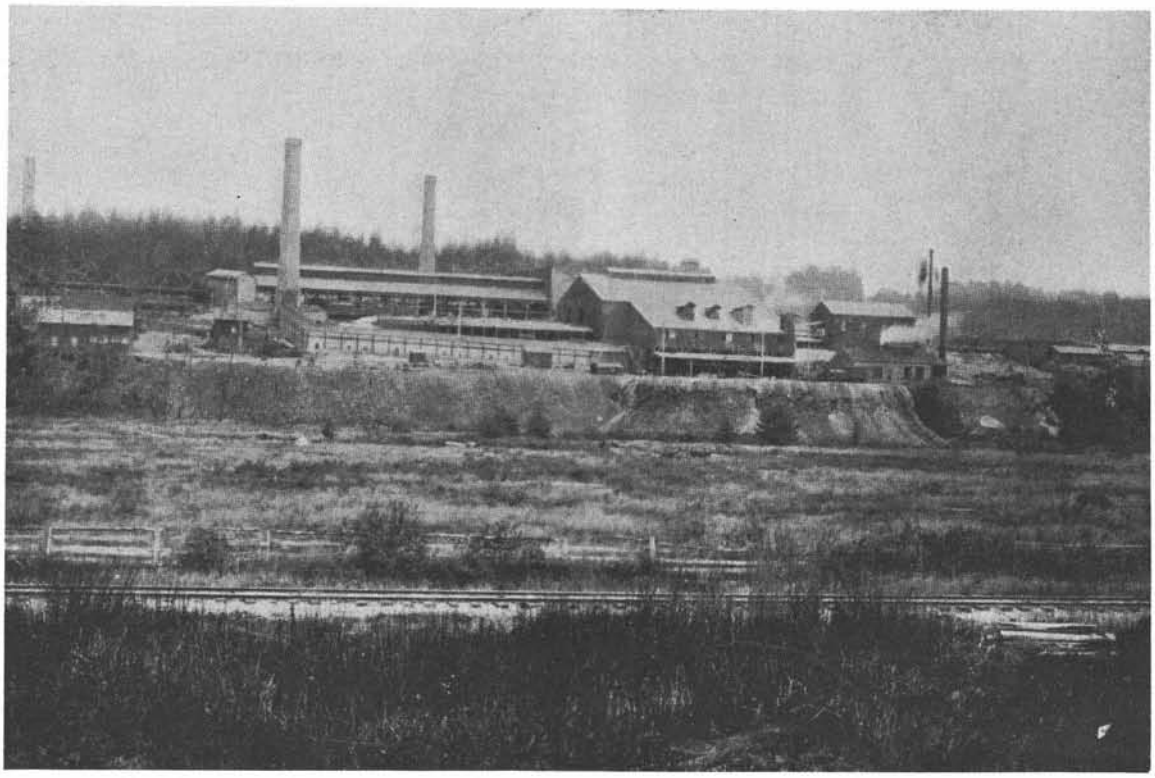


Everett smelter (1900)

1890, the ore averaged $25.20 per ton in gold and silver. As mining progressed, the average grade of the ore fell to $16.20 per ton, and in 1907 it had dropped to only $11.80 per ton. Inasmuch as mining, concentrating, freight, and smelting charges totaled $18 per ton, the mines were no longer profitable to operate, and Monte Cristo became a deserted mining camp. Elsewhere in Snohomish County most of the early discoveries did not prove to be valuable, and the claims were abandoned by the prospectors who discovered them.

In 1891, two years after metals had been discovered in the Monte Cristo district, deposits of gold, silver, copper, and lead were discovered in the Silverton area, which was 9 miles northwest of Monte Cristo. Among the first claims to be staked were the Hoodoo, Independent, Anacortes, and Bonanza Queen. The mining camp of Independence was established, but in August 1891, the camp changed its name to Silverton. The Stillaguamish mining district was organized, but by 1896, it had become the Silverton district. Hundreds of claims were staked with the hopes that the district would be as rich as the Monte Cristo district; however, by the early 1900's most prospectors and miners had left the district. None of the discoveries proved to be large, and by 1918, only around 1,000 tons of ore had been shipped from the Silverton district. The largest producer in the district was the Bonanza Queen, which by 1918 shipped 830 tons of ore containing 3 percent copper and 3 ounces per ton in silver.

By 1891, prospectors had worked their way into the Sultan Basin area and discovered high-grade silver deposits at the headwaters of Williamson Creek.

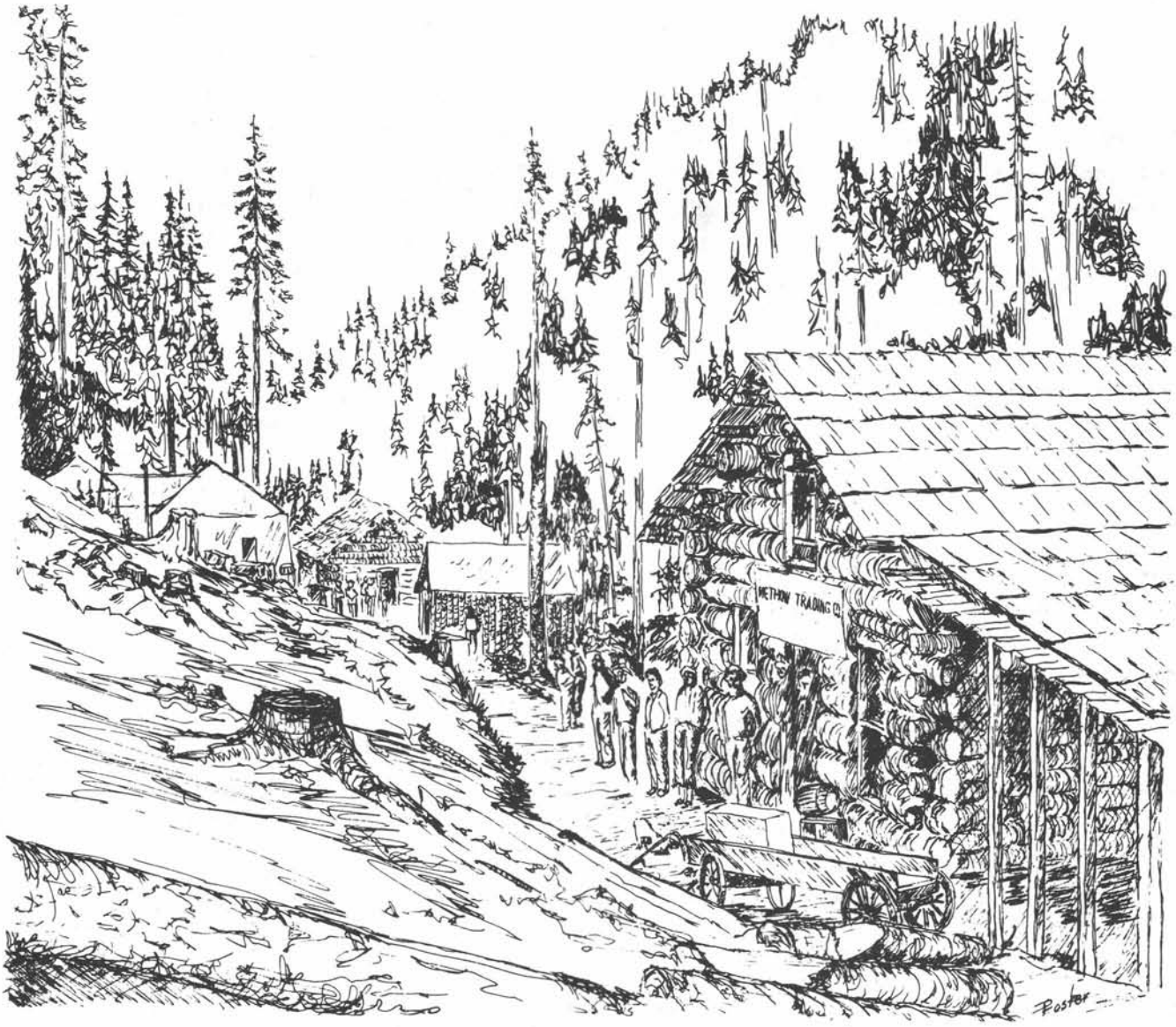
Sunset mine (circa 1935)

The Magus, Dee Pree, and Hard to Beat claims proved to be the most valuable, and the claim owners merged in 1897 to form the Forty-Five Consolidated Mining Co. From 1896 through 1901, ore valued at $100,000 was shipped to the Everett smelter from the claims. The average silver content of the ore was 90 ounces per ton, while some shipments averaged 170 ounces per ton in silver. After 1901, mining did not prove profitable because most of the ore contained less than $15 per ton in gold and silver.

Discoveries that had been made in the Index area of Snohomish County in 1872 were explored and found to contain copper that was accompanied by minor gold and silver. Among the early producing mines were the Sunset, Ethel, Copper Bell, and Wilbur Index. The Sunset became the only major mine in the Index district; and from 1902 through 1940, the mine produced 7,000 tons of copper, 156,000 ounces of silver, and 1,500 ounces of gold. Although significant amounts of silver were produced at the Sunset, the ore averaged only 0.59 ounce of silver per ton.

In King County, deposits of gold, silver, copper, iron, and lead were discovered in the Snoqualmie district in 1891, and in the Miller River district in 1892. Early prospecting activity in the Index and Miller River districts was influenced largely by the construction of the main transcontinental line of the Great Northern Railway eastward up the Skykomish Valley in 1892. The railroad made the area more

accessible, and prospecting became active over the entire region. A small railroad station was built near the present site of Index, and the station became the supply camp for prospectors and miners. Early producing mines in the Miller River district were the Apex, Seattle-Cascade, Cleopatra, and Coney Basin. The Apex proved to be the richest, and by 1900 had produced 300 tons of gold ore worth $80,000; by 1943, the production of the mine reached $300,000. Although several of the more promising deposits of the Snoqualmie district were explored and developed, production from the district was insignificant. Prior to 1900, several small shipments of copper ore were made from the Dutch Miller mine; and between 1952 and 1956, copper ore was shipped to the Tacoma smelter from the Quartz Creek mine. Prior to 1901, a small shipment of gold ore was made from the Carmack mine. Although the shipment was insignificant,



Barron gold camp (circa 1895)—typical of the many mining camps of that era

the Carmack mine is of historical interest because it was discovered by George Carmack, who is credited with the famous Klondike discovery of the north in 1896.

In Skagit County, rich deposits of lead and silver had been discovered at the headwaters of the Cascade River in 1889. The first discovery of the Cascade district was the Soldier Boy, which was followed by the discovery of other deposits that included the Boston, Midas, Chicago, and Johnsburg. Work was undertaken at many properties in the district, but only the Johnsburg became a producing mine. Small shipments were made in 1953 and 1955; the 1955 shipment of 9 tons, contained 57 percent lead and 40.4 ounces per ton in silver. By 1891, prospectors had moved north of the Cascade district and had discovered lead and silver at the headwaters of South Fork of Thunder Creek. High-grade lead ore from the Willis and Everett property contained as much as 3,400 ounces per ton in silver. Ore which contained 190 ounces per ton in silver, was shipped to the Everett smelter in 1893; however, high mining and shipping costs prevented further production at the mine.

In the Mount Baker district of Whatcom County significant discoveries of gold were made in 1897 and 1898. Both the Lone Jack and the Red Mountain mine became major gold producers with a combined production of around $1.5 million between 1902 and 1946. The Azurite mine in eastern Whatcom County also became one of the state's major gold producers. Although the Azurite was not discovered until 1915, it produced about $1 million in gold and silver between 1936 and 1939.

Elsewhere in western Washington deposits of gold, silver, and copper were discovered in the late 1800's and early 1900's in Pierce, Lewis, Skamania, and Clark Counties. Mining activity in these counties centered around the Silver Creek district in Pierce County, and the St. Helens district in Skamania County. Although hundreds of mining claims were staked and numerous deposits explored, only a few properties were placed into production, and the combined production of gold, silver, and copper from these four counties between 1903 and 1970 amounted to about $25,000.

By the early 1930's most of western Washington had been prospected, and nearly 40,000 mining claims had been staked. Sixty percent of the mining claims recorded in Washington were in Whatcom and Snohomish Counties, where significant discoveries of copper and gold had been made. Although work had been undertaken on hundreds of claims, no more than twenty-five properties became major producing mines. The most productive years for the mines were from 1890 until 1930; however, production was sporadic and most mines operated no more than 10 years. In order of decreasing value the mines produced gold, silver, and copper; the production of lead and zinc was insignificant. Only at the "45" mine in Snohomish County did the value of silver exceed that of the other metals in the ore. This made the "45" mine the only major silver mine in western Washington.

Production

Between 1903 and 1970 the bulk of the gold, silver, copper, lead, and zinc produced in western Washington came from Snohomish, Whatcom, and King Counties. Since 1962 no major metal mines have operated in western Washington. The combined metal production for western Washington counties from 1903 through 1970 totals $5,343,528; a breakdown by counties is shown in table 12.

The estimated silver production in western Washington from 1890 through 1969 is 2.25 million ounces. The leading silver-producing county was Snohomish, which produced 2,136,205 ounces; the

TABLE 12.—Metal production in western Washington, 1903-1970

County	Gold	Silver	Copper	Lead	Zinc	Total
Snohomish	$ 277,969	$199,487	$2,227,487	$ 437	...	$2,705,380
Whatcom	2,343,073	46,970	333	166	...	2,390,542
King	150,195	25,120	42,842	802	...	218,959
Pierce	486	356	6,448	206	...	7,496
Skagit	149	1,775	42	2,156	9	4,131
Lewis	60	69	1,760	...	...	1,889
Skamania	12,279	573	1,797	...	...	14,649
Clark	482	...	...	...	...	482
Total	$2,784,693	$274,350	$2,280,709	$3,767	$ 9	$5,343,528

bulk of the silver came from gold mines in the Monte Cristo district and from the Sunset copper mine near Index. Whatcom County is credited with around 80,000 ounces, most of which was a byproduct of gold mining operations in the Mount Baker district. King County produced around 36,500 ounces of silver, almost all of which was a byproduct of gold mining at the Apex mine. Lead-silver mines of Skagit County produced only around 2,380 ounces, whereas a total of less than 500 ounces of silver was produced by mines in Pierce, Lewis, Skamania, and Clark Counties.

TABLE 13.—Silver production of western Washington's major silver producing counties, 1903-1956

[Prior to 1903 silver production was not reported on an individual county basis. After 1956 silver production is not reported to avoid disclosing confidential company information. In the table below, . . . denotes no production; c denotes production but it is concealed with other counties.]

