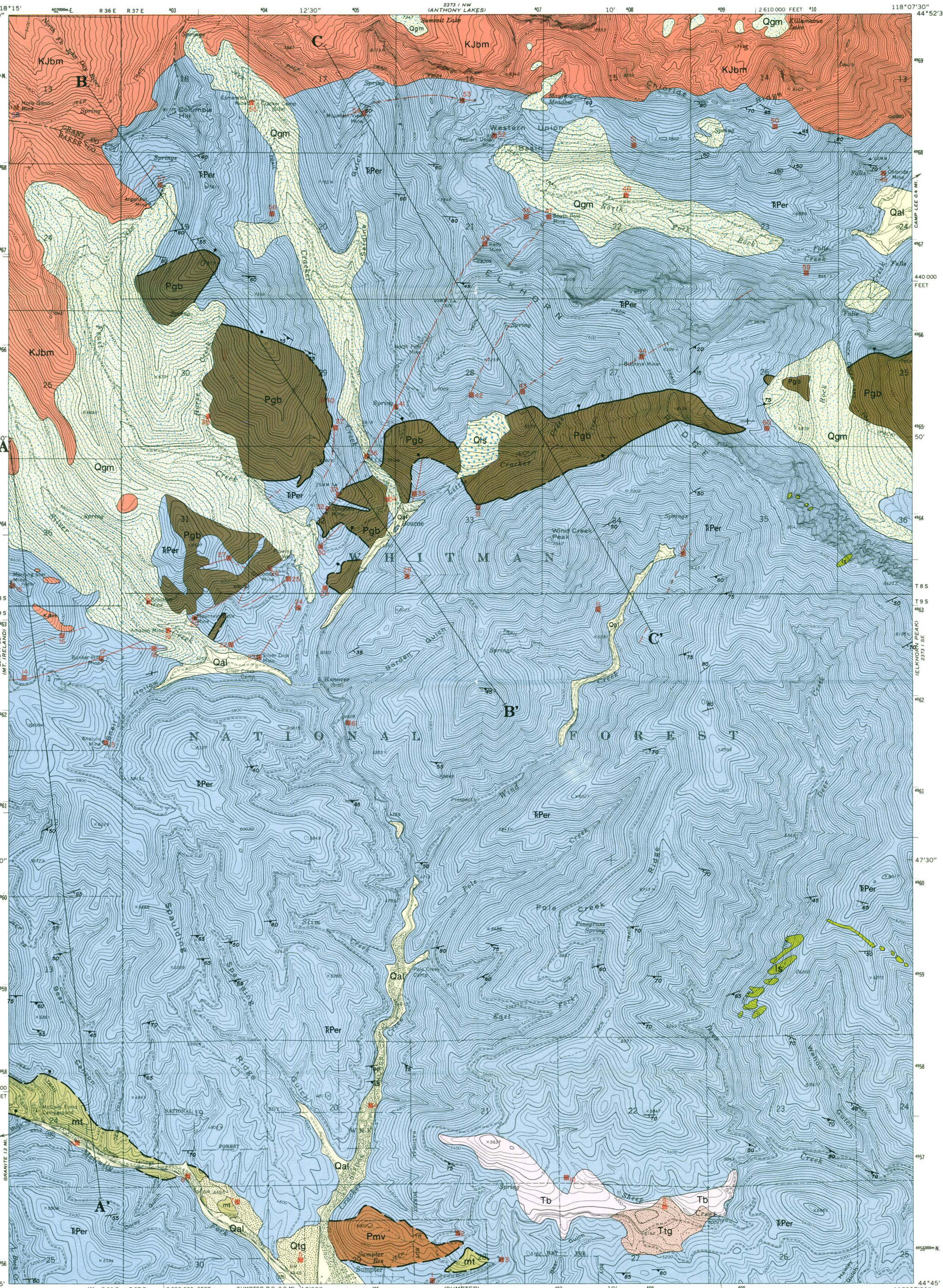
STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
DONALD A. HULL, STATE GEOLOGIST

Geology and Gold Deposits Map of the Bourne Quadrangle, Oregon

1982

Funded in part by United States Department of Agriculture – U. S. Forest Service



Base Map by U. S. Geological Survey
Control by USGS and NOS/NOAA
Topography by photogrammetric methods from aerial photographs taken 1971. Field checked 1972
Projection and 10,000-foot grid ticks: Oregon coordinate system, north zone (Lambert conformal conic)
1000-metre Universal Transverse Mercator grid ticks, zone 11, shown
1927 North American datum
Where omitted, land lines have not been established

Map prepared by STATE OF OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

Cartography by Paul E. Staub, 1981

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

QUADRANGLE LOCATION

Geology by H. C. Brooks, M. L. Ferns, R. I. Coward, E. K. Paul, and M. Nunlist.

