Hickok, 1990.

Primary reference: Anderson and others, 1979; Butherus and others, 1981; Retherford and Hickok, 1990

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/17/03

Site name(s): Unnamed (northeast of Mirror Lake)**Site type:** Occurrence**ARDF no.:** IL036**Latitude:** 59.2389**Quadrangle:** IL A-5**Longitude:** 154.7059**Location description and accuracy:**

This approximately located occurrence is at an elevation of about 2,250 feet approximately 1.5 miles northeast of the east end of Mirror Lake. It is near the center of sec. 8, T. 11 S., R. 32 W., Seward Meridian. The location is uncertain; it is based on a description by Mather (1925, p. 172), which correlates fairly well with the geology mapped by Detterman and Reed (1980). The location is probably accurate within about 1 mile. Mather (1925) also noted mineral deposits closer to the east end of Mirror Lake.

Commodities:**Main:** Cu**Other:****Ore minerals:** Chalcopyrite, pyrite**Gangue minerals:** Quartz**Geologic description:**

The country rocks at this site are mainly Tertiary volcanic strata that rest unconformably on Jurassic granodiorite that underlies much of the headwater area of Funnel Creek above Mirror Lake (Detterman and Reed, 1980). The granodiorite has a lobe-like western projection into the head of Mirror Lake. Mather (1925) believed that the granodiorite intrudes the Tertiary volcanic rocks, but it probably intrudes only nearby Jurassic or older rocks (Detterman and Reed, 1980).

The volcanic rocks at this occurrence reportedly are cut by abundant quartz-pyrite veins as much as several inches thick (Mather, 1925). Nearer Mirror Lake, and exposed in small creeks flowing into the lake, a swarm of pyrite- and chalcopyrite-bearing quartz veins as much as a half-mile across is in the Jurassic granodiorite and its metamorphic country rocks (Mather, 1925).

Alteration:**Age of mineralization:**

The veins in the volcanic rocks are Tertiary; the veins in the granodiorite and metasedi-

mentary rocks are Jurassic or younger.

Deposit model:

Uncertain. Possibly polymetallic veins or porphyry copper (Cox and Singer, 1986, models 22c and 17).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

22c?, 17?

Production Status: None

Site Status: Inactive

Workings/exploration:

No claims or workings are reported.

Production notes:

Reserves:

Additional comments:

References:

Mather, 1925; Cobb, 1976; Detterman and Reed, 1980.

Primary reference: Mather, 1925; Detterman and Reed, 1980

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/10/03

Site name(s): Pfaff; Battle Lake**Site type:** Prospect**ARDF no.:** IL037**Latitude:** 59.1067**Quadrangle:** IL A-6**Longitude:** 154.8793**Location description and accuracy:**

The Pfaff (Battle Lake) prospect is at an elevation of about 2,600 feet about 3.5 miles due east of the north end of Battle Lake. It is in the NW1/4 SW1/4 sec. 29, T. 12 S., R. 33 W., Seward Meridian. The location is accurate within about 0.5 mile. The prospect is number 18 of Detterman and Cobb (1972) and number 16 of Detterman and Reed (1980, fig. 6). The prospect is in Katmai National Park.

Commodities:**Main:** Ag, Au**Other:** Cu**Ore minerals:** Bornite?, chalcopryite, chrysocolla?, gold, malachite, pyrite, unidentified silver-bearing sulfosalt**Gangue minerals:** Amethyst, quartz**Geologic description:**

The country rocks at this prospect are Tertiary dacite and interbedded tuff and volcanic breccia (Detterman and Reed, 1980). About 0.5 mile northwest of the prospect, the dacite and fragmental units are overlain by Tertiary andesite and basalt.

The deposit consists of north-striking, quartz-sulfide veins that cut propylitically-altered flows, tuff, and breccia (Detterman and Reed, 1980). The veins range from a few inches to more than 6 feet thick, and can be traced through outcrops and pits for about 1,000 feet. Locally, the veins comprise quartz-cemented breccia of intensely altered andesite or dacite; the quartz is vuggy and some of the cavities are lined with amethyst crystals (C. C. Hawley, examination notes and samples, 1986). The veins locally contain abundant chalcopryite, pyrite, and an unidentified silver-bearing sulfosalt; some copper-rich parts of the veins contain abundant disseminated free gold (collection of prospector Ray Gatz, circa 1970).

Hawley tentatively identified bornite during his site visit in 1986. Sulfide-rich veins are locally oxidized to malachite and chrysocolla(?). Selected samples collected by Detterman and Reed (1980) contained 0.41 to 36.4 ounces of gold per ton and 6.6 to 168.8 ounces of silver per ton. Copper content ranged from almost nil in quartz-rich veins to

several percent in sulfide-rich veins. The property was drilled by its owners in 1965; according to Detterman and Reed (1980), results of the drilling were not encouraging.

Alteration:

Propylitically-altered volcanic breccia and dacitic flows; silicification; local argillic alteration. Oxidation of copper.

Age of mineralization:

Tertiary.

Deposit model:

Creede-type epithermal vein (Cox and Singer, 1986, model 25b).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

25b

Production Status: None**Site Status:** Inactive**Workings/exploration:**

The property was discovered by Ernie Pfaff in about 1964, and the owners of the claims drilled a few diamond core holes in 1965. Pfaff continued to prospect with cuts and trenches until about 1980. Essentially no work was done after the prospect area was included in Katmai National Park, and the claims were allowed to lapse after Pfaff's death.

Production notes:

High-grade specimens of gold ore were collected at the site and some, such as those in the collection owned by prospector Ray Gatz, may have been sold.

Reserves:**Additional comments:**

Detterman and Reed (1980, p. B79) suggested that: 'This area of Tertiary volcanic and intrusive rocks warrants further prospecting and geochemical sampling for precious and base-metal deposits.' Such work is unlikely in the near term, however, because the prospect is in Katmai National Park.

References:

Detterman and Cobb, 1972; Cobb, 1976; Detterman and Reed, 1980.

Primary reference: Detterman and Reed, 1980; This record**Reporter(s):** C.C. Hawley, Hawley Resource Group, Anchorage, Alaska**Last report date:** 06/09/03

Site name(s): Unnamed (northwest of Iron Springs Lake)

Site type: Occurrence

ARDF no.: IL038

Latitude: 59.0768

Quadrangle: IL A-5

Longitude: 154.8367

Location description and accuracy:

This occurrence is at an elevation of about 2,650 feet about 0.8 mile northwest of the north end of Iron Springs Lake. It is in the SE1/4 sec. 6, T. 13 S., R. 33 W., Seward Meridian. This site, which is locality 25 of MacKevett and Holloway (1977), is accurate within about 1 mile.

Commodities:

Main: Fe

Other: Ti

Ore minerals: Magnetite?

Gangue minerals:

Geologic description:

The country rocks at this occurrence are intermediate and mafic volcanic rocks of the Jurassic Talkeetna Formation (Detterman and Reed, 1980). A batholith, chiefly of Cretaceous or Tertiary granodiorite, crops out at Iron Springs Lake and possibly underlies the area of the occurrence at relatively shallow depth. The occurrence was staked (U.S. Bureau of Mines, 1973), probably as a magnetite-bearing skarn deposit (MacKevett and Holloway, 1977).