Year	County			
	Whatcom	Skagit	Snohomish	King
	Troy ounces			
1903	22,698	1,517	56,370	38
04	25,212	...	12,514	...
1905	22,111	...	29,946	c
06	465	...	5,084	c
07	244	...	19,389	535
08	71	...	53	1,732

Continued on next page

TABLE 13.—Silver production of western Washington's major silver producing counties, 1903-1956—Continued

Year	County			
	Whatcom	Skagit	Snohomish	King
	Troy ounces			
09	6	...	23	740
1910	...	4	32	3,145
11	1	...	5	3,499
12	24	...	6	2,778
13	95	...	673	3,038
14	188	...	1,371	...
1915	50	...	530	...
16	400	...	1,778	566
17	2,500	508	1,151	2,706
18	39	...	5,000	2,314
19	...	...	6,852	1,060
1920	3	...	14,648	693
21	91	...	2	...
22	247	...	1	360
23	164	...	10,018	...
24	38	...	8,646	...
1925	244	...	13,702	...
26	...	...	18,451	882
27	220	...	17,476	303
28	182	56	10,951	...
29	141	...	17,614	...
1930	173	...	9,277	...
31	35	...	1,350	...
32	246	...	7	...
33	23	...	14	...
34	116	...	17	116
1935	210	...	601	...
36	204	...	1,255	142
37	1,161	...	918	106
38	1,352	...	1,123	2,048
39	629	...	4,835	598
1940	121	...	9,187	322
41	180	...	16,591	1,139

Continued on next page

TABLE 13.—Silver production of western Washington's major silver producing counties, 1903-1956—Continued

Year	County			
	Whatcom	Skagit	Snohomish	King
	Troy ounces			
42	21	...	1,582	...
43	83	...	1,035	...
44	...	...	322	...
1945	...	...	218	...
46	...	...	349	...
47	115	...	...	...
48	...	...	105	31
49	21	...	1,106	...
1950	...	...	...	...
51	...	...	...	57
52	157	...	4	103
53	...	403	c	c
54	...	...	...	c
1955	...	125	c	c
1956	...	...	263	2,048
Total ounces	80,281	2,613	302,445	31,099

OCCURRENCES OF SILVER IN WASHINGTON

LOCATION OF DEPOSITS

In reviewing data on silver in Washington, the writer found it difficult to determine which properties should be covered by this report and which districts should be classed as silver districts. Silver is present in most of the state's base and precious metal deposits, but the average deposit contains no more than 1 ounce per ton. For the purpose of this report, a silver district is an area that contains several deposits from which silver has been mined, or an area containing deposits assaying 5 ounces or more per ton in silver. These districts are shown in figure 4. Eleven of the state's 20 silver districts are in the Okanogan Highlands physiographic province of northeastern Washington, and 9 districts are in the Cascade Mountains province.

GENERAL GEOLOGY

As in many mining districts of the west, most silver deposits in Washington appear to be related to granitic intrusive rocks. Although in several districts

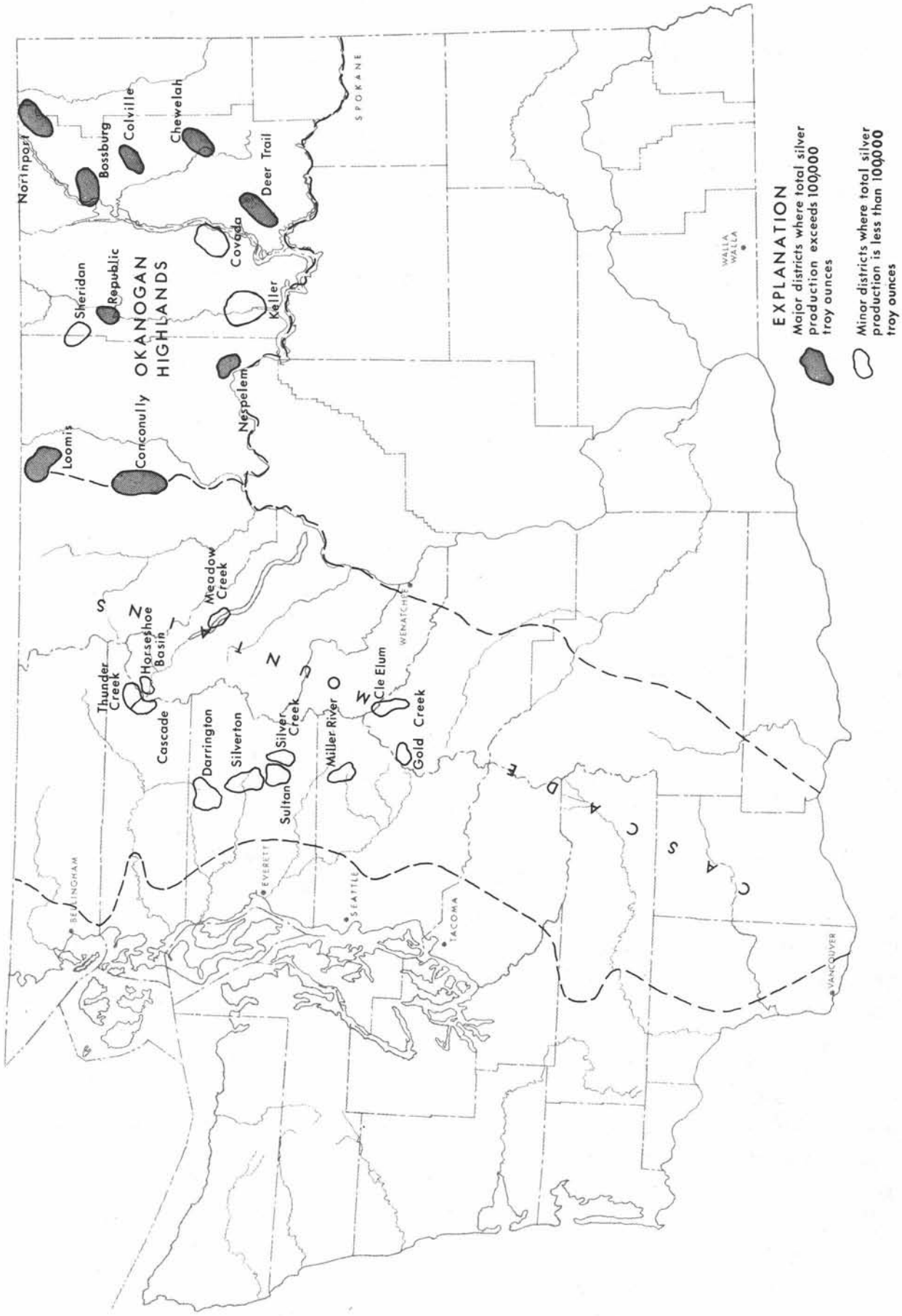


FIGURE 4.—Silver districts of Washington.

TABLE 14.—General location of silver districts in Washington

District	General location
Okanogan Highlands	
Northport	Northeastern Stevens County
Bossburg	Northwestern Stevens County
Colville	Central Stevens County
Chewelah	Southeastern Stevens County
Deer Trail	Southwestern Stevens County
Covada	Southeastern Ferry County
Republic	Northwestern Ferry County
Sheridan	Northwestern Okanogan and Northwestern Ferry Counties
Nespelem	Southeastern Okanogan County
Loomis	Northcentral Okanogan County
Conconully	Central Okanogan County
Cascade Mountains	
Cascade-Thunder Creek	Eastern Skagit County
Stehekin	Northwestern Chelan County
Darrington	North-central Snohomish County
Silverton	Central Snohomish County
Sultan	Southeastern Snohomish County
Silver Creek	Southeastern Snohomish County
Miller River	Northeastern King County
Snoqualmie	Northwestern Kittitas County
Cle Elum	Northwestern Kittitas County

the exposed granitic rocks may be a considerable distance from metal deposits, underlying granitic rocks are probably much closer. The general distribution of granitic rocks is shown in figure 5, which also shows the distribution of silver deposits, as well as base metal and gold deposits in Washington. It can be seen that silver deposits coincide with base metal and gold deposits.

In the Cascade Mountains and in the western part of the Okanogan Highlands argentiferous base metal deposits occur mainly in fissure veins and shear zones. The host rocks for the veins are chiefly lower to middle Tertiary quartz diorite and granodiorite and pre-Jurassic schist, gneiss, and hornfels. In the central part of the Okanogan Highlands, deposits of gold, silver, copper, lead, and zinc occur in quartz fissure veins, breccias, and disseminated deposits. Common host rocks for the deposits consist of Tertiary volcanic rocks, early Tertiary and late Mesozoic granitic rocks, and Mesozoic and Paleozoic sedimentary rocks. In the eastern part of the Okanogan Highlands silver is associated with lead, zinc, copper, and gold, which is found in fissure veins, shear zones, and disseminated deposits. Common host rocks for the deposits are argillaceous and calcareous rocks of Cambrian age, as well as Cretaceous and Tertiary granitic intrusive rocks, consisting mainly of granodiorite. The silver-bearing deposits of the eastern part of the Okanogan Highlands fall within the Kootenay Arc, which is a narrow miogeosyncline of

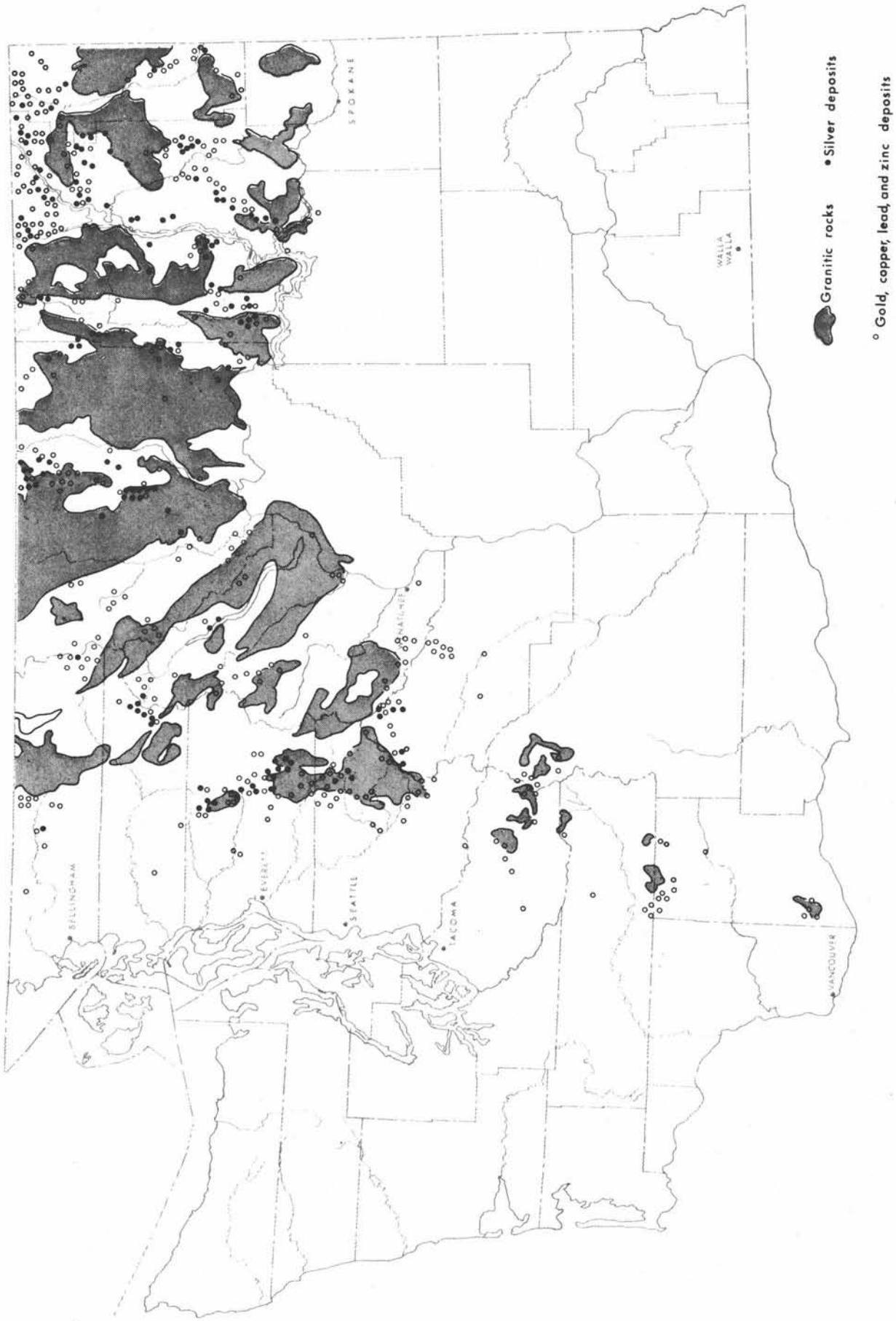


FIGURE 5.—Distribution of silver in relation to the granitic rocks and deposits of gold, copper, lead, and zinc.

northeast-trending folded and faulted rocks. The Kootenay Arc is the dominant regional structure of Stevens and Pend Oreille Counties and adjacent to British Columbia. In Ferry County the richest silver deposits fall within the Republic graben, which is a major north-northeast-trending structural feature of western Ferry County. In Okanogan County and the Cascade Mountains, metal deposits appear to be related to north- to northwest-trending folds and faults, and transverse east-west-trending shear zones.

NATURE OF THE DEPOSITS

Most of Washington's silver deposits occur in narrow, steeply dipping quartz fissure veins and shear zones. The width of the veins ranges from thin stringers less than ½-inch in thickness to massive veins as much as 40 feet in thickness. Most veins have strike lengths of several hundred feet, whereas some veins can be followed along their strikes for several thousand feet. It is not uncommon for veins to pinch out abruptly along their strike and dip, and the vertical extent of most silver veins is not known. In the Conconully district of Okanogan County, some silver-bearing veins appear to extend to at least 2,500 feet beneath the surface. In the Republic district, the gold-silver veins have been mined to depths of 1,700 to 1,800 feet. However, based on old mine workings the average silver-bearing vein in Washington has not been mined for much more than 150 feet in depth.