Field work completed in 1980.

TIME ROCK CHART

Era	Period	Epoch	Units
CENOZOIC	Quaternary	Holocene and Pleistocene	Qal, Qtg, Qgm, Qls
	Tertiary	Pliocene	
		Miocene	Tb, Ttg
		Oligocene	
		Eocene	
		Paleocene	
MESOZOIC	Cretaceous	upper	
		lower	KJbm
	Jurassic	upper	
		middle and lower	
	Triassic	upper	
		middle and lower	mt
PALEOZOIC	Permian		TRPer, ls, Pmv, Pgb
	Pre-Permian		

EXPLANATION

Qal — **Alluvium (Holocene and Pleistocene)** – *Unconsolidated, poorly sorted fluviatile deposits consisting of gravel, sand, and silt in channels and flood plains of the present drainage system*

Qls — **Landslide debris (Holocene and Pleistocene)** – *Unstratified, heterogeneous mixtures of soil and angular rock fragments resulting from bedrock failure on oversteepened slopes; typified by hummocky topography*

Qgm — **Glacial deposits (Holocene and Pleistocene)** – *Unconsolidated, unsorted accumulations of boulders, cobbles, sand, and silt deposited by glaciers. Includes terminal and lateral moraines on Silver Creek and Fruit Creek. Boulders are predominantly tonalite and granodiorite of unit KJbm and range up to 30 ft in diameter*

Qtg — **Terrace gravel (Holocene and Pleistocene)** – *Unconsolidated to weakly consolidated, poorly sorted fluviatile deposits of gravel, sand, and silt situated at higher levels than the flood plains of present streams*

Tb — **Basalt (Miocene?)** – *Bluish-gray to black, olivine-bearing vesicular basalt*

Ttg — **Older gravels (Miocene?)** – *Poorly consolidated, poorly sorted gravel deposits which in part overlie and in part underlie the basalt of unit Tb in sec. 27, T. 9 S., R. 37 E.*

KJbm — **Bald Mountain Batholith (Lower Cretaceous-Upper Jurassic)** – *Dominantly tonalite and granodiorite, with small amounts of norite and quartz diorite. Dikes and sills of similar compositions occur along the borders of the batholith. Rb-Sr and K-Ar dates for the batholith range from 131 m.y. to 158 m.y. (Armstrong and others, 1977)*

mt — **Mixed rock terrane** – *A structurally chaotic assemblage of rocks of different compositions and ages consisting of tectonically juxtaposed blocks and slices of altered serpentinite, basalt, gabbro, diorite, argillite, chert, volcaniclastic breccia and conglomerate, and limestone, all metamorphosed to the greenschist facies. Locally the serpentinite is recrystallized to talc-chlorite and talc-carbonate rock. Blocks range from a few meters to several hundred meters in longest dimension. Tectonism responsible for development of the terrane probably occurred in Early to Middle Triassic time. This conclusion is based on the assumption that the included argillite, chert, and limestone are correlative with similar rocks in the Elkhorn Ridge Argillite and that the unit correlates with the Canyon Mountain Complex near John Day are overlain unconformably by Upper Triassic sedimentary rocks*

TRPer / ls — **Elkhorn Ridge Argillite (Triassic, Permian, Pennsylvanian)** – *Mainly dark-colored argillite, siliceous argillite, and chert, with small amounts of fine-grained felsic tuff, sandstone, conglomerate, and small lenses of limestone (ls). Some argillites are nearly black due to high carbon content. Some siliceous rocks are light gray, pale brown, or slightly red or green. Rocks with volcanic material vary from grayish green to pale yellow. The limestones are bluish gray. Argillite and siliceous argillite are the most abundant rock types; chert predominates locally. Many exposures consist of alternating siliceous and argillaceous layers ranging from a fraction of an inch to several feet thick. The siliceous layers commonly pinch and swell between layers of argillite. The tuffs generally are aphanitic, flinty-textured rocks. Tiny quartz and feldspar phenocrysts are occasionally discernible in hand specimens. Rare pebble conglomerate beds consist of poorly sorted subrounded fragments up to 3 in in diameter of felsic and mafic volcanic rocks, chert, and argillite in a matrix of similar composition. The rocks underwent complex deformation and regional greenschist facies metamorphism prior to emplacement of the Bald Mountain Batholith. The most prominent structural features are a penetrative shear cleavage and small contorted folds with associated boudinage structures which generally trend easterly and dip steeply to the south. Intricate small-scale brecciation is common. Rocks in the thermal aureole of the Bald Mountain Batholith have been hornfelsed. Within a few hundred meters of the contact, argillite has been recrystallized to quartz-biotite-garnet schist. Biotite occurs in argillite as much as 1.5 mi from the intrusive contact.*