Alteration:

Age of mineralization:

Jurassic or possibly Cretaceous or Tertiary, the age of a nearby granodiorite batholith.

Deposit model:

Probably Fe skarn (Cox and Singer, 1986, model 18d).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

18d?

Production Status: None

Site Status: Probably inactive

Workings/exploration:

The area has been geologically mapped in reconnaissance (Detterman and Reed, 1980).
The occurrence was staked but there is no record of any workings.

Production notes:

Reserves:

Additional comments:

References:

U.S. Bureau of Mines, 1973; MacKevett and Holloway, 1977; Detterman and Reed, 1980.

Primary reference: U.S. Bureau of Mines, 1973; Detterman and Reed, 1980

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/09/03

Site name(s): Unnamed (in locally-named Sargent Creek)

Site type: Prospect

ARDF no.: IL039

Latitude: 59.1369

Quadrangle: IL A-5

Longitude: 154.6540

Location description and accuracy:

This lode prospect is at an elevation of about 1,800 feet in locally-named Sargent Creek (Richter and Herreid, 1965). Sargent Creek was called Crevice Creek by Jasper (1953, 1956). The prospect is near the center of the N1/2 SW1/4 sec. 15, T. 12 S., R. 32 W., Seward Meridian. The prospect coincides with number 7 of Richter and Herreid (1965) and may correspond approximately with locality 19 of Detterman and Cobb (1972). The location is accurate within 500 feet.

Commodities:

Main: Au, Cu, Fe

Other: Ag

Ore minerals: Azurite, chalcopyrite, magnetite, malachite

Gangue minerals: Calcite, epidote, garnet, quartz

Geologic description:

The country rocks at this prospect are chiefly intermediate and basic volcanic rocks of the Jurassic Talkeetna Formation (Richter and Herreid, 1965; Detterman and Reed, 1980). The deposit was largely snow covered when visited by Richter and Herreid, but they described dump samples of epidote-garnet tectite (skarn), garnet-magnetite skarn, massive magnetite, and massive magnetite-calcite rock. The samples were copper-stained, presumably by malachite and azurite, and contained chalcopyrite.

Alteration:

Contact metasomatism. Oxidation of copper.

Age of mineralization:

Probably Jurassic, the age of the nearby Pilot Knob granodiorite (IL041) (Richter and Herreid, 1965).

Deposit model:

Fe skarn, Cu skarn (Cox and Singer, 1986; models 18d, 18b).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

18d, 18b

Production Status: None**Site Status:** Inactive**Workings/exploration:**

Test pits were largely snow covered when visited by Richter and Herreid (1965); the claim-owner (Sargent) reported good showings of disseminated chalcopyrite. The deposit was probably covered by the McNeil (IL043) claims.

Production notes:**Reserves:****Additional comments:****References:**

Jasper, 1953; Jasper, 1956; Richter and Herreid, 1965; Detterman and Cobb, 1972; Detterman and Reed, 1980.

Primary reference: Richter and Herreid, 1965**Reporter(s):** C.C. Hawley, Hawley Resource Group, Anchorage, Alaska**Last report date:** 06/10/03

Site name(s): Unnamed (at head of locally named Sargent Creek; possibly McNeil No. 7 claim)

Site type: Prospect

ARDF no.: IL040

Latitude: 59.1430

Quadrangle: IL A-5

Longitude: 154.6548

Location description and accuracy:

This prospect is at an average elevation of about 2,050 feet at the head of locally-named Sargent Creek (Richter and Herreid, 1965). The prospect is in the N1/2 NW1/4 sec. 15, T. 12 S., R. 32 W., Seward Meridian. It is locality 6 of Richter and Herreid. The location is accurate for the approximate center of this six-acre prospect area.

Commodities:

Main: Fe

Other:

Ore minerals: Magnetite

Gangue minerals: Quartz

Geologic description:

The mineral deposits at this prospect are magnetite-rich skarns (tactites) in locally calcic, intermediate to mafic volcanic rocks and subordinate sedimentary rocks of the Jurassic Talkeetna Formation (Richter and Herreid, 1965; Detterman and Reed, 1980).

The prospect comprises ten exposed bodies of magnetite-quartz skarn in an area of about six acres (Richter and Herreid, 1965). The largest body is nearly pure magnetite and is about 75 feet long and 10 feet wide. The other bodies are smaller and contain as much as 50 percent quartz. A ground-based magnetic survey suggests that the masses are isolated pods, not connected to a large mass at depth (Richter and Herreid, 1965, p. 14). The prospect appears to be the one described by Jasper (1956, p. 9), who reported two magnetite-rich pods, one containing an estimated 10,000 tons, and the other 5,000 tons, of ore. Richter and Herreid (1965) estimated 100 tons per vertical foot in the largest exposed body.

Alteration:

Contact-metasomatic replacement of calcic volcanic and sedimentary(?) rocks by magnetite and quartz.

Age of mineralization:

Probably Jurassic.

Deposit model:

Fe skarn (Cox and Singer, 1986; model 18d).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

18d

Production Status: None**Site Status:** Probably inactive**Workings/exploration:**

Exploration includes detailed geologic mapping and a ground-based magnetic survey by Richter and Herreid, (1965). There are no reports of any workings.

Production notes:**Reserves:**

Jasper (1956) estimated a total of 15,000 tons of magnetite ore in two bodies. Richter and Herreid (1965) estimated 100 tons per vertical foot in the largest exposed body.

Additional comments:**References:**

Jasper, 1956; Richter and Herreid, 1965; Detterman and Reed, 1980.

Primary reference: Richter and Herreid, 1965**Reporter(s):** C.C. Hawley, Hawley Resource Group, Anchorage, Alaska**Last report date:** 06/17/03

Site name(s): Unnamed (at Pilot Knob)

Site type: Occurrence

ARDF no.: IL041

Latitude: 59.1696

Quadrangle: IL A-5

Longitude: 154.6219

Location description and accuracy:

The approximate location of this occurrence is on Pilot Knob in the NE1/4 NW1/4 sec. 2, T. 12 S., R. 32 W., Seward Meridian.

Commodities:

Main: Fe?

Other:

Ore minerals: Magnetite?

Gangue minerals:

Geologic description:

A broad magnetic anomaly having a maximum relative intensity of 1,600 gammas is centered on Pilot Knob (Richter and Herried, 1965, p. 15, figs. 7 and 8). The country rocks are hornfelsed volcanic rocks of the Jurassic Talkeetna Formation, underlain at shallow depth by the Cretaceous or Tertiary Pilot Knob granodiorite (Detterman and Reed, 1980). The granodiorite is partly altered to sericite, zoisite, and chlorite (Richter and Herried, 1965, p. 7).