The silver minerals are mostly sparsely disseminated in the veins, but in some veins they are concentrated into ore shoots. The average ore shoots are small and have strike and dip lengths of 10 feet or less. On the other hand, some ore shoots have been mined that had strike lengths of several hundred feet and dip lengths that were even greater. The veins may contain several ore shoots that are sporadically distributed in the vein. Individual ore shoots consist of massive sulfides with little if any gangue, or disseminated ore minerals and lenses of ore minerals intermixed with gangue. In some veins the ore minerals occur in narrow black bands that parallel the walls. Seldom can the ore minerals be identified in the field because of their dustlike size. Post-mineral faulting is a prominent feature of many veins. The faulting has produced granulation of gangue and ore minerals, and in some cases has drawn out the ore minerals into thin filaments that parallel the faults. Transverse faults tend to offset some veins, and some veins cannot be traced beyond the faults.

In addition to ore shoots in quartz fissure veins, some silver deposits occur as irregular disseminated replacements along shear zones. These deposits assume the general shape of the sheared rocks and have a habit of pinching and swelling along the strike and dip of the deposit. Rather than a distinct quartz vein, the shear zone commonly contains brecciated country rock, siderite, calcite, and quartz. For the most part the ore minerals are disseminated in, or have replaced, parts of the shear zone. The ore shoots tend to be of an irregular, lenticular shape. Individual ore shoots range from 3 to 20 feet in thickness and have strike and dip lengths of up to several hundred feet. Although some shear zones are metallized to depths of 1,000 feet beneath their outcrops, the richest parts of the shear zones tend to be within 100 feet of the surface.

The chief gangue minerals of the vein deposits are quartz, calcite, siderite, and dolomite; barite is a less common gangue mineral. Except in oxidized parts of the vein, pyrite, pyrrohotite, or arsenopyrite may also be present. In breccia and replacement deposits in limestone or dolomite, the principal gangue mineral is massive quartz that is often accompanied by calcite, siderite, dolomite, and pyrite.

Most silver veins in Washington are only slightly oxidized, and extensive downward enrichment

is lacking. In the Nespelem district of Okanogan County, the oxidized zone extends to around 40 feet beneath the surface, and in the Republic district it may be as great as 150 feet. Oxidation in both districts has not been complete and sulfide minerals in some veins occur almost at the surface. Available data indicate that most oxidized zones of silver deposits in the state are impoverished rather than enriched. In the near-surface and central parts of oxidized zones, some silver occurs as native silver in the form of leaves, small flakes, arborescent masses, and tangled wires. Parts of the veins that occur near water level are sometimes enriched by argentite, pyrargyrite, cerargyrite, and native silver. In almost all oxidized parts of the veins, iron and manganese oxides are common.

ORIGIN AND AGE

Almost all investigators of silver, gold, copper, lead, and zinc deposits in Washington attribute the origin of the metals to deep-seated granitic rocks. During cooling phases of granitic rocks, siliceous hydrothermal solutions rich in metals tend to segregate within parts of the congealing magma. When fractures develop within the rock that retains the hydrothermal solutions, the solutions ascend toward the surface along fractures in the earth's crust. Near the surface, temperatures and pressures drop and minerals precipitate out to form veins in open fissures, or to replace other minerals in the wall rock of fractures and fissures, forming replacement deposits. Recurrent fracturing of pre-existing veins, along with the introduction of other metalliferous solutions, can produce several generations of metals. Although most silver deposits in Washington appear to have originated during one period of metallization, the mineralogy of some deposits suggests at least two separate periods, and possibly more.

The age of most silver deposits in Washington appears to be Late Cretaceous-early Tertiary, as are most of the intrusive granitic rocks of the state. An exception to this is the gold-silver deposits of the Republic district, which are of Oligocene-Miocene age.

MINERALOGY

In Washington silver minerals are most commonly associated with the ore minerals of lead, copper, and gold, and less commonly with zinc and antimony minerals. In deposits where silver minerals predominate, the common silver minerals are argentite, stephanite, cerargyrite, proustite, pyrargyrite, and native silver. Associated ore minerals consist chiefly of galena, sphalerite, chalcopyrite, bornite, tetrahedrite, pyrite, pyrrhotite, and arsenopyrite. In lead deposits, where galena is the main ore mineral, silver is contained in argentite, tetrahedrite, and tennantite, that occur as minute inclusions in the galena. In some deposits one or more of these silver minerals occur interstitial to grains of galena. In copper deposits the silver is usually contained in minute grains of argentiferous tetrahedrite, which coat grains of chalcopyrite and(or) bornite. The tetrahedrite may also occur interstitial to copper minerals, and parts of some copper veins have consisted almost entirely of tetrahedrite. Some gold deposits contain silver minerals in addition to the silver that is almost always alloyed with the gold. Argentian tetrahedrite, argentite, pyrargyrite, native silver, sylvanite, and naumannite occur in several of the state's gold deposits. One or several of these silver minerals may occur as sparsely scattered grains in the gold veins,

or in narrow black streaks, which represent finely granulated minerals that rarely can be identified. Argentian tetrahedrite appears to be the most common silver mineral of gold veins. Silver is also present in several of the state's antimony deposits, but very few silver minerals have been identified. In most deposits the silver content of the ore may be attributed to argentiferous galena and tetrahedrite; however, at the Wells Fargo mine in Stevens County, where the silver content of the ore is as much as 25 ounces per ton, silver occurs in argentiferous zinkenite.

To date (1975) the bulk of silver mined in the state has come from gold, copper, and lead ore. Lead-zinc ores of Stevens and Pend Oreille Counties contain as little as 0.02 ounce per ton in silver, whereas high-grade lead ore mined in these counties has contained as much as 1,000 ounces. Copper ore from the Chewelah district of Stevens County contained up to 100 ounces, but the average silver content of mined ore was only 4 ounces per ton. At the Sunset mine in Snohomish County, the average silver content of high-grade copper ore was only 0.59 ounce per ton. All gold ore contains silver, usually in the form of gold-silver alloy. In some parts of the Republic district of Ferry County, the gold-silver ratio of the ore is as high as 1:12, whereas the average for the district is about 1:4. At other gold mines in the state gold ore contained as little as 0.5 ounce of silver for each ounce of gold. In deposits that contain mainly silver, and only minor base metals and gold, the average silver content of mined ore was around 60 ounces per ton. Much near-surface ore ran several hundred ounces per ton in silver, while a few high-grade shipments from several of the state's silver districts ran as high as 1,000 ounces per ton.

Of 63 known silver minerals, 15 have been reported in Washington. The most common silver minerals in the state include tetrahedrite, argentite, pyrargyrite, stephanite, and native silver in order of decreasing abundance. A brief description of these and other silver minerals of the state follows:

Andorite - $PbAgSb_3S_6$

A dark-gray to black silver mineral that occurs as prismatic crystals. A comparatively rare mineral.

Argentite - Ag_2S

Most common silver mineral and generally of hypogene origin. Dark lead gray, which tarnishes on surface to a black earthy sulfide. Occurs in large masses and as microscopic inclusions in galena and other sulfide minerals.

Bromyrite - AgBr

Bright-yellow to amber yellow, slightly greenish. Occurs in oxidized zones of silver deposits along with native silver and other supergene minerals.

Cerargyrite - AgCl

Highly sectile, usually massive and resembles wax. Known as horn silver, it often occurs in crusts. Pearl gray to colorless but becomes violet to brown on exposure to light. Secondary mineral in upper parts of silver deposits.

Diaphorite - $Pb_2Ag_3Sb_3S_8$

Light steel gray to silver white, also blackish lead gray. A comparatively rare mineral.

Dyscrasite - Ag_3Sb

Silver white, usually tarnished to lead gray; sometimes yellow or blackish. Associated with galena, ruby silver, argentite, and native silver.

Native silver - Ag

Silver white, tarnishes to gray or black. Ductile and malleable. May be primary in origin, but usually is secondary and found in upper part of silver deposits. Commonly occurs in arborescent and wiry forms, irregular masses, and scales. Nearly always present in native gold.

Naumannite - Ag_2Se

A comparatively rare mineral of hypogene origin. Iron black and occurs in cubic crystals and in thin plates, as well as massive and granular.

Proustite - $3Ag_2S-As_2S_3$

A ruby silver mineral that is scarlet vermilion, brittle, and transparent to translucent. A hypogene mineral in upper parts of silver veins.

Pyrargyrite - Ag_3SbS_3

Ruby silver mineral so called because it is dark red in thin splinters. Commonly black to grayish black and brittle. Common hypogene mineral in upper parts of silver veins.

Stephanite - Ag_5SbS_4

Brittle, iron black, and commonly associated with other silver minerals in upper parts of veins. Hypogene in origin.

Stromeyerite - $(Ag,Cu)_2S$

A fairly common silver mineral, especially in deposits that contain high contents of copper. Dark gray and tarnishes blue on exposed surfaces. May be hypogene or supergene, and the latter is often associated with chalcocite.

Tetrahedrite - $(Cu,Fe,Zn,Ag)_{12}(Sb,As)_4S_{13}$

High silver varieties are called argentian tetrahedrite, argentian tennantite, and freibergite. Flint gray to iron black, and rather brittle. Generally a hypogene mineral that is commonly associated with chalcopyrite, bornite, pyrite, sphalerite, galena, argentite, and pyrargyrite.

PART II

SILVER OCCURRENCES of NORTHEASTERN WASHINGTON

OKANOGAN HIGHLANDS

INTRODUCTION

Most of the state's silver deposits and the more important silver districts are in the Okanogan Highlands physiographic province of northeastern Washington. Silver has been reported at 703 properties and is a metal of principal value at 197 properties. To date (1975) over 200 mines have produced silver; however, most silver was a byproduct of lead, copper, and gold mining operations.

Although silver is widespread throughout northeastern Washington, the most significant deposits, as well as the major silver mines that have produced in the past, fall within 11 mining districts. These districts are Loomis, Conconully, Nespelem, and Sheridan, in Okanogan County; Republic and Covada, in Ferry County; and Northport, Bossburg, Colville, Chewelah, and Deer Trail, in Stevens County. Stevens County leads in the number of mines and prospects containing silver, followed in decreasing order by Okanogan, Ferry, and Pend Oreille Counties. A breakdown of silver occurrences by county and the principal metal at each property as reported by Huntting (1956) is listed in table 15.

PHYSIOGRAPHY

The Okanogan Highlands are bordered on the west by the Cascade Mountains and on the south by the Columbia Basin; they extend northward into Canada and eastward into Idaho. The highlands are

TABLE 15.—Distribution of silver in Pend Oreille, Stevens, Ferry, and Okanogan Counties
(Mines and prospects where silver occurs)

Principal metal at mine or prospect	Counties				No. of mines and prospects
	Pend Oreille	Stevens	Ferry	Okanogan	
Silver	15	47	49	86	197
Lead	13	91	56	37	197
Gold (lode)	0	35	52	57	144
Copper	11	56	16	28	111
Zinc	17	17	2	4	40
Iron	0	1	1	2	4
Antimony	0	1	2	0	3
Molybdenum	0	2	0	1	3
Nickel	0	0	2	1	3
Tungsten	0	1	0	0	1
Total	56	251	180	216	703

mountainous, but they lack the ruggedness of the Cascade Mountains. East of the Columbia River are the Huckleberry, Chewelah, and Selkirk Mountains; west of the river are the Kettle, San Poil, and other ranges. General summit elevations in the highlands range from 3,000 to 5,000 feet; however, rocky peaks rise above these levels, and on several peaks elevations exceed 7,000 feet. Most mountain slopes and summits are thickly wooded, but in some parts of the highlands sparsely wooded, steep, rocky hillsides and peaks dominate the local landscape. Numerous streams have thoroughly dissected the Okanogan Highlands. All streams ultimately drain into the Columbia River, which is the region's major drainage. Other major rivers are the Colville, Pend Oreille, San Poil, Kettle, and Okanogan. Elevations along the rivers range from lows of 800 to 900 feet along the Okanogan to highs of 2,000 to 2,100 feet along the Pend Oreille.

GENERAL GEOLOGY

As can be seen in figure 6, the Okanogan Highlands contain a wide variety of rocks that vary in age from Precambrian to Holocene. Throughout the Highlands, most major valleys and half the mountain slopes are covered by deposits of silt, sand, and gravel of glacial origin.

West of the Columbia River, in Ferry and Okanogan Counties, Mesozoic and early Tertiary granitic rocks of the Colville and Similkameen batholiths predominate. The granitic rocks, consisting mainly of granodiorite, intrude pre-Jurassic schist, quartzite, phyllite, greenstone, and amphibolite in northeastern Ferry County and north-central Okanogan County. In southeastern Ferry County, the granitic rocks intrude Paleozoic metasedimentary rocks, consisting chiefly of graywacke, impure quartzite, slate, greenstone, and limestone. Near the central part of the Okanogan Highlands, the Republic graben, an elongated down-faulted block 55 miles long and about 15 miles wide is filled with great thicknesses of Tertiary andesitic lavas and flow breccias, as well as conglomerate and siltstone. In the southwestern corner of the highlands, Columbia River basalts of Miocene age have been deposited upon erosion surfaces of Mesozoic granitic rocks. These basalts are the northern limits of lava flows covering most of southeastern Washington.

East of the Columbia River in Stevens and Pend Oreille Counties, Precambrian and Paleozoic metamorphic and sedimentary rocks predominate. Precambrian rocks are mainly quartzite, argillite, and impure dolomite; Paleozoic rocks consist mainly of quartzite, phyllite, limestone, and dolomite. The limestone and dolomite are important host rocks for silver-lead deposits in Stevens County and lead-zinc deposits in Pend Oreille County. Throughout both counties the Precambrian and Paleozoic rocks have been intruded by Mesozoic granodiorite of the Loon Lake batholith.

In the eastern Okanogan Highlands, northeast-trending folds predominate. They are part of the Kootenay Arc—a northeast-trending miosyncline formed during mountain-building activity that began in the Middle Jurassic and continued into early Tertiary. As the rocks were folded, northwest- and northeast-trending faults developed. In the western Okanogan Highlands, northwest-trending folds and faults predominate and conform with northwest-trending structures of the Northern Cascades. In the valley of the Columbia River between Ferry and Stevens Counties, folds trend both northeast and northwest with some intermediate north trends.