Fossils of Pennsylvanian, Permian, and Triassic age have been found in limestone pods in Elkhorn Ridge Argillite outside the Bourne quadrangle. The diverse age and structural complexity show that the Elkhorn Ridge Argillite is not a simple stratigraphic unit

Pmv — **Metavolcanic rocks** – *Greenish-gray to yellowish-green fine-grained lava flows and volcaniclastic rocks of basaltic composition. Primary igneous textures are obscured by metamorphism. Greenschist facies mineral assemblages include clinozoisite-albite-prehnite and clinozoisite-chlorite-albite-quartz-actinolite. Chemical analysis of a single sample showed 50.5 percent SiO_2, 0.1 percent K_2O, and 3.3 percent Na_2O*

Pgb — **Metamorphosed igneous complex** – *Mainly gabbro with some diorite and quartz diorite which have been metamorphosed to the greenschist facies. Includes minor amounts of metapyroxenite and hornblende pegmatite, notably in the SE¼NW¼ sec. 29, T. 8 S., R. 37 E. Locally the metagabbro is foliated and grades into amphibolite. Grayish-green fine-grained andesitic and basaltic greenstone is included in the complex in sec. 25, T. 8 S., R. 37 E. Some of the rocks probably represent dikes, and some may have originated as lava flows. Since the complex forms a large part of the complex in the adjacent Elkhorn Peak quadrangle and are believed by Stimson (1980) to interfinger with chert and argillite in that area. All contacts with the Elkhorn Ridge Argillite are probably fault contacts. Age of the complex is unknown. Metagabbro similarly associated with the Elkhorn Ridge Argillite in the Oxman area east of Baker is cut by plagiogranite dikes which have yielded a Pb-U date of 241 m.y., and zircons from quartz-bearing gabbro and from plagiogranite dikes in the Canyon Mountain Complex gave Pb-U ages of 278 m.y. (Walker and Mattinson, 1980)*

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GEOLOGIC SYMBOLS

Contact

Fault – dashed where approximately located; ball and bar on downthrown side

Quartz veins, and lodes – dashed where approximately located

Strike and dip of beds

Strike and dip of foliation

Strike of vertical beds

Mines and prospects

GOLD AND SILVER DEPOSITS

Gold and silver from quartz vein and placer deposits have been the main mineral products of the quadrangle, which covers most of the Cracker Creek mining district and small parts of the Rock Creek and Cable Cove districts. Historically, the Cracker Creek district is one of the most important mining districts in Oregon. Using historical values of gold and silver at the time of mining, total value of output from mines in the quadrangle has been about $11 million – $8 million from vein deposits and $3 million from placers. Most of the lode production occurred between 1895 and 1916. Placer production was greatest from 1938 to 1941.

Lode gold production has been mainly from composite veins that are the result of several stages of brecciation and mineralization, including partial to complete quartz replacement of the brecciated rocks. Simple veins of quartz, with or without sulfides, are common, but few, if any, have been productive. With few exceptions, the veins strike northeast and dip steeply southeast. Most of the production was from veins in argillite and chert of the Elkhorn Ridge Argillite. Some veins cut granitic rocks of the Bald Mountain Batholith, and some are in the older gabbro.

Known mines and prospects are located on the map by numbers that correspond to the list of names and locations in Table 1. A check of patent plats and other maps indicated that some mines and prospects are misnamed on the topographic base map. These errors have been corrected whenever possible. Some of the names of lesser known mines and prospects were found in the literature and on old property maps. Owing to time constraints, some map traverses were as much as half a mile apart, and it is likely that many small veins and prospect excavations were not observed.