No magnetite or skarn is exposed at the site, but there could be shallow buried magnetite bodies at or near the contact between the granodiorite and the volcanic rocks. According to Richter and Herried (1965), the contact of the granodiorite beneath Pilot Knob dips about 30 degrees. Nearby deposits of magnetite skarn in Talkeetna Formation volcanic rocks are at IL040 and IL042.

Alteration:

Age of mineralization:

Deposit model:

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

Production Status: None

Site Status: Inactive

Workings/exploration:

Exploration consists of geologic mapping and a ground-based magnetic survey (Richter and Herreid, 1965). There are no workings.

Production notes:

Reserves:

Additional comments:

References:

Richter and Herreid, 1965; Detterman and Reed, 1980.

Primary reference: Richter and Herreid, 1965

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/17/03

Site name(s): Unnamed (northwest of upper Paint River)

Site type: Prospect

ARDF no.: IL042

Latitude: 59.1435

Quadrangle: IL A-5

Longitude: 154.6392

Location description and accuracy:

This prospect is at an elevation of about 1,500 feet on the west valley wall of upper Paint River, about 0.8 mile northwest of the junction of Crevice Creek. The prospect is in the SE1/4 SE1/4 sec. 10, T. 12 S. R. 32 W., Seward Meridian. It corresponds to locality 1 of Richter and Herreid, 1965. The location is accurate within 500 feet.

Commodities:

Main: Cu, Fe

Other: Ag

Ore minerals: Azurite, chalcopyrite, chrysocolla, magnetite, malachite, pyrite

Gangue minerals: Actinolite, calcite, epidote, garnet, quartz

Geologic description:

This prospect consists of skarn in mafic and intermediate volcanic rocks of the Jurassic Talkeetna Formation within a few hundred feet of the contact of the Jurassic Pilot Knob granodiorite (Richter and Herreid, 1965; Detterman and Reed, 1980).

The skarn mainly comprises epidote, garnet, actinolite, quartz, magnetite, and chalcopyrite, and the oxidized minerals azurite, chrysocolla, and malachite. The chalcopyrite is generally associated with actinolite and occurs in disseminations and small pods; it is accompanied by pyrite and calcite (Richter and Herreid, 1965). The most abundant ore mineral is magnetite. Richter and Herreid (1965, p. 14) described two lenses or layers of magnetite in epidote-garnet-actinolite skarn. They are as much as 25 feet thick and about 10 feet apart. The deposit is marked by a local ground-based magnetic anomaly. Richter and Herreid's locality is probably the same as Jasper's (1956, p. 9, section II), who reported magnetite float and malachite in an open cut on the steep slope above Paint River.

Alteration:

Development of garnet-epidote-calcite-actinolite skarn in calcic volcanic rocks. Oxidation of copper.

Age of mineralization:

Jurassic, possibly related to Pilot Knob granodiorite.

Deposit model:

Iron skarn; possibly copper skarn (Cox and Singer, 1986, models 18d and 18b).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

18d, 18b?

Production Status: Undetermined.

Site Status: Probably inactive

Workings/exploration:

Exploration includes detailed geologic mapping and a ground-based magnetic survey by Richter and Herreid, (1965). There are a few prospect pits in the area.

Production notes:

Reserves:

Additional comments:

References:

Jasper, 1953; Jasper, 1956; Richter and Herreid, 1965; Detterman and Reed, 1980.

Primary reference: Richter and Herreid, 1965

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/11/03

Site name(s): Crevice Creek; McNeil; Sargent (also Holly and others; Ok-chiak Creek; Reward-Ridgway; Cook & Bornland)

Site type: Prospect

ARDF no.: IL043

Latitude: 59.1369

Quadrangle: IL A-5

Longitude: 154.6390

Location description and accuracy:

The Crevice Creek prospect is at an elevation of about 1,250 feet on the northwest valley wall of Crevice Creek about 0.7 mile above the junction of Paint River. The coordinates are for the midpoint of the half-mile-long prospect area, near the center of SE1/4 sec. 15, T. 12 S., R. 32 W., Seward Meridian. The location is accurate within 500 feet. The site corresponds to number 8 of Richter and Herreid (1965), and approximately to locality 20 of Detterman and Cobb (1972).

Other creek names have been used in the area. Jasper (1953, plate 2) calls Crevice Creek Paint River, and calls locally-named Sargent Creek (IL039) Crevice Creek.

Commodities:

Main: Ag, Au, Cu

Other: Fe

Ore minerals: Azurite, chalcopyrite, chrysocolla, malachite, magnetite, pyrite

Gangue minerals: Actinolite, calcite, epidote, garnet, quartz

Geologic description:

The Crevice Creek prospect is a linear skarn deposit (tactite of Richter and Herreid, 1965) along the contact between intermediate and basic volcanic rocks of the Jurassic Talkeetna Formation and chert and limestone of the Triassic Kamishak(?) Formation (Richter and Herreid, 1965; Detterman and Reed, 1980). The Kamishak(?) Formation generally strikes northeast and dips steeply northwest (Richter and Herreid, 1965, p. 3). The deposit is about one mile south of a south-southwest-trending lobe of Jurassic granodiorite that possibly continues under the prospect area at shallow depth. The volcanic and sedimentary strata are cut by a few sills and hundreds of intermediate to basic dikes that generally strike N70W and dip 80N (Richter and Herreid, 1965, p. 6, fig. 3). A lesser number of diorite and granodiorite dikes and sills occur along Sargent Creek that strike west and dip north at a moderate angle (Richter and Herreid, 1965, fig. 6).

The Crevice Creek deposit consists chiefly of chalcopyrite and other metallic minerals in epidote-garnet skarn. Quartz-magnetite rock occurs locally. The deposit is irregular

and lenticular, but can be traced generally northeast from Sargent Creek for about a half mile (Richter and Herreid, 1965, fig. 6). Actinolite is abundant and forms radiating crystals as much as 2 feet across; grossularite-andradite garnets are as much as 2 inches across. Calcite is common and locally massive (Richter and Herreid, 1965).

Chalcopyrite and pyrite are the main sulfide minerals; the chalcopyrite is locally oxidized to azurite, malachite, and chrysocolla. The sulfide-bearing skarn locally contains gold and silver, probably in, or associated with, chalcopyrite. Selected samples from the No. 3 adit at the Crevice Creek deposit assayed 0.04 to 0.08 ounce of gold per ton, 6.24 to 9.12 ounces of silver per ton, and 6.41 to 7.03 percent copper (Jasper, 1956). A selected sample from the No. 8 open cut south of Sargent Creek (IL039) contained 0.30 ounce of gold per ton and 3.66 percent copper (Jasper, 1953). In general, gold concentrations are low.

Claims were first staked in 1911 by C. H. McNeil, who prospected in the area until 1924. At least two test shipments of copper-rich ore were made. A one-ton shipment of hand-sorted ore graded 18.19 percent copper, 0.29 ounce of gold per ton, and 10.93 ounces of silver per ton. A 10.5-ton test shipment assayed 17.55 percent copper, 0.12 ounce of gold per ton, and 15 ounces of silver per ton (Mather, 1925; Jasper, 1953). It appears that most of the work on the property was done by McNeil between 1911 and 1924.