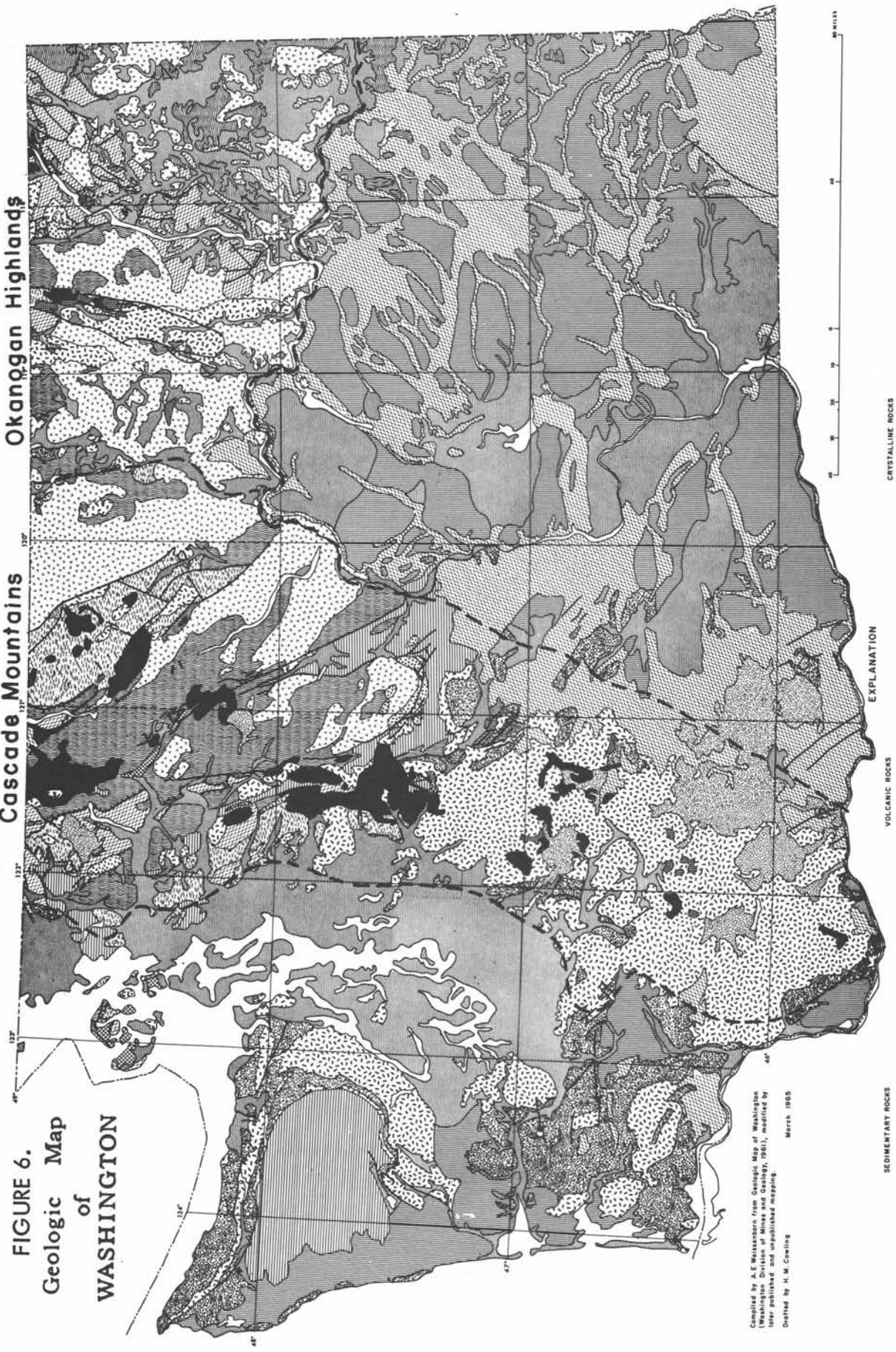


FIGURE 6.
Geologic Map
of
WASHINGTON

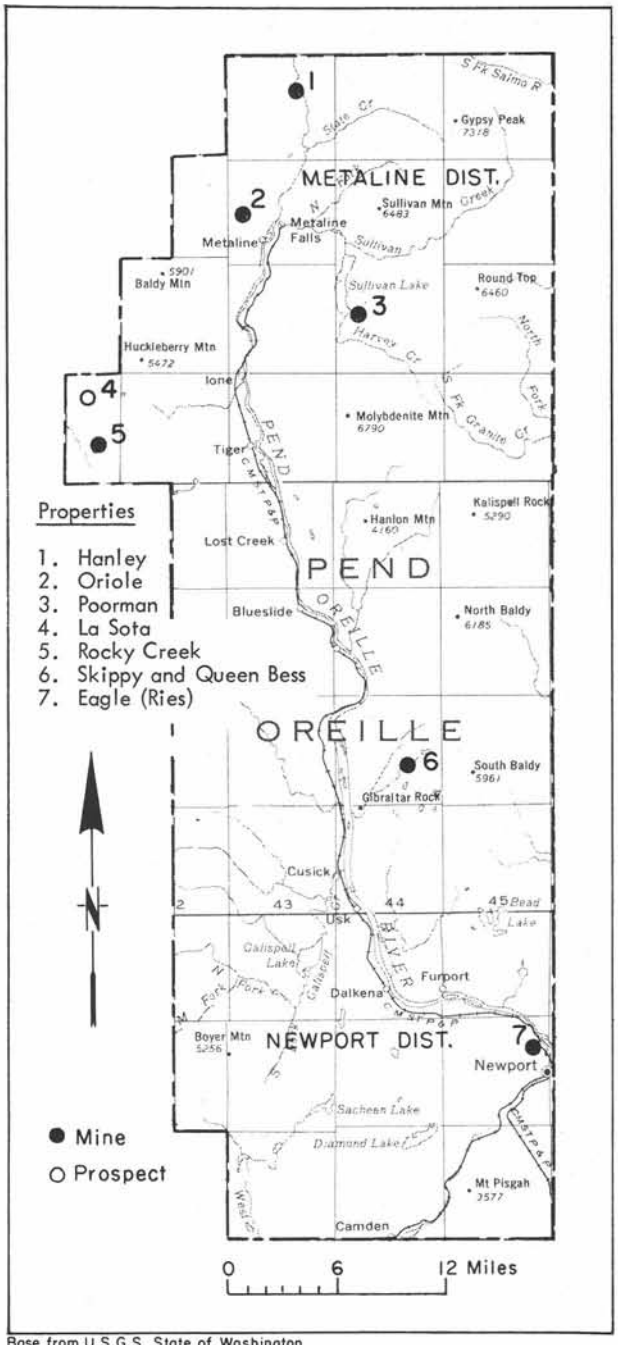
PEND OREILLE COUNTY

Although there never have been any major silver mines in Pend Oreille County, silver has been an important byproduct of lead-zinc mining operations. From 1906 through 1969, 30 mines in the county produced 708,330 ounces of silver from ores that averaged only 0.040 ounce per ton in silver. In addition to silver the mines produced 427,041 tons of zinc, 196,373 tons of lead, 526 tons of copper, and 266 ounces of gold. The combined value of the silver, gold, copper, lead, and zinc totaled $145,944,035.

Currently (1975), the Pend Oreille mine in the Metaline district is the county's only producing metal mine; it produces around 6,000 ounces of silver, 10,000 pounds of copper, 4 million pounds of lead, and 13 million pounds of zinc yearly.

The bulk of the silver produced in Pend Oreille County has come from the Metaline district; less than 1 percent has come from the Newport district, which is the only other mining district in the county. The silver-bearing deposits of the Metaline district occur chiefly in the "Josephine Horizon" of the Metaline Limestone (Cambrian). Addie (1970, p. 75) describes the ore bodies of the "Josephine Horizon" as follows:

> The ore bodies range from pods and lenses a few feet thick and 10 to a few tens of feet wide and long, to masses 3,000 feet long, 100 feet thick, and 300 feet wide. The ore bodies are highly irregular, and many are elongated in channel-like shapes that pinch and swell, and coalesce irregularly with nearby ore pods. The longest elongated bodies plunge northeastward at 10° to 20°.
>
> The ore consists of an intimate mixture of sphalerite and galena in a wide range of proportions. This range is sufficient that certain parts of the ore bodies can be characterized as lead-rich areas, others as zinc-rich areas. Silver minerals have not been identified. Pyrite is the common gangue



Base from U.S.G.S. State of Washington 1:500,000, 1962

FIGURE 7.—Silver deposits of Pend Oreille County.

sulfide. Other gangue minerals are quartz, calcite, dolomite, barite, and palygorskite.

Sphalerite occurs chiefly as fine disseminations in the matrix of the breccias, and also rims breccia fragments. In "zebra rock," sphalerite may form narrow bands along one edge of white dolomite streaks. Coarser grained sphalerite, with quartz, forms irregular vein-like streaks and patches in the matrix and between breccia fragments. It may occur also within white, coarse-grained dolomite fragments that are fragments of the breccia. Sphalerite also replaces fine-grained gray limestone, either as coarse-grained aggregates or as fine-grained masses in which individual grains cannot be detected in hand specimens. The color of sphalerite varies from reddish brown to pale yellow.

Most of the galena is distributed irregularly throughout the breccia as stringers, pods, and segregations. It is ordinarily medium grained, but large cubes are found occasionally. In places, it fills faults and fractures in the breccia matrix.

Small, irregular bodies and scattered grains of sphalerite and galena are found throughout the entire stratigraphic thickness of the Metaline Limestone, except in the very basal part. All the presently mined ore bodies, however, are in the upper 200 feet of the Metaline Limestone. Most ore bodies are found in the breccia. Most of the breccia contains at least traces of sphalerite and galena, but not all of it is ore. Very few ore bodies are in contact with the Ledbetter Slate.

A small tonnage of more pyritic ore was mined some years ago from a second zone, known locally as the "Yellowhead Horizon," 1,100 to 1,200 feet stratigraphically below the Ledbetter Slate. This zone is exposed in only a few places and has been little explored in the Metaline district. It has been a productive ore zone to the west in parts of Stevens County, Washington. [In 1970, diamond drilling disclosed significant lead-zinc stratiform mineralization in the "Yellowhead Horizon" and subsequent drilling on the ore body encountered milling ore.]

In the Metaline district no ore bodies have been found in the Maitlen Phyllite, which underlies the Metaline Limestone, although important ore bodies are found in carbonate rocks in Stevens County, Washington, and in its Canadian equivalent, the Laib Formation in adjoining parts of British Columbia. Minor amounts of ore have been found at the Oriole mine in a limy zone near the base of the Gypsy Quartzite, which stratigraphically underlies the Maitlen. The Oriole is west of the graben outside the main producing area of the district.

In addition to the silver-bearing lead-zinc deposits in the Metaline Limestone of the Metaline Falls area, silver is present elsewhere in the county, but occurs chiefly in metallized quartz veins and shear zones. These deposits are found in a variety of host rocks which include limestone, dolomite, argillite, phyllite, quartzite, and greenstone. The quartz veins and shear zones are from 1 to 6 feet wide, and carry pyrite, chalcopyrite, tetrahedrite, galena, sphalerite, and, rarely, native silver. The ore minerals are generally sparse, but in a few deposits they are concentrated into small ore shoots. To date (1975), less than 3,000 tons of ore has been shipped from the deposits. Although the ore averaged only around 10 ounces per ton in silver, small shipments have yielded as much as 1,190 ounces of silver per ton. As many as 56 properties in Pend Oreille County have reported the presence of silver, but only at the following properties has it been reported to be present in significant amounts.

METALINE DISTRICT

Principal Silver Deposits

Hanley

Location: NE¼ sec. 10, T. 40 N., R. 43 E.

Development: 20-foot shaft and large open cut.

Geology: Replacement deposit in silicified limestone, traceable for 300 feet on surface.

Ore minerals: Argentiferous galena.

Production: 2 carloads of high-grade lead-silver ore in the 1880's.

Reference: Huntting, 1956, p. 368.

LaSota

Location: SE¼ sec. 3 and NE¼ sec. 10, T. 37 N., R. 41 E.

Development: 40-foot shaft, and 3 adits which total 350 feet in length.

Geology: 1½- to 6-foot-thick quartz veins in phyllite and schistose greenstone assay up to 11.5 ozs. per ton in silver.

Ore minerals: Galena, sphalerite, bornite, chalcopyrite, and tetrahedrite.

Production: None.

Reference: Huntting, 1956, p. 313.

Oriole

Location: SE. cor. sec. 19, T. 39 N., R. 43 E.

Development: 135-foot shaft.

Geology: Quartz lenses up to 3 feet thick and 20 feet long in brecciated dolomite. Hand-sorted ore contained 42 ozs. silver, 22 percent zinc, 15 percent lead, and 1 percent copper. Ore averaged 5.8 ozs. per ton in silver.

Ore minerals: Sphalerite, galena, tetrahedrite, chalcopyrite, pyrite, smithsonite, cerussite, and bornite.

Production: 2,000 tons prior to 1943.

Reference: Huntting, 1956, p. 371.

Poorman

Location: Center sec. 17, T. 38 N., R. 44 E.

Development: Unknown.

Geology: Unknown.

Ore minerals: Unknown

Production: 2 tons of ore mined in 1937 yielded 2,380 ozs. silver, 14 lbs. copper, and 18 lbs. lead.

Reference: Fulkerson and Kingston, 1958, p. 23.

Rocky Creek

Location: NE. cor. sec. 26 and SW¼ sec. 23, T. 37 N., R. 41 E.

Development: Caved shaft and two adits each several hundred feet in length.

Geology: 2-foot-thick quartz vein in argillite and quartzite. Parts of the vein contained 360 ozs. per ton in silver. Most of the vein averages less than 1 oz. per ton in silver.

Ore minerals: Galena, sphalerite, chalcopyrite, and native silver.

Production: 1953, 1956, 1958, and 1959: 9 tons yielded 3 ozs. gold, 1,238 ozs. silver, 1,240 lbs. lead, and 1,715 lbs. zinc; 275 tons yielded 5 ozs. gold, 263 ozs. silver, 300 lbs. copper, 9,400 lbs. lead, and 6,700 lbs. zinc.

Reference: Huntting, 1956, p. 314.

NEWPORT DISTRICT

Principal Silver Deposits

Ries (Eagle)

Location: N½NW¼ sec. 12, T. 31 N., R. 45 E.

Development: 80- and 215-foot shafts, and a 40-foot adit.

Geology: 6-foot-thick quartz vein in quartz diorite porphyry.
Ore minerals: Galena and minor chalcopyrite.
Production: 1910-1922: 21 tons of ore yielded 5 ozs. gold, 363 ozs. silver, 414 lbs. copper, and 973 lbs. lead.
Reference: Huntting, 1956, p. 229.

Skippy and Queen Bess

Location: Sec. 23 and SW¼ sec. 14, T. 34 N., R. 44 E.
Development: 80- and 105-foot adits.
Geology: 10- to 12-inch-thick quartz vein in quartzite.
Ore minerals: Galena and pyrite.
Production: None.
References: Huntting, 1956, p. 229; Schroeder, 1952, p. 53-54.