North Pole-Columbia lode:
The most productive vein deposits are along the North Pole-Columbia lode, which is traceable by outcrops and mine and prospect workings for about 4.5 mi. Total output of the North Pole-Columbia lode is approximately 370,000 oz of gold and about $190,000 in silver. The productive part of the lode is about 2.3 mi long, extending through the Golconda (26), Columbia (32), Taber Fraction (33), Eureka and Excelsior (36), and North Pole (41) Mines. From the Columbia through the North Pole Mines, stopes in the lode are nearly continuous for about 9,000 ft. Vertical extent of mine workings is about 2,500 ft, from the upper levels of the North Pole Mine to the bottom of the Columbia shaft, which is 918 ft deep. A large part of the lode within 1,000 ft of the surface remains unexplored.

In most places the lode cuts only argillite and chert of the Elkhorn Ridge Argillite. Metagabbro crops out along the footwall of the lode on Golconda ground and along the hanging wall on Columbia ground. Pardee (1909) concluded that the lode occupies a fault zone on which there has been about 1,800 ft of horizontal movement and 400 ft of vertical movement. The lode dips steeply southeast. Widths range from 10 to 300 ft and average about 25 ft. Outcrops locally project as much as 30 ft above ground level. The widths of mined ore shoots vary from a few inches to about 30 ft and average between 4 and 6 ft.

The lode consists mainly of irregular bands and lenses of silicified argillite and chert breccia, quartz, and fault gouge. Some of the quartz replaced the country rocks, and some was deposited in fractures and other open spaces. Evidently quartz deposition was sporadic and repeatedly interrupted by brecciation. Sulfide minerals and gold were deposited locally near the end of the mineralizing process.

Reports by Pardee and Hewett (1914) and Swartley (1914) indicate that the best gold and silver values are in silicified argillite. The massive quartz generally contains very little gold. Calcite, roscoelite, fuchsite, and sericite are present locally. Sulfides, chiefly pyrite, typically comprise a small percentage of the ore. Other sulfides include arsenopyrite, marcasite, chalcopyrite, tetrahedrite, stibnite, galena, sphalerite, pyrargyrite, antimonite, schwatzite, and cinnabar; gold telluride minerals are rare. Roscoelite, fuchsite, arsenopyrite, and chalcopyrite, either singly or together, are typical components of the rich ore, but their presence does not necessarily indicate high values. Practically all of the gold and silver is in sulfide minerals, chiefly arsenopyrite, and, to a lesser extent, pyrite and chalcopyrite. Ore minerals are not disseminated throughout the lode but occur in shoots along or near one wall, usually the footwall, although several ore shoots were found along the hanging wall, and, in a few places, near the middle of the lode. At least one ore shoot cut diagonally across the lode (Parks and Swartley, 1916, p. 62). The ratio of silver to gold ranged from 3:1 to less than 1:1. There was some near-surface enrichment of the ore shoots due to leaching of sulfide and carbonate minerals, but no evidence of downward enrichment of the ore minerals has been recognized.

Placer deposits:
The lower portions of Cracker Creek and McCully Fork were worked by dragline dredges during 1938-1942. Production totaled about 22,000 oz of gold from 3.5 million yd of gravel. Earlier, parts of these areas and some of the adjacent bench gravels had been worked by hand and hydraulic methods. Quantity of output is unknown. According to Pardee (1910), these deposits were "comparatively lean," and the gravels in Fruit Creek, Silver Creek, Rock Creek, and the upper part of Cracker Creek were practically barren of gold as a result of glaciation.

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Table 1. GOLD AND SILVER MINES AND PROSPECTS IN THE BOURNE QUADRANGLE