Alteration:

Alteration of cherty and calcareous sedimentary rocks and intermediate to basic volcanic rocks to garnet-epidote-actinolite-calcite skarn and subordinate quartz-magnetite rock (Richter and Herreid, 1965). Oxidation of copper.

Age of mineralization:

Probably Jurassic; the age of the nearby granodiorite pluton.

Deposit model:

Fe skarn, Cu skarn (Cox and Singer, 1986; models 18d, 18b).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

18d, 18b

Production Status: Yes; small**Site Status:** Inactive**Workings/exploration:**

The area was located by C. H. McNeil in 1911 and prospected by him until 1924. The principal deposit was covered by four lode claims: McNeil and McNeil Nos. 1-3; and subsequently by McNeil Nos. 4-6 and Joker. The earlier McNeil claims were restaked as Reward and Reward Nos. 1-3

(Jasper, 1953, plate 2). At least two test shipments were made. One ton of ore shipped before 1925 graded \$6.08 in gold (at \$20.67 per ounce), 10.93 ounces of silver per ton, and 18.19 percent copper. Ten and a half tons shipped in 1914-1916 from scattered workings assayed \$2.50 in gold, 15 ounces of silver per ton, and 17.55 percent copper (Mather,

1925, p. 173-174; Jasper, 1953). McNeil abandoned the claims around 1926 due in part to differences with his associates on the value of the claims (Jasper, 1953). The claims were relocated by E. Sargent and associates in 1953. The claims were examined for the Territory of Alaska by Jasper (1953, 1956) and for the State of Alaska by Richter and Herried (1965).

Production notes:

One ton of ore shipped in the early part of 20th century graded \$6.08 in gold (at \$20.67 per ounce), 10.93 ounces of silver per ton, and 18.19 percent copper. Ten and a half tons shipped in 1914 to 1916 from scattered workings assayed \$2.50 in gold, 15 ounces of silver per ton, and 17.55 percent copper (Mather, 1925). The shipments were probably from the Crevice Creek claims but possibly included some ore from claims in Sargent Creek (IL039).

Reserves:**Additional comments:****References:**

Brooks, 1913; Brooks, 1914; Brooks, 1915; Brooks, 1918; Martin, 1920; Brooks and Martin, 1921; Brooks, 1925; Mather, 1925; Bain, 1946; Moxham and Nelson, 1952; Wedow and others, 1952; Jasper, 1953; Jasper, 1956; Richter and Herried, 1965; Berg and Cobb, 1967; Detterman and Cobb, 1972; Detterman and Reed, 1980; Cobb and Reed, 1981 (OFR 81-1343A); Cobb and Reed, 1981 (OFR 81-1343B).

Primary reference: Richter and Herried, 1965; Jasper, 1953

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/08/03

Site name(s): Unnamed (headwater area of Middle and South Forks of Paint River)

Site type: Occurrence

ARDF no.: IL044

Latitude: 59.0978

Quadrangle: IL A-5

Longitude: 154.6200

Location description and accuracy:

The approximate location of this occurrence is on or near hill 3601 between the Middle and South Forks of Paint River. For this record, the occurrence is at an elevation of about 3,400 feet in the NW1/4 NE1/4 sec. 35, T. 12 S., R. 32 W., Seward Meridian. The site, which is locality 26 of MacKevett and Holloway (1977), is accurate within about 1 mile.

Commodities:

Main: Cu?, Fe?

Other:

Ore minerals: Chalcopyrite?, magnetite?

Gangue minerals:

Geologic description:

The area of this occurrence is underlain by volcanic flows and fragmental rocks of the Jurassic Talkeetna Formation, and possibly at shallow depth by Jurassic granodiorite, which crops out to the south and northeast (Detterman and Reed, 1980). Copper or iron claims were staked in the area (U.S. Bureau of Mines, 1973; MacKevett and Holloway, 1977), probably on chalcopyrite- or magnetite-bearing skarn deposits.

Alteration:

Age of mineralization:

Jurassic or younger.

Deposit model:

Probably Fe or Cu skarn (Cox and Singer, models 18d, 18b).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

18d?, 18b?

Production Status: None

Site Status: Probably inactive

Workings/exploration:

Claims have been located, but there is no record of any workings.

Production notes:

Reserves:

Additional comments:

References:

U.S. Bureau of Mines, 1973; MacKevett and Holloway, 1977; Detterman and Reed, 1980.

Primary reference: U.S. Bureau of Mines, 1973; Detterman and Reed, 1980

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/09/03

Site name(s): Unnamed (east of lakes at head of Lake Fork)

Site type: Occurrence

ARDF no.: IL045

Latitude: 59.2297

Quadrangle: IL A-5

Longitude: 154.5035

Location description and accuracy:

This occurrence is at an elevation of about 1,050 feet east of the lakes at the head of Lake Fork of Paint River. The occurrence is in the approximate center of the N1/2 NE1/4 sec.16, T. 11 S., R. 31 W., Seward Meridian. The location is number 27 of MacKevett and Holloway, and is accurate within about 0.5 mile.

Commodities:

Main: Cu

Other:

Ore minerals: Chalcopyrite?

Gangue minerals:

Geologic description:

The country rock at this occurrence is probably mainly Jurassic quartz diorite (Detterman and Reed, 1980). The quartz diorite has local phases of diorite and granodiorite and contains roof pendants of gneiss and of mafic and ultramafic rocks. The occurrence is based on claims located for copper, probably as chalcopyrite (U.S. Bureau of Mines, 1973; MacKevett and Holloway, 1977). No further data are available.

Alteration:

Age of mineralization:

Probably Jurassic or younger.

Deposit model:

Porphyry copper? (Cox and Singer, 1986; model 17).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

17?

Production Status: None

Site Status: Probably inactive

Workings/exploration:

The area has been geologically mapped in reconnaissance (Detterman and Reed, 1980).
There is no record of any workings.

Production notes:

Reserves:

Additional comments:

References:

U.S. Bureau of Mines, 1973; MacKevett and Holloway, 1977; Detterman and Reed, 1980.

Primary reference: U.S. Bureau of Mines, 1973; Detterman and Reed, 1980

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/09/03

Site name(s): Unnamed (east of head of Lake Fork of Paint River)

Site type: Prospect

ARDF no.: IL046

Latitude: 59.2422

Quadrangle: IL A-4

Longitude: 154.4847

Location description and accuracy:

This prospect is at an elevation of about 1,600 feet, east of the head of Lake Fork and 1.35 miles west of hill 3169. The prospect is in the NW1/4 sec.10, T. 11 S., R. 31 W., Seward Meridian. The site corresponds to locality 17 of Detterman and Cobb (1972) and locality 17 of Reed (1967), and is accurate within about 0.5 mile.

Commodities:

Main: Ag, Au, Cu

Other: Fe?

Ore minerals: Chalcopyrite, magnetite?, malachite, pyrite

Gangue minerals: Quartz?