STEVENS COUNTY

Stevens County ranks second in the production of silver in Washington, having produced 3,378,763 ounces of the metal from 1904 through 1969 (table 5). Metal deposits containing silver occur in many parts of the county, but the bulk of the silver has come from five of the county's nine mining districts. These

TABLE 16.—Major silver-producing districts of Stevens County, 1902-1969

District	Predominant metals	Total silver production	Average silver content (oz/ton) of ore
Chewelah	Copper-silver	1,792,219	4.5
Colville	Lead-silver	366,717	53.68
Bossburg	Lead-silver	307,288	2.62
Northport	Zinc-lead	239,956	0.075
Deer Trail	Lead-silver	190,602	9.82

TABLE 17.—Major silver producers of Stevens County, 1902-1956

Mine	District	Chief metal	Years operated 1/	Production (troy ozs)
United Copper	Chewelah	Copper	1906-1931	1,645,997
Old Dominion	Colville	Lead	1902-1953	342,517
Queen Seal	Deer Trail	Silver	1903-1940	285,759
Bonanza	Bossburg	Lead	1907-1952	238,485
Legal Tender	Deer Trail	Silver	1902-1904	122,211
Cleveland	Deer Trail	Lead	1903-1948	98,745
Providence	Deer Trail	Silver	1902-1911	87,442
Young America	Bossburg	Lead	1905-1953	69,893

1/ Operations not continuous.

Properties

1. Comstock
2. Iron Mask
3. Montana and Washington
4. Easter Sunday
5. McKinley
6. Bullion
7. Great Republic
8. Coyote
9. Sunset
10. Sterret
11. Silver Crown
12. Melrose
13. Jackson
14. Red Top
15. Hazel
16. Roosevelt
17. United Treasure
18. Keough
19. Myeerah
20. Frisco Standard
21. Morning
22. Burrus
23. Galena Farm
24. Al Ki
25. Silver Trail
26. Young America
27. Bonanza
28. Gold Bar
29. Chloride Queen
30. Avondale-Dome
31. Gold Ledge
32. Vanasse
33. Gold Reef
34. Ark
35. Aguila
36. Longshot
37. Middleport
38. Old Dominion
39. Ore Cache
40. Daisy Tempest
41. Silver Summit
42. Krug (Hanford)
43. Jay Dee
44. High Grade
45. United Copper
46. Copper King
47. Amazon
48. Chinto
49. Eagle (Blue Star)
50. Jay Gould
51. U.S. Copper Gold
52. Mullen
53. Nevada
54. Edna
55. Double Eagle
56. Wells Fargo
57. Orchid
58. Cleveland
59. Deer Trail
60. Brooks
61. Saturday Night-Sunday Morning
62. Queen-Seal
63. Aichan Bee
64. Silver Star
65. Orazada
66. Indian Trail

● Mine

o Prospect

0 6 12 Miles

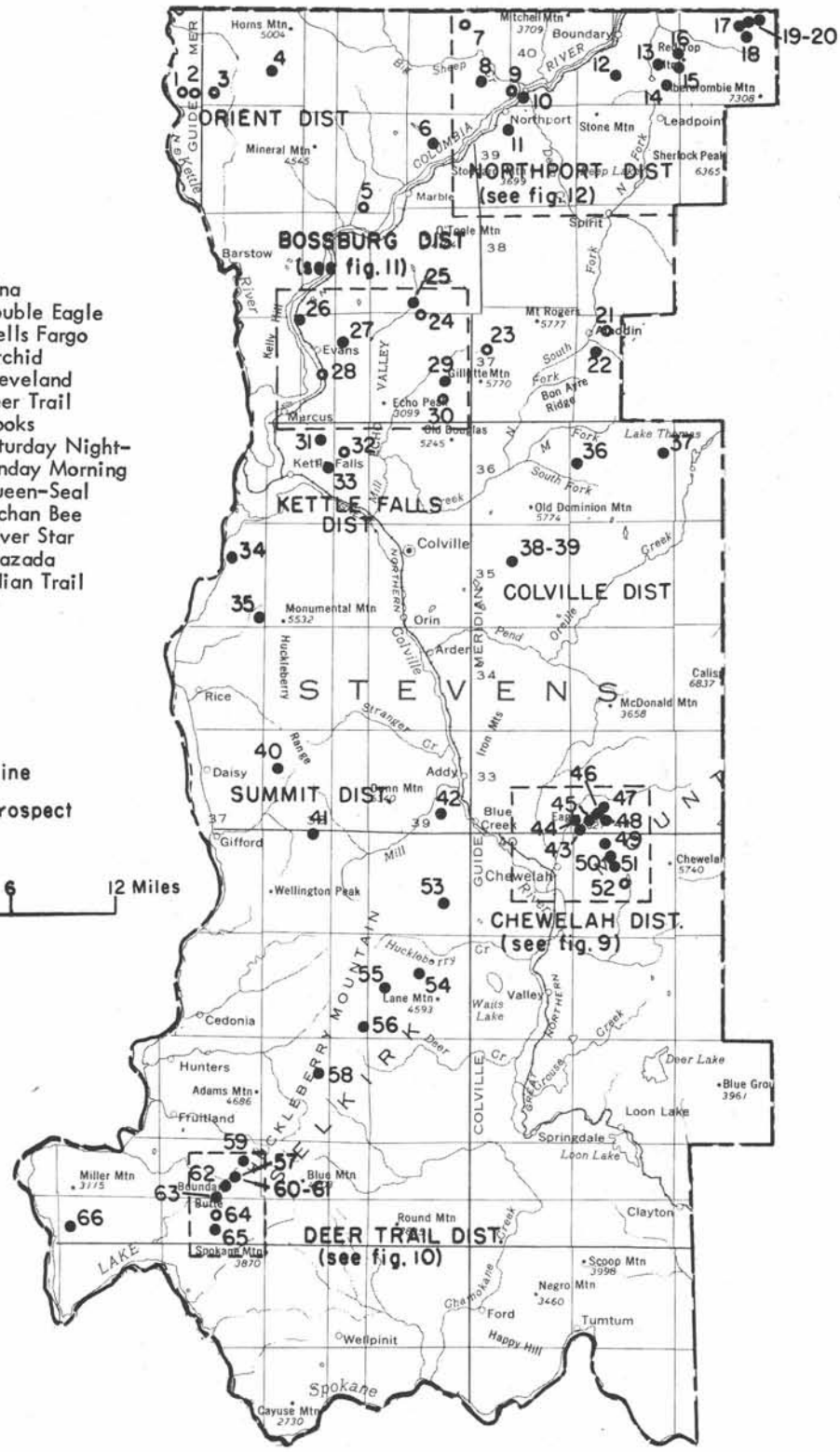


FIGURE 8.—Silver deposits of Stevens County.

five districts, along with predominant metals of the districts, silver production, and average silver content of the ore, are listed in table 16.

According to U.S. Bureau of Mines figures (Fulkerson and Kingston, 1958, p. 24-46), 193 mines in Stevens County are credited with the production of silver from 1902 through 1956. However, only at 38 mines did the value of silver exceed that of any other single metal, and only at 8 mines did the total silver production exceed 50,000 ounces. A breakdown, according to the main metal produced, shows that silver was produced by 70 lead mines, 38 silver mines, 37 gold mines, 32 copper mines, and 16 zinc mines. Mines that produced in excess of 50,000 ounces of silver are listed in table 17.

CHEWELAH DISTRICT

Location

The Chewelah district of southeastern Stevens County is one of the oldest mining districts in Washington. In 1883, lead and silver deposits were discovered at Embry camp, which was 2 miles east of Chewelah. Subsequent discoveries proved to be rich in copper and silver, which lead to the development of some of the most productive silver mines in the state. Although silver occurs throughout the district, the most productive mines are 3 to 5 miles east of Chewelah near Eagle Mountain and Quartzite Mountain (fig. 9). Several other silver mines are 12 miles

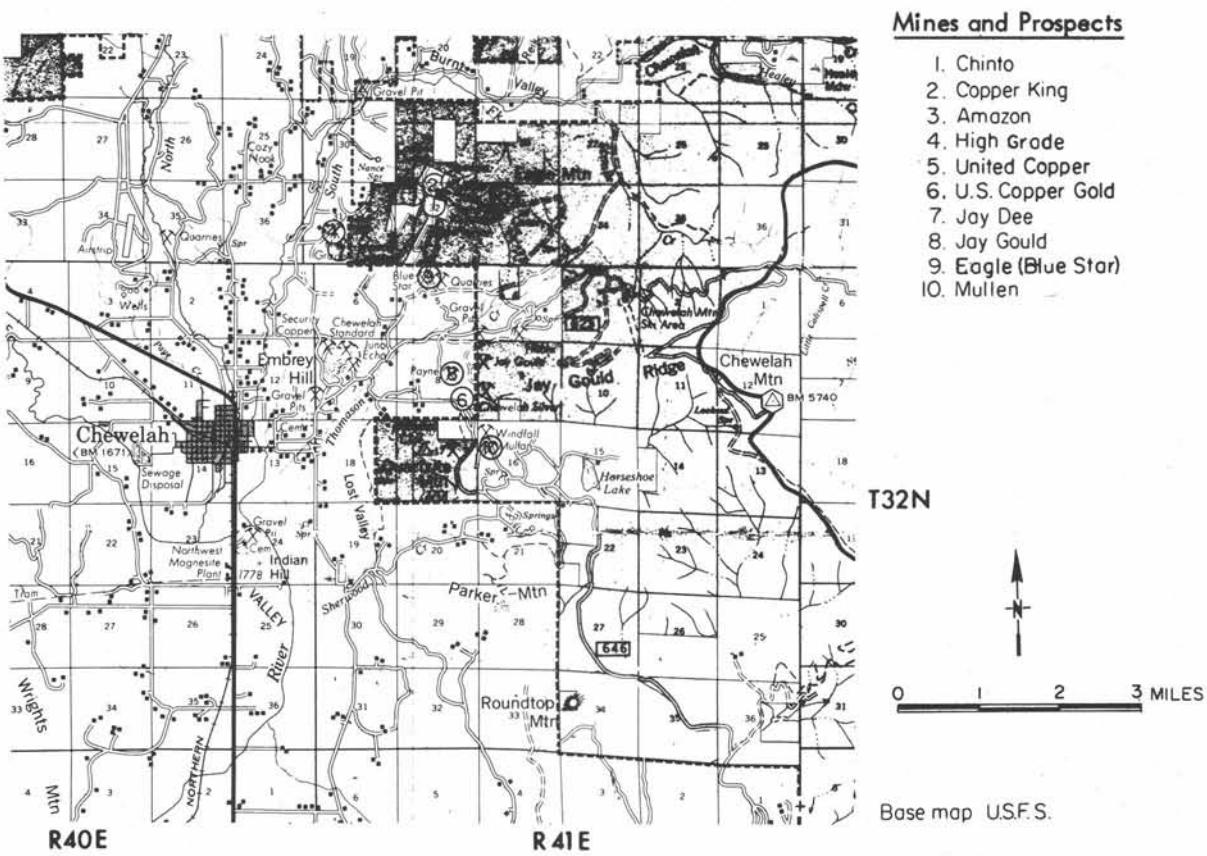


FIGURE 9.—Index map of the Chewelah district.

southwest of Chewelah, but production from these mines has been minor. Currently (1975), no metal mines are operating in the district.

Geology and Mineralization

The predominant rocks of the Chewelah district consist of interbedded argillite, slate, phyllite, and quartzite of the Belt Series (Precambrian); argillite, quartzite, phyllite, and dolomite of the Deer Trail Group (Precambrian); Addy Quartzite (Cambrian); and Flowery Trail Granodiorite (Mesozoic). Mafic dikes occur throughout the district in metamorphic and plutonic rocks. High-angle, northeast-trending faults and shear zones served as depositional loci for metal deposits, consisting of metallized veins of white quartz and carbonate minerals (calcite to siderite). The chief sulfide minerals of the veins are pyrite, pyrrhotite, chalcopyrite, tetrahedrite, covellite, chalcocite, and molybdenite. The silver occurs chiefly in the tetrahedrite, either as argentian tetrahedrite or as freibergite. Other silver minerals appear to be absent in the district. The quartz-carbonate veins range from stringers less than 1 inch thick to massive veins as much as 25 feet thick. Most veins contain only sparsely disseminated sulfides, but in some veins the sulfides are concentrated into ore shoots. The richest ore shoot mined in the district was at the United Copper mine where a 2- to 12-inch-thick ore shoot of tetrahedrite contained 75 to 300 ounces of silver per ton. This shoot had a horizontal length of 100 to 200 feet; the vertical extent of the shoot is not known. Elsewhere in the mine the ore averaged only 4.63 ounces per ton in silver.

Although quartz-carbonate veins predominate in the Chewelah district, ore minerals have also been found in chimneylike breccia zones in limestone. At the Eagle (Blue Star) mine, argentiferous galena and cerussite occurred in a chimney of brecciated limestone that was several hundred feet in diameter. However, the lead-silver ore bodies of the breccia zone were sparse.

Near-surface parts of most veins contain iron and manganese oxides, while oxidized parts of the copper veins contain malachite and azurite. No large zones of secondary enrichment occur in the district; if they did exist, they were probably removed by glacial erosion.

Most silver-bearing metal deposits of the Chewelah district occur in metamorphic rocks that border granodiorite intrusives. As such, the ore deposits appear to have originated from hydrothermal metalliferous solutions that formed vein-type deposits in fissures, while other solutions formed metosomatic replacement deposits along shear zones.

Production

The bulk of the silver produced in Stevens County came from the Chewelah mining district, mainly as a byproduct of copper mining operations. From 1902 through 1957, 24 mines in the district produced 1,771,435 ounces of silver. High-grade silver ore was shipped from the district as early as 1890; however, production figures for individual districts are not available prior to 1902. The leading silver producers of the Chewelah ores were United Copper and Copper King mines, which produced 95 percent of the silver from the Chewelah district. Between 1902 and 1956, the district produced 386,535 tons of ore that had an average silver content of 4.5 ounces per ton. In addition to copper and silver, the district has produced lesser amounts of gold, lead, and zinc. Since 1957, no metal mines have operated in the Chewelah area. The leading silver-producing mines of the Chewelah area are in table 18.