Map no.	Mine or prospect name	Quarter section	Section	Township (South)	Range (East)	Elevation (ft)	Geologic formation	Geologic description	Surface and/or underground workings	Past production	References
1.	Name unknown	SW	28	9	37	4,600	TRPer	Quartz veinlets in shear zone in argillite	Short adit	Unknown	—
2.	Aldora claim	NW	28	9	37	4,800	TRPer Pmv	Quartz veinlets in shear zone along contact between carbonaceous argillite and greenstone	Short adit	Unknown	—
3.	Name unknown	SE	28	9	37	4,840	TRPer	Quartz veinlets in shear zone in carbonaceous argillite	Short adit	Unknown	—
4.	Cracker Creek dredge placer	—	20, 29	9	37	4,400-4,680	Qal	Placer. Channel gravel in Cracker Creek	2½ mi of creek channel mined by dragline dredges	Estimated 22,000 oz of gold from 3.5 million yd of gravel (1938-1942)	10
5.	Ellis Mine	NW	29	9	37	4,480	Qtg	Placer. Terrace gravel at confluence of McCully Fork and Cracker Creek	Small area mined	Unknown	1, 13
6.	McCully Fork dredge placer	SW SE	19 24	9 9	37 36	4,500 4,500	Qal	Placer. Channel gravel in McCully Fork	1 mi of creek channel mined by dragline dredge	Estimated 4,000 oz of gold	10
7.	Downie placer	NE	30	9	37	4,560	Qtg	Placer. Terrace gravel of McCully Fork	Small area mined	Estimated 4,000 oz of gold prior to 1910	1, 13
8.	Name unknown	SE	24	9	36	4,560	Qtg	Placer. Terrace gravel of McCully Fork; weakly consolidated	Small area mined	Unknown	—
9.	Name unknown	NE	27	9	37	5,160	Qtg	Placer. Terrace gravel of Sheep Creek	Small area mined	Unknown	—
10.	Name unknown	SW	22	9	37	5,300	TRPer	6-in-wide quartz vein with pyrite in argillite	Trenches	None	—
11.	Porcupine Group	NW	3	9	37	5,900	TRPer	Quartz veinlets in shear zone in argillite	400-ft crosscut adit and several pits	Unknown	12 (9/7/01, 8/29/03, 9/19/03)
12.	Name unknown	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13.	Midway, Bonanza	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14.	Bunker Hill	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	On North Pole-Columbia lode	[illegible]	[illegible]	[illegible]
15.	Morning Star	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16.	Cracker-Klondike	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17.	Anaconda	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	On North Pole-Columbia lode	[illegible]	[illegible]	[illegible]
18.	Mayflower	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19.	Amazon	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	On North Pole-Columbia lode	[illegible]	[illegible]	[illegible]
20.	Mountain Belle	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	On North Pole-Columbia lode	[illegible]	[illegible]	[illegible]
21.	Free Coinage	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22.	Silver Dick	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23.	Big Pine Group	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24.	Golden Gate	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26.	Golconda	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	On North Pole-Columbia lode	[illegible]	[illegible]	[illegible]
27.	Climax	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28.	Name unknown	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29.	Homestake	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30.	[illegible] (part of Columbia Group)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
31.	Name unknown	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
32.	Columbia	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	North Pole-Columbia lode	[illegible]	[illegible]	[illegible]
33.	Taber Fraction	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	North Pole-Columbia lode	[illegible]	[illegible]	[illegible]
34.	Victor	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
35.	Cracker-Oregon	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
36.	Eureka and Excelsior	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	North Pole-Columbia lode	[illegible]	[illegible]	[illegible]
37.	Cracker-Summit, Dutchman	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
38.	[illegible] (part of King Pin Group)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
39.	Name unknown	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
40.	King Pin (part of King Pin Group)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
41.	North Pole	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	North Pole-Columbia lode	[illegible]	[illegible]	[illegible]
42.	Lakeview Spring	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
43.	Sampson and Risk	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
44.	Buckeye	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
45.	South Pole	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	North Pole-Columbia lode	[illegible]	[illegible]	[illegible]
46.	Name unknown	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
47.	Jim Blaine, Platt Group	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
48.	Name unknown	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
49.	Chloride	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
50.	Name unknown	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
51.	Midas	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
52.	Western Union	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
53.	Kelly	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
54.	Mountain View	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Quartz veins and gouge zones in breccia zone 4 ft wide in argillite	[illegible]	[illegible]	[illegible]
55.	Esmeralda	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Quartz vein 2 ft wide with pyrite in siliceous hornfels	Two adits	Unknown	1
56.	Name unknown	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Pyrite in quartz stringers in fracture zone 6 ft wide strikes N. 45° W., dips 70° SW.	Two adits about 100 ft long	Unknown	—
57.	Argonaut	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Two veins in hornfelsed argillite; one strikes N. 30° E. and dips 65° E.; the other strikes N. 75° W. and dips 65° S.	2,000 ft in two adits	Small	7, 8, 9, 10
58.	Molly Gibson	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
59.	Name unknown	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
60.	Name unknown	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
61.	Gold Coin Consolidated	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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Geologic Cross Sections