Geologic description:

The area of this prospect is underlain mainly by Jurassic, biotite-hornblende quartz diorite (Detterman and Reed, 1980). At the prospect, the quartz diorite intrudes hornblende gabbro (Reed, 1967).

The prospect is a 100- to 150-foot-wide breccia zone in quartz diorite. The breccia is cut by a 0.5- to 2-foot-wide, malachite-stained fault zone and by many smaller, sulfide-rich, quartz(?) veins. The sulfides almost certainly include chalcopyrite and pyrite. Four of five grab samples of mineralized rock collected by Reed (1967) contained more than 0.5 percent copper. One grab sample assayed 11.9 parts per million (ppm) gold, 20 ppm silver, and more than 5,000 ppm copper. Selected sulfide-rich specimens from the mineralized fault zone yielded assays of more than 0.5 ounce of gold per ton (Reed, 1967; Cobb, 1976).

The prospect was restaked in 1964, possibly for iron present as magnetite(?). A short, partly caved, adit found by Reed (1967) dates from an earlier period of exploration.

Alteration:

Oxidation of copper.

Age of mineralization:

Jurassic or younger.

Deposit model:

Polymetallic vein? (Cox and Singer, 1986; model 22c).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

22c?

Production Status: None

Site Status: Inactive

Workings/exploration:

The prospect was explored by a short adit that was partly caved when visited by Reed (1967). The prospect area was restaked in 1964 during a flurry of exploration for iron on the Alaska Peninsula.

Production notes:

Reserves:

Additional comments:

References:

Reed, 1967; Detterman and Cobb, 1972; Cobb, 1976; MacKevett and Holloway, 1977; Detterman and Reed, 1980; Cobb and Reed, 1981 (OFR 81-1343A); Cobb and Reed, 1981 (OFR 81-1343B).

Primary reference: Reed, 1967

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/09/03

Site name(s): Kamishak (Painted River)

Site type: Prospect

ARDF no.: IL047

Latitude: 59.2329

Quadrangle: IL A-4

Longitude: 154.4713

Location description and accuracy:

The Kamishak prospect is in the SE1/4 SE1/4 sec. 10, T. 11 S., R. 31 W., Seward Meridian (written commun., P. Thurston, Kennecott Exploration Company, June 18, 2003). It is at an elevation of about 1,500 feet and is on the northwest wall of a southwest-trending canyon that continues into adjacent section 15. The location is accurate within 500 feet.

Commodities:

Main: Au, Cu

Other: Ag, Fe

Ore minerals: Bornite, chalcopyrite, magnetite, malachite, pyrite

Gangue minerals:

Geologic description:

The Kamishak prospect is a breccia pipe at least 300 feet in diameter in Jurassic(?) intermediate and mafic igneous rocks (Detterman and Reed, 1980; Alaska Geologic Materials Center, 1995; P. Thurston, written commun., 2003). The strongest mineralization in the pipe is near its walls, and consists of angular blocks of intensely sericitized, fine- to medium- grained gabbro in a matrix of coarse amphibole, biotite, and plagioclase, and 1 to more than 5 percent sulfides. Weaker mineralization occurs in less-brecciated to massive gabbro and diorite containing irregular clots of amphibole, biotite, chlorite, and sulfides. Minor phases of the breccia include hornblende gabbro and gabbroic anorthosite; the anorthosite locally contains a few percent of disseminated magnetite.

The sulfide minerals are chiefly pyrite and chalcopyrite; bornite locally makes up as much 5 percent of the breccia. Malachite coats joint faces of mineralized rock, and magnetite occurs in amounts up to about 3 percent. Samples of the breccia locally contain significant gold and copper, and up to about 0.3 ounce of silver per ton. American Copper and Nickel Company (ACNC) drilled the deposit in 1990 and 1991 for a total of 5,300 feet (Alaska Geologic Materials Center, 1995). In drill hole 83523, the interval between 166 and 235 feet contained as much as 1,990 parts per billion gold and 2.58 percent copper; none of the interval contained less than 102 parts per billion gold and 0.255 per-

cent copper. The interval from 15 to 166 feet also is mineralized. Drill holes 83521 and 83524 through 83527 are also appreciably mineralized.

Alteration minerals in the breccia include chlorite, biotite, potassium feldspar, and sericite. Relatively high gold values appear to accompany coarse secondary biotite and do not necessarily correlate with copper content.

Alteration:

Propylitic and potassic: development of secondary biotite and potassium feldspar; local sericitization.

Age of mineralization:

Jurassic?

Deposit model:

Porphyry copper-gold(?) (Cox and Singer, 1986; model 20c).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

20c

Production Status: None**Site Status:** Uncertain**Workings/exploration:**

The prospect was discovered by Andy Snyder of the Spokane office of American Copper and Nickel Company (P. Thurston, written commun., 2003). The company core drilled 18 holes in 1990 and 1991 for a total of 5,300 feet.

Production notes:**Reserves:****Additional comments:**

Most of the geologic description in this record is abstracted from logs of drill core stored at the Alaska Geologic Materials Center in Eagle River, Alaska (Alaska Geologic Materials Center, 1995).

References:

Detterman and Reed, 1980; Alaska Geologic Materials Center, 1995.

Primary reference: This record; Alaska Geologic Materials Center, 1995

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/18/03

Site name(s): Unnamed (east of the head of Lake Fork of Paint River)

Site type: Prospect

ARDF no.: IL048

Latitude: 59.2486

Quadrangle: IL A-4

Longitude: 154.4666

Location description and accuracy:

This prospect is at an elevation of about 2,050 feet, east of the head of Lake Fork of Paint River and 0.9 mile northwest of hill 3169. The prospect is in the SW1/4 SW1/4 sec. 2, T. 11 S., R. 31 W., Seward Meridian. The site is locality 21 of Detterman and Cobb (1972), and is accurate within about 0.5 mile.

Commodities:

Main: Fe

Other: Ti

Ore minerals: Magnetite

Gangue minerals: Quartz

Geologic description:

The country rock at this prospect is mainly Jurassic quartz diorite that locally contains roof pendants of Jurassic mafic and ultramafic igneous rocks (Detterman and Reed, 1980). The prospect consists of small bodies of magnetite-quartz and magnetite-rich skarn in the mafic and ultramafic rocks (Berg and Cobb, 1967; Detterman and Reed, 1980).

Alteration:

Contact metasomatism: formation of replacement bodies of iron-rich skarn in mafic and ultramafic rocks intruded by quartz diorite.

Age of mineralization:

Jurassic.

Deposit model:

Fe skarn (Cox and Singer, 1986, model 18d).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

18d

Production Status: None

Site Status: Inactive

Workings/exploration:

Prospect was staked but little work was done (Berg and Cobb, 1967).

Production notes:

Reserves:

Additional comments:

References:

Berg and Cobb, 1967; Detterman and Cobb, 1972; Detterman and Reed, 1980.