TABLE 18.—Leading silver mines of the Chewelah area

Mine	Total production (troy ounces)	Average silver content of ore (oz/ton)
United Copper	1,673,072	4
Copper King	39,593	3
Chinto	5,040	33
Eagle (Blue Star)	3,540	10
Jay Gould	2,502	11
Amazon	2,191	3
High Grade (Turk)	1,956	19

Major Mines

United Copper mine

United Copper, which is 3 miles northeast of Chewelah, operated continually from 1906 through 1931, and part time between 1955 and 1957. Since 1957, the mine has been closed. The mine produced a total of 1,673,072 ounces of silver, with a yearly average of 141,288 ounces. In addition to silver, 1,300 ounces of gold, and 9,714,504 pounds of copper was recovered from the mine's total production of 370,554 tons of ore.

The mine is developed over a horizontal distance of 1,500 feet by a 4,220-foot main adit, several hundred feet of sublevels, and a 300-foot shaft. From these workings, which are as much as 1,200 feet beneath the surface, considerable drifting and stoping was undertaken. The vein, which is 3 to 15 feet thick, follows a strong shear zone in argillite. The general strike of the vein is N. 20° E., and its dip is nearly vertical. The milky quartz of the vein contains chalcopyrite, tetrahedrite, and pyrite. The part of the vein that was mined averaged 4 ounces per ton in silver, and 1.5 percent copper; however, one tetrahedrite-rich part of the vein contained 75 to 300 ounces of silver per ton. This high-grade streak was 2 to 12 inches thick, and its horizontal extent was 100 to 200 feet.

Copper King mine

This property adjoins United Copper on the southeast. Between 1904 and 1941, the Copper King produced 13,027 tons of ore that contained 39,593 ounces of silver, 183 ounces of gold, and 446,879 pounds of copper. The mine is developed by several thousand feet of adits and drifts, which contain several stopes. One 200-foot-long stope contained 6,000 tons of ore that averaged 1.5 percent copper. The veins average around 6 feet in thickness; however, bulges in the veins are up to 30 feet thick. The veins consist of quartz and siderite that fill N. 30° E. trending, nearly vertical shear zones in argillite and quartz-mica schist. The sulfide minerals of the veins are chalcopyrite and pyrite, with lesser amounts of tetrahedrite. Tetrahedrite appears to be the main carrier of silver. Several tetrahedrite-rich ore shoots averaged 35 ounces per ton in silver; however, the average silver content for all ore mined was only 3 ounces per ton.

Principal Silver Deposits of Chewelah District

Amazon

Location: Secs. 29 and 32, T. 33 N., R. 41 E.; part of Chinto property.

Development: 650-foot adit, with 310 feet of drifts.

Geology: Quartz veins 2 to 6 feet thick in argillite and quartz-mica schist. Veins strike N. 23° E. and dip 70° NW.

Ore minerals: Chalcopyrite, pyrite, and azurite sparsely disseminated in the veins.

Production: 1911-1918: 665 tons yielded 6 ozs. gold, 2,191 ozs. silver, and 29,540 lbs copper.

References: Fulkerson and Kingston, 1958, p. 27; Weaver, 1920, p. 150-151.

Chinto

Location: Near center N½ sec. 32, T. 33 N., R. 41 E.

Development: 1,500-foot adit, and 350-foot shaft; total of 7,000 feet of workings on three levels.

Geology: Quartz-calcite-siderite veins in argillite. Veins strike N. 20° E., have near vertical dips, and are up to 6 feet thick.

Ore minerals: Chalcopyrite, tetrahedrite, sphalerite, pyrite, arsenopyrite, azurite, and malachite occur in lenses and as scattered grains.

Production: 1937 and 1939: 151 tons yielded 9 ozs. gold, 5,040 ozs. silver, and 15,032 lbs. copper.

References: Fulkerson and Kingston, 1958, p. 27; Patty, 1921, p. 131-135.

Copper King

Location: N¼ cor. sec. 32, T. 33 N., R. 41 E.; part of Chinto property.

Development: Several thousand feet of underground workings on two levels. Main adit 1,500 feet long.

Geology: Quartz-siderite veins in argillite and quartz-mica schist. Veins strike N. 30° E.; have near vertical dips; and average 6 feet in thickness, with lenses up to 30 feet thick.

Ore minerals: Chalcopyrite, tetrahedrite, and pyrite in small lenses and as disseminated grains.

Production: 1904-1941: 13,027 tons yielded 183 ozs. gold, 39,593 ozs. silver, and 446,879 lbs. copper.

References: Fulkerson and Kingston, 1958, p. 27; Patty, 1921, p. 131-135.

Double Eagle

Location: SE¼ sec. 18, T. 31 N., R. 39 E.

Development: 2,200 feet of workings in a 750-foot adit, a 300-foot adit, and a shaft of unknown depth.

Geology: Metallized shear zones in argillite, limestone, and quartzite. Boulders of solid galena found in overburden. Ore averaged 39 ozs. per ton in silver; high-grade ore averaged 70 ounces.

Ore minerals: Galena, chalcopyrite, and pyrite.

Production: 1916 and 1939: 42 tons yielded 1,625 ozs. silver, 3,089 lbs. lead, and 3,171 lbs. copper.

References: Weaver, 1920, p. 179-180; Huntting, 1956, p. 240.

Eagle (Blue Star)

Location: Center N½ sec. 5, T. 32 N., R. 41 E. and sec. 32, T. 33 N., R. 41 E.

Development: Main adit with more than 3,000 feet of drifts and crosscuts, and a 217-foot shaft.

Geology: Ore shoots in dolomitic limestone near granodiorite contact. Ore averaged 12 ounces per ton in silver.

Ore minerals: Galena, tetrahedrite, sphalerite, chalcopyrite, cerussite, anglesite, molybdenite, pyrite, and pyrrhotite.

Production: 1902-1935: 173 tons yielded 2 ozs. gold, 2,166 ozs. silver, 88,693 lbs. lead, and 1,085 lbs. copper.

References: Bancroft, 1914, p. 105-106; Weaver, 1920, p. 148-149; Huntting, 1956, p. 326.

Edna

Location: SE¼SE¼ sec. 9, T. 31 N., R. 39 E.

Development: 450-foot shaft with 1,000 feet of drifts. Drifts at 110- and 225-foot levels in shaft.

Geology: 80-foot metallized zone along contact between diorite and argillite. Ore-grade material averages about 4 feet in width. Vein assays up to 20 ozs. per ton in silver and 7 percent copper.

Ore minerals: Chalcopyrite, tetrahedrite, bornite, chalcocite, pyrite, arsenopyrite, and malachite.

Production: 1899, 1904-1906, 1917: $5,000 mainly in copper.

References: Weaver, 1920, p. 181-182; Huntting, 1956, p. 96.

High Grade

Location: SW¼ sec. 31, T. 33 N., R. 41 E.

Development: 160-foot shaft and a 100-foot adit with a 50-foot winze.

Geology: Sparsely metallized quartz stringers up to several inches thick in limestone.

Ore minerals: Chalcopyrite, galena, tetrahedrite, sphalerite, chalcocite, chrysocolla, malachite, and azurite.

Production: 1917-1920: 98 tons yielded 2 ozs. gold, 1,956 ozs. silver, and 14,914 lbs. copper.

References: Fulkerson and Kingston, 1958, p. 28, Weaver, 1920, p. 144.

Jay Dee

Location: SW¼ sec. 31, T. 33 N., R. 41 E.

Development: 160-foot shaft, and a 100-foot adit with a 50-foot winze.

Geology: Narrow quartz stringers up to several inches thick in limestone.

Ore minerals: Galena, tetrahedrite, sphalerite, malachite, azurite, chalcocite, and chrysocolla.

Production: 1917, 1919, 1920: 98 tons of ore yielded 2 ozs. gold, 1,956 ozs. silver, and 14,914 lbs. copper.

References: Weaver, 1920, p. 144-145; Huntting, 1956, p. 328.

Jay Gould

Location: Center S½ sec. 8, T. 32 N., R. 41 E.

Development: 200-foot inclined shaft with two levels containing several hundred feet of drifts.

Geology: Quartz veins in argillite near granite contact. Ore averaged 11 ounces per ton in silver.

Ore minerals: Galena, sphalerite, chalcopyrite, tetrahedrite, bornite, and pyrite.

Production: 1902-1904, 1907, 1939: 226 tons yielded 2,502 ozs. silver, 42,742 lbs. lead, and 82 lbs. copper.

References: Bancroft, 1914, p. 106-107; Weaver, 1920, p. 151-152.

Krug (Hartford)

Location: NE¼SE¼ sec. 26, T. 33 N., R. 39 E.

Development: 340-foot adit, 35-foot shaft, and several open cuts.

Geology: Several quartz veins in limestone and diabase. One 2- to 3-foot thick vein is fairly well metallized, and assays up to 94.2 ozs. of silver per ton.

Ore minerals: Chalcopyrite, tetrahedrite, galena, sphalerite, pyrite, malachite, azurite, and cuprite.

Production: 1916-1917: 78 tons yielded 316 ozs. silver and 52 lbs. copper.

References: Weaver, 1920, p. 167-169.

Mullen

Location: W½NW¼ sec. 16, T. 32 N., R. 41 E.

Development: 17-foot shaft.

Geology: 3- to 4-foot-wide quartz vein along granodiorite-quartzite contact. High-grade ore contains 34 percent lead, 8 percent zinc, 21.6 ozs. silver, and 0.56 ozs. gold.

Ore minerals: Galena, sphalerite, tetrahedrite, zinkenite, chalcopyrite, and pyrite.

References: Huntting, 1956, p. 245; Purdy, 1951, p. 142-143.

Nevada

Location: SW¼ sec. 23, T. 32 N., R. 39 E.

Development: 30-foot shaft.

Geology: Ore minerals form pods and pockets in limestone.

Ore minerals: Galena, sphalerite, tetrahedrite, chalcopyrite, and pyrite.

Production: 1937: 5 tons of ore yielded 58 ozs. silver, 1,390 lbs. lead, and 38 lbs. copper.

References: Huntting, 1956, p. 245; Fulkerson and Kingston, 1958, p. 28.

U.S. Copper Gold

Location: SE¼SE¼ sec. 8, T. 32 N., R. 41 E.

Development: 340-foot adit.

Geology: 4-foot-thick quartz vein in quartzite, limestone, and argillite.

Ore minerals: Chalcopyrite and pyrite.

Production: 1916-1917: 20 tons of ore yielded 35 ozs. silver and 1,104 lbs. copper.

References: Weaver, 1920, p. 161; Huntting, 1956, p. 333.

United Copper

Location: E½NW¼ sec. 32, and NE¼ sec. 31, T. 33 N., R. 41 E.

Development: Main adit 4,200 feet long and a 300-foot shaft with considerable drifting and stoping on several levels.

Geology: Quartz-calcite-siderite vein 5 to 20 feet thick in argillite. Vein

strikes N. 20° E., and is nearly vertical. High-grade ore contained 75 to 300 ounces of silver per ton.

Ore minerals: Chalcopyrite, argentian tetrahedrite, pyrite, arsenopyrite, and malachite.

Production: 1906-1931, 1955-1957: 370,554 tons of ore yielded 1,673,072 ozs. silver, 1,300 ozs. gold, and 9,714,504 lbs. copper.

References: Patty, 1923, p. 123-131; Weaver, 1920, p. 139-141.

Wells Fargo

Location: NW¼NE¼ sec. 36, T. 31 N., R. 38 E.

Development: Main adit 1,500 feet long with short drifts and raise. Upper adit contains 200 feet of workings.

Geology: 3- to 5-foot-thick quartz-barite veins in argillite and dolomite. Zinkenite contains up to 25 ozs. per ton in silver, 24 percent antimony, 18 percent lead, and 18 percent zinc, and occurs as solid masses up to 18 inches thick.

Ore minerals: Zinkenite, sphalerite, stibnite, jamesonite, and pyrite.

Production: 1916: two carloads of barite. 1960: 50 tons barite.

References: Purdy, 1951, p. 146-148; Moen, 1964, p. 53-55.

DEER TRAIL DISTRICT

Location

The Deer Trail district is in southwestern Stevens County, in the general vicinity of Fruitland (fig. 10). The principal lead-silver deposits are at the head of Cedar Canyon, and near the headwaters of O-Ra-Pak-En Creek. Elevations in the district range from 3,600 to 4,650 feet. Deer Trail is also known as the Cedar Canyon district.

Geology and Mineralization

The silver-bearing deposits of the Deer Trail district occur mainly as quartz veins in a steeply dipping, northeast-trending belt of dolomite, slate, and phyllite, which is a part of the Deer Trail Group (Precambrian). The rocks have been intruded by quartz monzonite of the Loon Lake batholith (Cretaceous). Most veins occupy moderately to steeply dipping northeast-trending shear zones that parallel several major high-angle faults. The veins consist mainly of white quartz that is accompanied by varying amounts of calcite, siderite, and barite. The veins range from less than a foot to as much as 12 feet in thickness, with an average of 2 to 3 feet. Metallized parts of the veins contain pods and lenses of ore minerals that are as much as 6 feet thick. However, mining in the past indicates that the average ore shoot is only around 18 inches thick. The silver minerals of the veins consist of argentite, cerargyrite, stephanite, argentiferous galena, and native silver. These minerals are accompanied by sphalerite, chalcopyrite, tetrahedrite, azurite, malachite, pyrite, and limonite. Some silver-bearing veins have been mined for several hundred feet along their strikes,

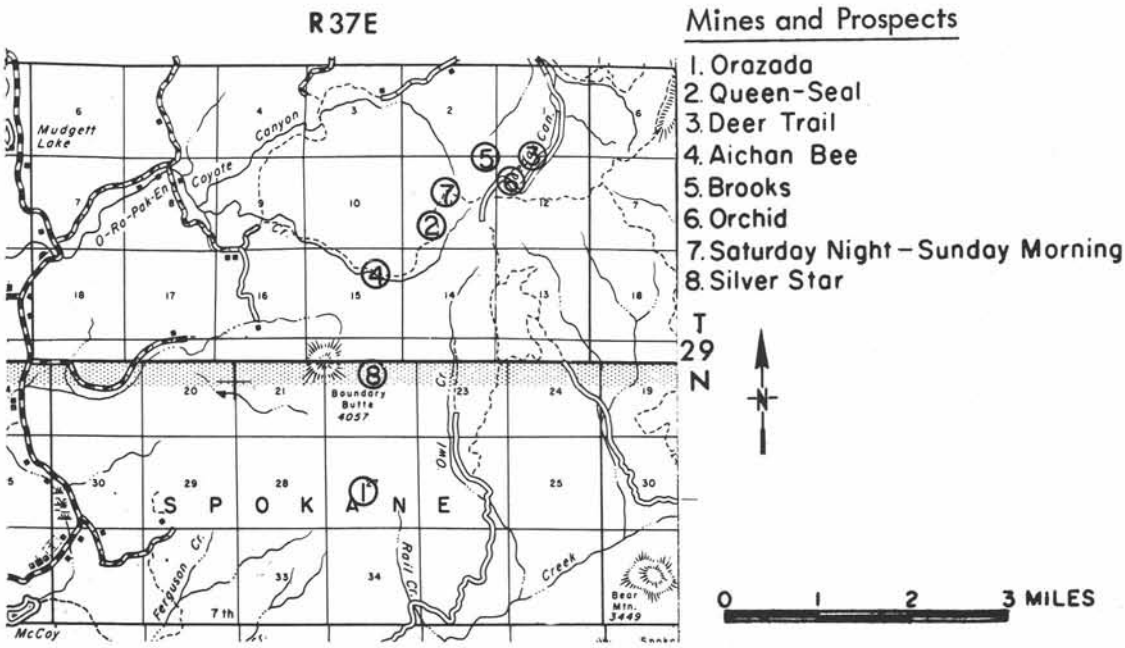


FIGURE 10.—Index map of the Deer Trail district.

and for a maximum depth of about 400 feet beneath their outcrops; however, nothing suggests that mineralization terminates at this depth.