Primary reference: Detterman and Reed, 1980; Berg and Cobb, 1967

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/10/03

Site name(s): Unnamed (east of Seven Sisters)

Site type: Prospect

ARDF no.: IL049

Latitude: 59.4164

Quadrangle: IL B-4

Longitude: 154.2031

Location description and accuracy:

This prospect is at an elevation of about 2,200 feet, about 1.25 miles east-southeast of the summit of Seven Sisters. It is in the NE1/4NW1/4 sec. 8, T. 9 S., R. 29 W., Seward Meridian. The site, which is locality 30 of MacKevett and Holloway (1977), is accurate within about 1 mile.

Commodities:

Main: Fe

Other: Ti

Ore minerals: Magnetite?

Gangue minerals:

Geologic description:

This prospect appears to be in a batholith of Jurassic, medium- to coarse-grained quartz diorite, east of an outcrop area of Tertiary basalt and andesite on the Seven Sisters (Detterman and Reed, 1980). The batholith locally contains diorite and granodiorite phases, and includes roof pendants of metamorphic rocks.

Lode claims, probably for iron, were staked at this site (U.S. Bureau of Mines, 1973; MacKevett and Holloway, 1977). The deposit probably consists of disseminations and veinlets of magnetite in relatively mafic phases of the batholith.

Alteration:

Age of mineralization:

Probably Jurassic.

Deposit model:

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

Production Status: None

Site Status: Probably inactive

Workings/exploration:

Claims were staked at this site during or before 1973 (U.S. Bureau of Mines, 1973).
There is no record of any workings.

Production notes:

Reserves:

Additional comments:

References:

U.S. Bureau of Mines, 1973; MacKevett and Holloway, 1977; Detterman and Reed, 1980.

Primary reference: Detterman and Reed, 1980; McKevett and Holloway, 1977

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/09/03

Site name(s): Chenik Mountain; Pan American Petroleum Corp.

Site type: Prospect

ARDF no.: IL050

Latitude: 59.2414

Quadrangle: IL A-4

Longitude: 154.2737

Location description and accuracy:

This prospect is on or near the westernmost peak of Chenik Mountain at an elevation of about 3,000 feet. The site, which approximates the center of the outcrop area of the prospect, is about 1,700 feet west-northwest of peak 3117, in the E1/2 NE1/4 sec. 11, T. 11 S., R. 30 W., Seward Meridian. The site is location 22 of Detterman and Cobb (1972), and is accurate within 0.5 mile.

Commodities:

Main: Fe

Other: Ti

Ore minerals: Magnetite

Gangue minerals:

Geologic description:

This prospect is in the upper part of a Lower or Middle Jurassic quartz diorite batholith which intrudes older Jurassic, mafic and ultramafic rocks (Detterman and Reed, 1980). The mafic and ultramafic rocks form large roof pendants that probably are remnants of the roof of the batholith. Mafic and ultramafic rocks that crop out about a mile southeast of the site are downfaulted in a northeast-trending graben (Detterman and Reed, 1980).

The deposit consists of magnetite that is relatively abundant in diorite, gabbro, and hornblendite, and less abundant in quartz diorite (Detterman and Reed, 1980, p. B79). It occurs as disseminations, veinlets, lenses, and pods. In the hornblendite, magnetite makes up as much as 15-20 percent of the rock and occurs as grains in hornblende, along hornblende grain boundaries, and in lenses and irregular clots. In rocks other than hornblendite, magnetite generally makes up less than 10 percent of the rock.

The Chenik Mountain deposit is probably large but relatively low-grade (Berg and Cobb, 1967). It was discovered by Pan American Petroleum Company following a regional aeromagnetic survey in 1964.

Alteration:

Age of mineralization:

Jurassic.

Deposit model:

Fe-Ti magmatic segregation deposit similar to Alaska PGE (Cox and Singer, 1986; model 9).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

9

Production Status: None

Site Status: Inactive

Workings/exploration:

The Chenik Mountain iron deposit was discovered by Pan American Petroleum Company after a regional aeromagnetic survey in 1964. Large magnetic anomalies revealed by the survey led to a staking rush by private interests.

Production notes:**Reserves:**

The deposit is a possible large, low-grade, resource of titaniferous magnetite (Berg and Cobb, 1967).

Additional comments:

Claim names at this occurrence include: Gaec 1-8, Amak 98-104, and Snow Job 1-13 (McFaul and others, 2000).

References:

Berg and Cobb, 1967; Detterman and Cobb, 1972; MacKevett and Holloway, 1977; Detterman and Reed, 1980; Cobb and Reed, 1981 (OFR 81-1343A); Cobb and Reed, 1981 (OFR 81-1343B); McFaul and others, 2000.

Primary reference: Detterman and Reed, 1980

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/11/03

Site name(s): Unnamed (on peninsula south of Bruin Bay)

Site type: Prospect

ARDF no.: IL051

Latitude: 59.3490

Quadrangle: IL B-3

Longitude: 154.0125

Location description and accuracy:

This prospect is on or near the north shoreline of the peninsula between Bruin Bay and Kamishak Bay, about two miles west of Contact Point. It probably is in the E1/2 sec. 32, T. 9 S., R. 28 W., Seward Meridian. The location is probably accurate within about 0.5 mile. It includes site no. 16 of Detterman and Cobb (1972), which is appreciably inland. A mineral locality described in Detterman and Reed (1980, fig. 6) may be about 0.5 mile farther east.

Commodities:

Main: Cu, Fe, Zn

Other: Cd, Pb, Sn

Ore minerals: Chalcopyrite?, pyrite?, sphalerite?

Gangue minerals:

Geologic description:

This prospect appears to be in Jurassic quartz monzonite (Detterman and Reed, 1980; Detterman and Reed, 1964). A grab sample from an old prospect pit (Detterman and Reed, 1964, sample no. 120) contained more than 10 percent iron, 2 percent zinc, 0.05 percent each of copper and cadmium, and 0.01 percent each of lead and tin. Additional samples may have contained more copper, inasmuch as Detterman and Reed (1980, fig. 6) show the same or a nearby prospect as a copper deposit. The ore minerals are not described, but the assays suggest that the prospect contains sphalerite, chalcopyrite, and pyrite, or their oxidation products. The tin value may reflect its background level in the quartz monzonite; other prospects in Jurassic quartz monzonite in the area contain small amounts of tin (see, for example, Diamond Point, IL018).

Alteration:

Age of mineralization:

Probably Jurassic, the age of the host rock.

Deposit model:

Possibly polymetallic vein (Cox and Singer, 1986, model 22c).

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

22c?

Production Status: None

Site Status: Inactive

Workings/exploration:

The deposit was explored by a prospect pit (Detterman and Reed, 1964).

Production notes:

Reserves:

Additional comments:

References:

Detterman and Reed, 1964; Detterman and Cobb, 1972; Detterman and Reed, 1980.

Primary reference: Detterman and Reed, 1964

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/09/03

Site name(s): Augustine Island; Alaska Katmalite Corp.

Site type: Mine

ARDF no.: IL052

Latitude: 59.3418

Quadrangle: IL B-2

Longitude: 153.4469

Location description and accuracy:

This mine is at an elevation of about 1,250 feet on the south flank of Augustine volcano, approximately 2,300 feet southwest of VABM Kamishak. The map site is in the NW1/4 sec. 2, T. 10 S., R. 25 W., Seward Meridian. The location of the mine is shown as a prospect symbol on the Iliamna 1:250,000-scale topographic map; a tractor trail to the mine is shown on the Iliamna B-2 quadrangle map (1958 ed., rev. 1977). The location of the mine is accurate within a few hundred feet.

Commodities:

Main: Pumice

Other:

Ore minerals: Pumice

Gangue minerals:

Geologic description:

Augustine Island is a volcanic cone composed mainly of Quaternary, trachytic and andesitic pyroclastic material, subordinate lava, and rhyolitic pumice and scoria (Detterman and Reed, 1980). Several occurrences of pumice have been staked. At the Alaska Katmalite mine site, a deposit of pumice about 10 feet thick, 300 feet long, and probably about 50 feet wide was partly mined (Moxham, 1951).

Alteration:

Age of mineralization:

Quaternary.

Deposit model:

Deposit model number (After Cox and Singer, 1986 or Bliss, 1992):

Production Status: Yes

Site Status: Inactive

Workings/exploration:

Between 1946 and 1949, pumice was mined, trucked to a landing, and barged to Anchorage. Volcanic eruptions since 1949 have caused considerable local changes, cutting off the road to the main deposit and destroying several buildings.

Production notes:

Between 1946 and 1949, pumice was mined and barged to Anchorage, and used to make building blocks (Moxham, 1951).

Reserves:

Additional comments:

References:

Moxham, 1951; Rutledge and others, 1953; Eckhart and Plafker, 1959; Detterman and Reed, 1973; Cobb, 1976; Detterman and Reed, 1980.

Primary reference: Moxham, 1951

Reporter(s): C.C. Hawley, Hawley Resource Group, Anchorage, Alaska

Last report date: 06/09/03

References

- Alaska Geologic Materials Center, 1995, Geologic and mineral logs of 18 holes of the Kamishak prospect in the Paint River area of southwest Alaska: Alaska Geologic Materials Center Data Report No. 256, Eagle River, Alaska, 127 p.
- Anderson, Gary, and others, 1979, The mineral potential of the Bristol Bay Native region, v. II, book 4: Resource Associates of Alaska, Fairbanks, Alaska (Report on file, Bristol Bay Native Corporation, Anchorage, Alaska).
- Bain, H.F., 1946, Alaska's minerals as a basis for industry: U.S. Bureau of Mines Information Circular 7379, 89 p.
- Berg, H.C., and Cobb, E.H., 1967, Metalliferous lode deposits of Alaska: U.S. Geological Survey Bulletin 1246, 254 p.
- Bouley, B.A., St. George, P., and Wetherbee, P.K., 1995, Geology and discovery at Pebble Copper, a copper-gold porphyry system in southwest Alaska: CIM Special Volume 46, p. 422-435.
- Brooks, A.H., 1913, The mining industry in 1912: U.S. Geological Survey Bulletin 542, p. 18-51.
- Brooks, A.H., 1914, The Alaskan mining industry in 1913: U.S. Geological Survey Bulletin 592, p. 45-74.
- Brooks, A.H., 1915, The Alaskan mining industry in 1914: U.S. Geological Survey Bulletin 622, p. 15-68.
- Brooks, A.H., 1918, The Alaskan mining industry in 1916: U.S. Geological Survey Bulletin 622, p. 11-62.
- Brooks, A.H., 1923, The Alaskan mining industry in 1921: U.S. Geological Survey Bulletin 739, p. 1-44.
- Brooks, A.H., 1925, Alaska's mineral resources and production, 1923: U.S. Geological Survey Bulletin 773, p. 3-52.
- Brooks, A.H., and Capps, S.R., 1924, The Alaskan mining industry in 1924: U.S. Geological Survey Bulletin 755, p. 3-49.
- Brooks, A.H., and Martin, G.C., 1921, The Alaskan mining industry in 1919: U.S. Geological Survey Bulletin 714, p. 59-95.
- Bundtzen, T. K., Swainbank, R. C., Wood, J. E., and Clough, A. H., 1991, Alaska's mineral industry 1991: Alaska Division of Geological and Geophysical Surveys Special Report 46, 89 p.
- Butherus, D. L., 1984, Assessment work [1984], KUY claims, Bristol Bay Native Corporation lands: Resource Associates of Alaska, Fairbanks, Alaska (Report on file, Bristol Bay Native Corporation, Anchorage, Alaska).
- Butherus, D. L., White, D. C., Smith, W. H., Radford, Geoff, Sandberg, R. J., and Pray, J. C., 1981, Exploration and evaluation of precious metals potential of Bristol Bay Native Corporation lands, southwest Alaska, v. 1: Resource Associates of Alaska, Fairbanks, Alaska. (Report on file, Bristol Bay Native Corporation, Anchorage, Alaska).
- Capps, S.R., 1935, The southern Alaska Range: U.S. Geological Survey Bulletin 862, 101 p.
- Cobb, E.H., 1976, Summary of references to mineral occurrences (other than mineral fuels and construction materials) in the Iliamna, Lake Clark, Lime Hills, and MaGrath quadrangles, Alaska: U.S. Geological Survey Open-File Report 76-485, 94 p.