The average silver content of ore from the district was 9.82 ounces per ton; however, individual shipments of ore were much richer. At the Legal Tender mine, 122,211 tons of ore averaged 216.30 ounces per ton in silver, while 881 tons of ore from the Queen-Seal mine averaged 240.3 ounces per ton. Properties that have high lead contents generally have a high silver content. The silver content of lead ore from mines in Cedar Canyon ranged from 13.5 to 215 ounces per ton, with an average of 150 ounces per ton. At properties where copper minerals predominate, the silver content of the ore is lower. At the Turk mine, where the chief copper mineral is chalcopyrite, the average silver content of the ore is only 0.32 ounce per ton. At the Queen-Seal, where tetrahedrite is the main copper mineral, the copper ore averaged about 16 ounces per ton in silver. At the Providence and Queen-Seal, parts of the veins contained mainly silver minerals and little if any ore minerals of copper, lead, and zinc. The silver content of these veins was as much as 200 ounces per ton.

Production

Although not the most productive silver area of Stevens County, some of the richest silver ore mined in the state came from the Deer Trail district. As early as 1894, mines in Cedar Canyon shipped ore that averaged 200 ounces per ton in silver and 8 percent lead; by 1900 the production of lead and silver reached $500,000. The district's most productive mines were the Legal Tender, Providence, Queen, and Silver Seal. From 1902 through 1967, mines of the area produced 21,606 tons of ore that contained 89 ounces of gold, 190,602 ounces of silver, 292,780 pounds of copper, 1,874,066 pounds of lead, and

558,800 pounds of zinc. Sixteen mines in the district have produced silver; however, only three mines have been major silver producers. The leading silver mines of the Deer Trail district are the Legal Tender, Providence, and Queen-Seal; currently (1975) all mines are idle, except for limited development work at the Deer Trail mine.

TABLE 19.—Leading silver producers of the Deer Trail district (1894-1941)

Mine	Total production (troy ounces)	Average silver content of ore (oz./ton)
Queen-Seal	285,759	97.53
Legal Tender	122,211	216.30
Providence	87,442	143.80

Major Mines

Queen-Seal mine

This property, which is near the headwaters of O-Ra-Pak-En Creek, consists of the Silver Queen and Silver Seal mining claims from which rich silver ore was first shipped in 1900. In 1902, ore shipped from the Seal averaged 240 ounces per ton in silver, and ore from the Queen averaged 200 ounces. From 1900 through 1941, the total combined production of the Queen-Seal was 2,930 tons of ore that averaged 97.53 ounces per ton in silver. In addition to 285,759 ounces of silver, the mine produced 14,148 pounds of lead, and 821 pounds of copper. Almost all the ore was shipped crude to smelters; however, in 1937 and 1938, a 50-ton flotation mill was operated at the mine by Queen-Seal Mining Co. Small-scale mining was attempted in the 1960's, but less than 100 tons of ore was shipped.

The mine contains several thousand feet of workings that are inaccessible because of caved adits and shafts. The main adit intersects the vein about 400 feet from its portal, and two shafts were sunk on the vein for depths of 300 and 200 feet beneath the surface; considerable stoping was undertaken on the vein, which has been drifted upon for over 1,600 feet. The silver-bearing quartz vein is 1 to 3 feet thick, strikes N. 25°-35° E., and dips 75° NW. Ore shoots, which pitch to the northeast, contain argentite, native silver, tetrahedrite and cerargyrite that is accompanied by minor pyrite, galena, and sphalerite. Host rocks for the vein consist of massive white dolomite and artillite, both of the Deer Trail Group (Precambrian). These rocks are no doubt underlain by Cretaceous age granodiorite and quartz monzonite, as the granitic rocks crop out less than 1 mile both east and west of the Queen-Seal mine.

Deer Trail mine

The Deer Trail mine at the head of Cedar Canyon is reported to have produced more than $3 million from 1894 to 1947, with the most productive years being 1894 to 1911. Some ore contained as much as 2,000 ounces per ton in silver, and in the late 1890's and early 1910's only ore that ran 80 ounces or more per ton in silver was shipped; the shipments averaged 300 ounces per ton in silver and 8 percent lead. Prior to 1900, most production was from the Deer Trail claims, whereas, from 1900 to 1911, production was mainly from the Elephant, Legal Tender, and Providence claims of the Deer Trail group. From 1902 through 1911, 1,173 tons of ore shipped from the Legal Tender and Providence averaged 265 ounces per ton in silver, and 11 percent lead. The mine has not been in production since 1947, and the portals of most adits are caved. Currently (1975), the property is under development by Deer Trail Mines Co.

The mine is developed over a vertical distance of 500 feet by 11 adits that contain over 4,000 feet of drifts and raises. In several parts of the mine, the vein has been extensively stoped. Near-surface parts of the vein contained abundant limonite rich in cerargyrite and native silver. Below the oxidized zone the chief ore minerals were argentiferous galena, argentite, and sphalerite. The ore minerals occur in quartz-calcite veins that follow shear zones in argillite and dolomite of the Deer Trail Group (Precambrian). The veins have a general N. 35°-50° E. strike and dip 35° to 60° SE.; they average around 30 inches in thickness, and contain tabular and lenticular ore shoots that are up to 2½ feet thick. Generally, the thinnest ore shoots were richest in silver. In the vicinity of the mine, rocks of the Deer Trail Group are underlain by Cretaceous granodiorite and quartz monzonite. These granitic rocks are probably not much more than 1,500 feet beneath the mine workings, and are probably the source rocks for the silver deposits of the area.

Because all adits are caved at their portals, it is not possible to determine if ore remains in the mine. According to Max Slate, owner of the mine, the old mine dumps have been sampled, and average around 15 ounces per ton in silver, while parts of some veins still contain silver ore.

Principal Silver Deposits of Deer Trail District

Aichan Bee

Location: Center NE¼ sec. 15, T. 29 N., R. 37 E.

Development: 600-foot adit with a 150-foot drift.

Geology: Ore minerals disseminated along shear zones in argillite, quartzite, and limestone.

Ore minerals: Sphalerite, galena, chalcopyrite, and pyrite. Ore assays up to 12 percent lead, 18 percent zinc, and 12 ozs. per ton in silver.

Production: Minor amounts in 1943.

Reference: Huntting, 1956, p. 323.

Brooks

Location: NE¼ cor. sec. 11, T. 29 N., R. 37 E.

Development: 50-foot shaft and 2 adits.

Geology: 5- to 7-foot quartz veins in argillite and limestone.

Ore minerals: Stephanite, galena, sphalerite, tetrahedrite, and pyrite.

Production: Shipped ore prior to 1901.

Reference: Huntting, 1956, p. 324.

Cleveland

Location: NE¼ sec. 9, T. 30 N., R. 38 E.

Development: Lower adit with 1,400 feet of crosscuts, drifts, and raises; intermediate adit 750 feet long; upper adit with 1,200 feet of drifts, crosscuts, and raises. Several other adits, shafts, and open cuts.

Geology: Lenses of ore in brecciated dolomitic limestone. Ore also occurs in thin veins and in chimneys. Ore averaged 3.73 ozs. per ton in silver, 5 percent lead, and 1 percent zinc. High-grade ore contained up to 132 ozs. per ton in silver.

Ore minerals: Galena, stibnite, boulangerite, sphalerite, tetrahedrite, chalcopyrite, cerussite, anglesite, bindheimite,

pyrite, arsenopyrite, and malachite.

Production: 1903-1948: 26,459 tons yielded 89 ozs. gold, 98,745 ozs. silver, 2,700,000 lbs. lead, 551,170 lbs. zinc, 7,396 lbs. copper. 1968: 56 tons.

References: Purdy, 1951, p. 137-141; Jenkins, 1924, p. 127-132; Gage, 1941, p. 91-96.

Deer Trail

Location: SW¼ sec. 1 and NW¼ sec. 12, T. 29 N., R. 37 E.

Development: 11 adits containing over 4,000 feet of drifts, crosscuts, and raises. Vein extensively stoped in several adits.

Geology: 1- to 6-foot-thick quartz vein in argillite and dolomite containing tabular and lenticular ore shoots up to 2½ feet thick. High-grade shoots contained up to 2,000 ozs. per ton in silver. Ore averaged around 280 ozs. per ton in silver, and 10 percent lead.

Ore minerals: Cerargyrite, native silver, argentite, galena, pyrargyrite, sphalerite, cerussite, tetrahedrite, and pyrite.

Production: 1894-1902: substantial production of unknown value. 1902-1947: 1,855 tons of ore yielded 2 ozs. gold, 304,557 ozs. silver, 323,417 lbs. lead, and 293 lbs. copper.

References: Huntting, 1956, p. 325; Bancroft, 1914, p. 117-118; Jenkins, 1924, p. 134-136; Poole, 1936.

Indian Trail

Location: NE¼ sec. 31, T. 29 N., R. 36 E.

Development: 400-foot crosscut with drift and 150-foot raise to surface.

Geology: 2-foot-thick quartz vein in monzonitic and metasedimentary rocks. Vein carries 15 to 20 ozs. of silver, 6 to 7 percent lead, and 4 to 5 percent zinc.

Ore minerals: Galena, sphalerite, and pyrite.

Production: Small shipment in 1969 assayed 21.6 ozs. silver, 0.05 oz. gold, 7.4 percent lead, and 4.7 percent zinc.

Reference: Washington Division of Geology and Earth Resources files.

Orchid

Location: Sec. 12, T. 29 N., R. 37 E.

Development: 1,750 feet of workings in shaft and several adits.

Geology: Quartz vein in argillite and limestone.

Ore minerals: Argentite and cerargyrite.

Production: 3 tons in 1900.

Reference: Huntting, 1956, p. 330.

Orazada

Location: SE¼NW¼ sec. 27, T. 39 N., R. 37 E., on Spokane Indian Reservation.

Development: 2,400-foot adit.

Geology: Narrow metallized shear zones in argillite and limestone. Ore averaged 13.5 ozs. per ton in silver.

Ore minerals: Galena, sphalerite, jamesonite, pyrite, and arsenopyrite.

Production: 1927 and 1941: 35 tons of ore yielded 468 ozs. silver, 5 ozs. gold, 7,374 lbs. lead, and 77 lbs. copper.

References: Gage, 1941, p. 110-111; Huntting, 1956, p. 330.

Queen-Seal

Location: SW¼ sec. 11, T. 29 N., R. 37 E.

Development: 300- and 200-foot shafts, and a 1,370-foot crosscut adit; several stopes, and 1,500 feet of drifts on the vein.

Geology: 1- to 3-foot-thick quartz vein in dolomite and argillite. Vein strikes N. 25°-35° E., dips 75° NW.

Ore minerals: Argentite, cerargyrite, native silver, galena, sphalerite, tetrahedrite, and pyrite. High-grade ore contained up to 240 ozs. per ton in silver; much ore averaged 97.53 ozs. per ton in silver and 10 percent lead.

Production: 1900-1941: 2,930 tons of ore yielded 285,759 ozs. silver, 14,148 lbs. lead, and 821 lbs. copper.

References: Weaver, 1920, 193-195; Huntting, 1956, p. 331.

Saturday Night-Sunday Morning

Location: Sec. 11, T. 29 N., R. 37 E.

Development: Caved adits and shafts with 800 feet of workings.

Geology: Metallized zone, 18 inches thick in argillite and limestone.

Ore minerals: Tetrahedrite, galena, and sphalerite.

Production: Two tons of ore shipped prior to 1897 contained 71 ozs. of silver.

Reference: Huntting, 1956, p. 247.

Silver Star

Location: NE¼SW¼ sec. 22, T. 29 N., R. 37 E.

Development: Several open cuts and a caved shaft.

Geology: Quartz vein up to 5 feet thick in dolomite. Vein averages 8 ozs. per ton in silver.

Ore minerals: Galena and tetrahedrite.

Production: None.

Reference: Washington Division of Geology and Earth Resources files.

BOSSBURG DISTRICT

Location

The Bossburg district of northwestern Stevens County lies between the town of Bossburg on the west, and the headwaters of Clugston Creek on the east. The area includes parts of T. 37 N., R. 38 and 39 E. (fig. 11). The area is mountainous, and fairly well accessible. Elevations range from 1,380 feet at Bossburg to a maximum of 4,655 feet on Uncle Sam Mountain in the eastern part of the area. Lake Roosevelt is at the western edge of the area; Bruce Creek is the principal stream in the central part of the area, and Clugston Creek is the principal stream in the eastern part.