- Cobb, E.H., and Reed, B.L., 1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in the Iliamna, Lake Clark, Lime Hills, and McGrath quadrangles, Alaska, supplement to Open-File Report 76-485, Part A – Summaries to January 1, 1981: U.S. Geological Survey Open-File Report 81-1343A, 29 p.
- Cobb, E.H., and Reed, B.L., 1981, Summaries of data on and lists of references to metallic and selected nonmetallic mineral occurrences in the Iliamna, Lake Clark, Lime Hills, and McGrath quadrangles, Alaska, supplement to Open-File Report 76-485, Part B – References to January 1, 1981: U.S. Geological Survey Open-File Report 81-1343B, 20 p.
- Dahners, L. A., 1947, Preliminary reports on some pumice deposits, Augustine Island, Alaska: Alaska Territorial Department of Mines Mineral Investigation 103-1, 22 p.
- Detterman, R.L., 1969, Analyses of selected limestone samples from Iliamna and Bruin Bays, Iliamna quadrangle, Alaska: U.S. Geological Survey Open-File Report 392, 6 sheets.
- Detterman, R. L., 1973, Geologic map of the Iliamna B-2 quadrangle, Augustine Island, Alaska: U. S. Geological Survey Geologic Quadrangle Map GQ-1068, 1 sheet, scale 1:63,360.
- Detterman, R.L., and Cobb, E.H., 1972, Metallic mineral resources map of the Iliamna quadrangle, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-364, 1 sheet, scale 1:250,000.
- Detterman, R.L., and Hartsock, J.K., 1966, Geology of the Iniskin-Tuxedni region, Alaska: U.S. Geological Survey Professional Paper 512, 78 p.
- Detterman, R. L., and Reed, B. L., 1964, Preliminary map of the geology of the Iliamna quadrangle, Alaska: U. S. Geological Survey Miscellaneous Geological Investigations Map I-407, 1 sheet, scale 1:250,000.
- Detterman, R. L., and Reed, B. L., 1968, Geology of the Iliamna quadrangle, Alaska: U. S. Geological Survey Open-File Report 68-72, scale 1:250,000.
- Detterman, R. L., and Reed, B. L., 1973, Surficial deposits of the Iliamna quadrangle, Alaska: U.S. Geological Survey Bulletin 1368-A, 64 p., 1 sheet, scale 1:250,000.
- Detterman, R. L., and Reed, B. L., 1980, Stratigraphy, structure, and economic geology of the Iliamna quadrangle, Alaska: U.S. Geological Survey Bulletin 1368-B, 86 p.
- Eckhart, R. A., and Plafker, G., 1959, Haydite raw material in the Kings River, Sutton, and Lawing areas, Alaska: U.S. Geological Survey Bulletin 1039-C, p. 33-65.
- Fischer, R.P., 1975, Vanadium resources in titaniferous magnetite deposits: U.S. Geological Survey Professional Paper 926-B, p. B1-B10.
- Foley, J. Y., Light, T. B., Nelson, S. W., and Harris, R. W., 1997, Mineral occurrences affiliated with mafic-ultramafic and related alkaline complexes in Alaska: Economic Geology Monograph 9, Mineral Deposits of Alaska, p. 396-449.
- Freeman, C. L., and Farnham, Susan, 1983, Bristol Bay Native Corporation [1983] Native Corporation lands, Final report: Resource Associates of Alaska, Fairbanks, Alaska (Report on file, Bristol Bay Native Corporation, Anchorage, Alaska).
- Jasper, M.W., 1953, Preliminary report on copper occurrences on McNeil claim group, Paint River area, Kamishak Bay region: Alaska Territorial Department of Mines Property Examination 103-1, 14 p. 6 sheets.

- Jasper, M.W., 1956, McNeil copper claim group, Paint River area: Alaska Territorial Department of Mines Property Examination 103-2, 19 p., 3 sheets.
- MacKevett, E.M., and Holloway, C.D., 1977, Metalliferous mineral deposits in the western part of southern Alaska: U.S. Geological Survey Open-File Report 77-169F, 38 p., 1 sheet, scale 1:1,000,000.
- Martin, G.C., 1920, The Alaskan mining industry in 1918: U.S. Geological Survey Bulletin 712, p. 11-52.
- Martin, G.C., and Katz, F.J., 1910, Outline of the geology and mineral resources of the Iliamna and Clark Lake region: U.S. Geological Survey Bulletin 442, p. 179-200.
- Martin, G.C., and Katz, F.J., 1912, A geologic reconnaissance of the Iliamna region, Alaska: U.S. Geological Survey Bulletin 485, 138 p.
- Mather, K.F., 1925, Mineral resources of the Kamishak Bay region: U.S. Geological Survey Bulletin 773, p. 159-181.
- McFaul, E. J., Mason, G. T., Jr., Ferguson, W. B., and Lipin, B. R., 2000, U.S. Geological Survey mineral databases, MRDS and MAS/MILS: U.S. Geological Survey Digital Data Series, Report DDS-0052, 2 discs.
- Moller, S. A., Bernt, J., Farnstrom, H. E., Toupe, W., Hanneman, Nancy, 1982, Exploration and evaluation of precious metals potential of Bristol Bay Native Corporation lands, SW Alaska, vols. IV and V: Resource Associates of Alaska, Fairbanks, Alaska. (Report on file, Bristol Bay Native Corporation, Anchorage, Alaska).
- Moxham, R.M., 1951, Pumice deposits in the Alaska Peninsula-Cook Inlet region, Alaska: U.S. Geological Survey Open-File Report 49, 21 p.
- Moxham, R.M., and Nelson, A.E., 1952, Reconnaissance for radioactive deposits in the southern Cook Inlet region, Alaska, 1949: U.S. Geological Survey Circular 207, 7 p.
- Muller, Daniel, and Groves, D. I., 1995, Potassic igneous rocks and associated gold-copper mineralization: *in* No. 56, Lecture notes in Earth Sciences, Springer-Verlag, New York, 210 p.
- Northern Dynasty Minerals, 2003, Internet Home Page, March 14, 2003: <www.northerndynastyminerals.com/ndm/Home.asp>
- Reed, B.L., 1967, Results of stream-sediment sampling and bedrock analyses in the eastern part of the Iliamna quadrangle, and at Kasna Creek, Lake Clark quadrangle, Alaska: U.S. Geological Survey Open-File Report 67-185, 18 p.
- Reed, B.L., and Detterman, R.L., 1965, A preliminary report on some magnetite-bearing rocks near Frying Pan Lake, Iliamna D-7 quadrangle, Alaska: U.S. Geological Survey Open-File Report 260, 2 p.
- Retherford, R. M., and Hickok, B. D., 1990, Reconnaissance of Bristol Bay Native Corporation lands, v. II: Western Gold Mining and Exploration Co., Ltd. (Report on file, Bristol Bay Native Corporation, Anchorage, Alaska).
- Retherford, R. M., and Klemmick, George, 1999, The Fog Lake property. A summary: Alaska Earth Sciences, Anchorage, Alaska. (Report on file, Bristol Bay Native Corporation, Anchorage, Alaska).
- Richter, D. H., and Herreid, G., 1965, Geology of the Paint River area, Iliamna quadrangle, Alaska: Alaska Division of Mines and Minerals Geologic Report 8, 30 p., 1 sheet, scale 1:31,680.
- Roehm, J. C., 1941, Millett copper property Alaska: Territorial Department of Mines Miscellaneous Report 103-

1, 9 p.

Rutledge, F. A., and Mulligan, J. J., 1952, Investigation of the Millett copper deposit, Iliamna Lake, southwestern Alaska: U. S. Bureau of Mines Report of Investigations 4890, 22 p.

Rutledge, F. A., Thorne, R.L., Kerns, W.H., and Mulligan, J.J., 1953, Preliminary report: nonmetallic deposits accessible to The Alaska Railroad as a possible source of raw materials for the construction industry: U. S. Bureau of Mines Report of Investigations 4932, 129 p.

Smith, P.S., 1917, The Lake Clark-central Kuskokwim region, Alaska: U.S. Geological Survey Bulletin 655, 162 p.

Smith, P.S., 1942, Occurrences of molybdenum minerals in Alaska: U.S. Geological Survey Bulletin 926-C, p. 161-210.

U.S. Bureau of Mines, 1973, Iliamna, Alaska quadrangle maps showing mineral deposit locations, principal minerals, and number and type of claims: U.S. Bureau of Mines Open-File Report 20-73, scale 1:250,000.

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, 123 p.

Youngman, Bruce, 2003, New discoveries within the giant Pebble copper-gold sulfide system [abs]: 20/2003 Cordilleran Exploration Roundup, Vancouver, B.C., Canada, p. 40-41.