Geology and Mineralization

Silver in the Bossburg district is associated mainly with lead-zinc deposits. The host rocks for the deposits are limestone, dolomite, argillite, quartzite, and schist, of late Paleozoic and Triassic age. Mesozoic and Tertiary granitic rocks underlie parts of the area, and appear to be the source of the metal deposits. In order of decreasing abundance the ore minerals are galena, sphalerite, cerussite, smithsonite, chalcopyrite, tetrahedrite, and geochronite. Minor calamine, wulfenite, anglesite, azurite, and malachite occur at several deposits, while pyrite and

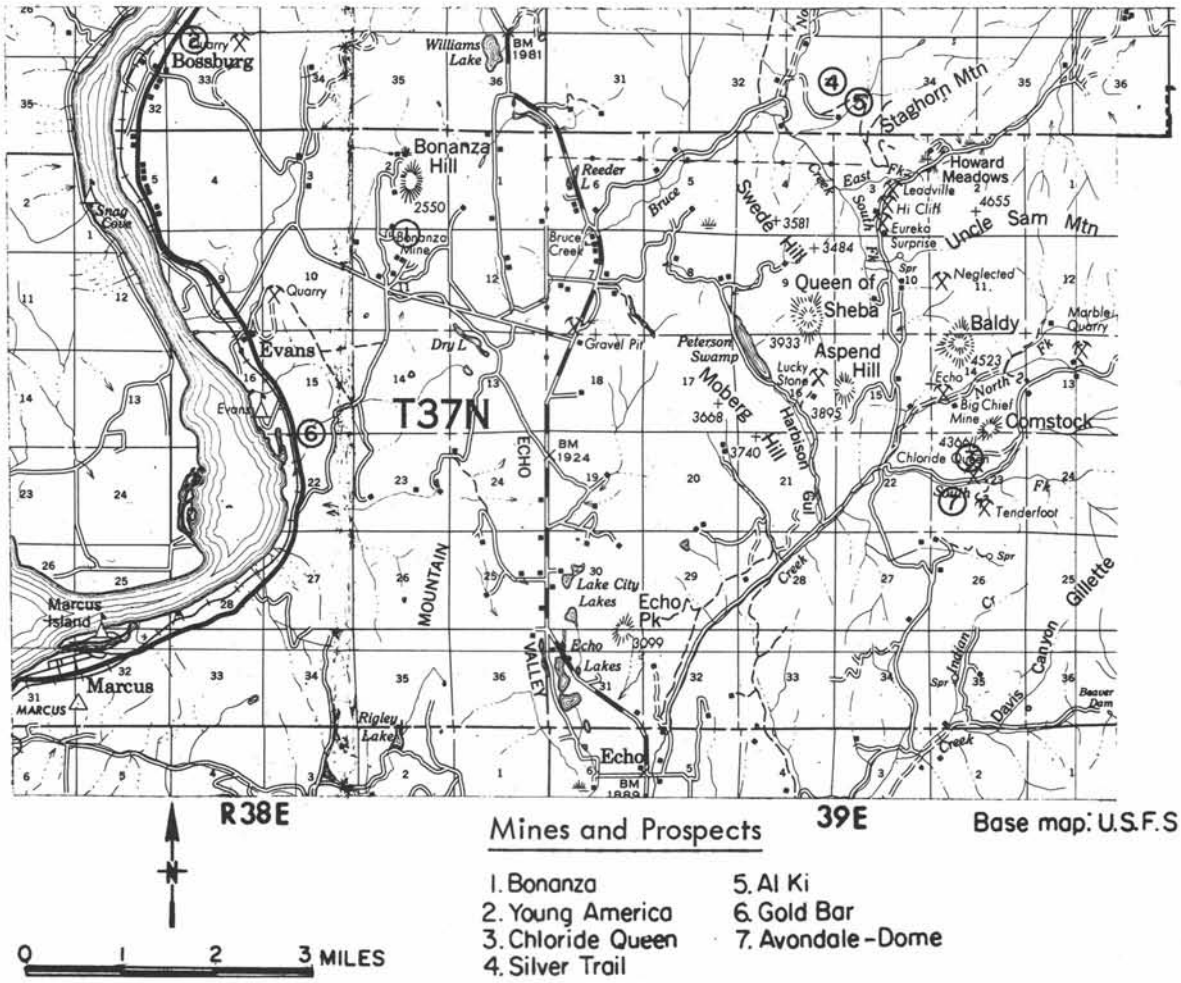


FIGURE 11.—Index map of the Bossburg district.

limonite are present at most deposits. Silver minerals have not been reported in any ores of the Bossburg area; the silver occurs mainly in argentiferous galena and argentian tetrahedrite.

The ore minerals occur mainly in nodules, pods, and stringers in quartz-calcite veins. The veins, which average 4 to 5 feet in thickness, occur along shear zones, and are not persistent for great distances. Other pods and nodules of ore minerals are randomly scattered in fractured and sheared limestone, and form disseminated deposits, some of which are chimneylike in shape. At the Young America mine, disseminated grains of sphalerite and galena occur along bedding planes in limestone, whereas at the Bonanza mine galena occurs as replacement lenses along schistosity planes in schist. At the Uncle Sam mine, galena and sphalerite occur as irregular shaped masses in a chimney of highly brecciated dolomite.

At most properties in the Bossburg area, oxidation at the surface is only slight. Some sphalerite has been altered to smithsonite, and cerussite is the common alteration product of galena.

The average silver content of ore from the Bossburg area was only 2.63 ounces per ton. This figure is influenced greatly by ore from the Bonanza mine, which produced the bulk of lead and silver from the Bossburg area. The average silver content of 101,994 tons of ore from the Bonanza was 2.34 ounces per ton. Ore from the Silver Trail mine averaged 7 ounces per ton in silver, while the average silver content of ore from the Young America mine was 5.22 ounces. Hand-sorted ore from several other mines was much richer. Ninety tons of ore from the Minorca mine contained 9,259 ounces of silver, and 35 tons from the Chloride Queen contained 1,569 ounces.

Most ore shoots in the Bossburg area have been small; the largest ore shoots were at the Bonanza and Young America mines. In the Young America, one ore shoot was 300 feet long and was mined along its dip for 200 feet. Another ore shoot had a strike length of 100 feet and a dip length of 200 feet. Two main ore shoots at the Bonanza mine had strike lengths of up to 200 feet and dip lengths of around 600 feet. The shoots averaged around 4 feet thick, but in places were up to 27 feet thick.

Production

Production of silver from the Bossburg district between 1902 and 1956 totaled 307,288 ounces. Prior to 1902, and as early as 1885, the Young America, Bonanza, Silver Trail, and Chloride Queen mines had a combined silver production of around 100,000 ounces. Peak production years for the district were 1947 through 1952; silver production averaged 33,536 ounces yearly, with most of the silver coming from the Bonanza mine. Between 1903 and 1954, mines of the district produced 116,961 tons of ore that contained 102 ounces of gold, 307,288 ounces of silver, 145,765 pounds of copper, 24,785,332 pounds of lead, and 971,514 pounds of zinc. The leading silver producers of the Bossburg district are shown in table 20.

TABLE 20.—Leading silver producers of the Bossburg district

Mine	Total production (troy ounces)	Average silver content of ore (oz./ton)
Bonanza	238,485	2.34
Young America ..	69,893	5.22
Silver Trail	2,916	7.00
Chloride Queen..	1,569	44.80

Principal Silver Deposits of Bossburg District

Al Ki

Location: Sec. 33, T. 38 N., R. 39 E.

Development: Unknown.

Geology: 3- to 4-foot quartz veins in granite. Select samples from vein contained 17 to 56 ozs. of silver, 2.5 ozs. gold, and 50 to 64 percent lead.

Ore minerals: Galena and pyrite.

Production: Unknown.

References: Huntting, 1956, p. 236.

Avondale-Dome

Location: SW¼ sec. 2, T. 37 N., R. 39 E.

Development: 800 feet of workings in 108- and 125-foot adits.

Geology: Lenses and nodules of ore minerals in a 4-foot shear zone in limestone. Select samples assayed 60 percent lead and 15 ozs. silver.

Ore minerals: Galena with minor cerussite, calamine, anglesite, wulfenite, limonite, and pyrite.

Production: Unknown.

References: Huntting, 1956, p. 237.

Bonanza

Location: Secs. 2 and 11, T. 37 N., R. 38 E.

Development: 750-foot incline shaft with seven working levels; more than 15,000 feet of underground workings; metallized shear zone extensively stoped.

Geology: Ore shoots up to 27 feet thick along shear zone in chlorite and graphite schist. Ore shoots lenticular, and averaged 3 to 4 feet in thickness. Average silver content 2.34 ozs. per ton.

Ore minerals: Galena, sphalerite and pyrite.

Production: 1907-1952: 101,994 tons yielded 12 ozs. gold, 238,485 ozs. silver, 24,880,359 lbs. lead, 230,687 lbs. zinc and 21,913 lbs. copper. Prior to 1907 several thousand tons of unknown value.

References: Weaver, 1920, p. 174-176; Jenkins, 1924, p. 118-120; Bancroft, 1914, p. 63-64; Huntting, 1956, p. 238; Patty, 1921, p. 117-119.

Chloride Queen

Location: E½ sec. 23 and W½ sec. 24, T. 37 N., R. 39 E.

Development: 350-foot adit with drifts, shafts and stopes; 1,500-foot adit with short crosscuts.

Geology: 5-foot quartz vein along quartzite-dolomite contact. Also replacement deposits in brecciated limestone. Several ore shoots contained up to 34.3 percent lead, and 14 ozs. of silver per ton. One ore shoot contained 136 ozs. per ton in silver.

Ore minerals: Galena, cerussite, sphalerite, chalcopyrite, limonite, and pyrite.

Production: 1900, 1914, 1924, 1929. Eleven tons of ore mined in 1929 yielded 1 oz. gold, 1,492 ozs. silver, 10 lbs. copper and 160 lbs. lead.

References: Jenkins, 1924, p. 113-115; Gage, 1941, p. 43-45; Weaver, 1920, p. 235-237.

Gold Bar

Location: Secs. 15 and 22, T. 37 N., R. 38 E.

Development: 1,000 feet of underground workings in 4 adits and 2 shafts.

Geology: Narrow quartz veins fill fractures in quartzite and argillite. Veins assay from 1.2 to 62 ozs. silver, trace to 1.3 percent lead, trace to 1.7 percent zinc, trace to 0.3 percent copper, and 1.02 to 2.70 percent arsenic.

Ore minerals: Galena, sphalerite, tetrahedrite, pyrite, and arsenopyrite.

Production: Unknown.

Reference: Huntting, 1956, p. 169.

Silver Trail

Location: N½ sec. 33, T. 38 N., R. 39 E.

Development: 850- and 320-foot adits, and two shallow shafts; several open cuts.

Geology: $1\frac{1}{2}$- to 8-foot-thick quartz veins in argillite and quartzite. High-grade ore contained 20 percent lead, and 129 ozs. per ton in silver. Average ore contained 7 ozs. per ton in silver, and 1.5 percent lead.

Ore minerals: Galena, sphalerite and chalcopyrite.

Production: About 6,000 tons of ore from 1891 to 1952; 908 tons produced from 1912 to 1952 contained 4,876 ozs. silver, 26,333 lbs. lead, and 27,701 lbs. zinc.

References: Weaver, 1920, p. 246-248; Bethune, 1892, p. 127-128; Huntting, 1956, p. 248.

Young America

Location: NE$\frac{1}{4}$NW$\frac{1}{4}$ sec. 33, T. 38 N., R. 38 E.

Development: Six adits with considerable stoping.

Geology: Disseminated ore minerals and stringers and lenses of ore minerals in dolomite. Area of disseminated ore minerals 30 to 150 feet wide and 900 feet long. Ore mined to date averaged 5.2 ozs. per ton in silver, 3.5 percent lead, and 2.9 percent zinc.

Ore minerals: Galena, sphalerite, smithsonite, cerussite, geocronite, and pyrite.

Production: 1905-1953: 13,409 tons yielded 50 ozs. gold, 70,857 ozs. silver, 5,138 lbs. copper, 949,719 lbs. lead, and 771, 629 lbs. zinc. Produced between 1889 and 1905, but value of ore unknown.

References: Hundhausen, 1949, 13 p.; Patty, 1921, p. 119-121; Purdy, 1951, p. 148-153.

SUMMIT DISTRICT

Location

The Summit district of west-central Stevens County lies immediately east of Roosevelt Lake; Kettle Falls district is to the north, and Deer Trail district is to the south (fig. 8). The Summit district is classed as a lead-silver district; however, production from the district has been minor.

Geology and Mineralization

The ore deposits of the Summit district occur mainly as metallized quartz-calcite fissure veins in Paleozoic argillite and quartzite, which have been intruded by Mesozoic diorite, porphyritic granodiorite, and trachite. The veins, which have northwest to northeasterly strikes and nearly vertical dips, are as much as 12 feet thick; the average thickness is 3 to 4 feet. The veins commonly pinch and swell, and some veins are offset several feet by post-mineralization faulting. Common ore minerals, sparsely disseminated in most veins, are argentiferous galena, sphalerite, and chalcopyrite. The less common ore minerals are tetrahedrite, scheelite, wolframite, argentite, molybdenite, cerussite, and anglesite. The ore minerals are almost always accompanied by pyrite, and occasionally by arsenopyrite and marcasite. Although the ore minerals are only sparsely disseminated in the veins, parts of some veins contain pods and lenses of ore minerals that are up to several feet thick.

Production

Almost the total production of silver, gold, copper, and lead of the Summit district has come from the Daisy mine. Prior to 1890, the mine produced 2,000 tons of ore of undisclosed value. Sporadic mining operations from 1916 through 1935 yielded 1,484 tons, averaging 9.43 ounces of silver per ton and 1 percent lead. Around 1890, high-grade lead-silver ore was shipped from the Silver Summit mine to Denver smelters. The ore averaged 50 ounces per ton in silver and 45 percent lead. In 1935, 2 tons of ore from the Silver Summit yielded 26 ounces per ton in silver and 29 percent lead. There has been no production from the district since 1935; however, exploration work was undertaken at the Daisy mine in 1970, and at the Silver Summit mine in 1968.

Principal Silver Deposits of Summit District

Daisy-Tempest

Location: Secs. 6 and 7, T. 33 N., R. 38 E.

Development: 11 adits with more than 4,000 feet of underground workings over a vertical distance of 600 feet.

Geology: Quartz-calcite veins up to 16 feet thick along shear zones in argillite and limestone. Main vein strikes N. 52° W., dips 70° SW. and contained ore shoots as much as 2½ feet in thickness, which averaged around 20 ozs. per ton in silver.

Ore minerals: Galena, argentite, chalcopyrite, sphalerite, cerargyrite, pyrargyrite, azurite, malachite, pyrite, and arsenopyrite.

Production: Main production prior to 1900; 1,482 tons produced from 1916 through 1935 yielded 10 ozs. gold, 13,978 ozs. silver, 4,527 lbs. copper, and 28,967 lbs. lead.

References: Patty, 1921, p. 136-143; Jenkins, 1924, p. 124-126.

Silver Summit

Location: Center sec. 33, T. 33 N., R. 37 E.

Development: 3 shafts, 1 adit, and several open cuts. One incline shaft 300 feet deep with 340 feet of drifts on the vein.

Geology: 2½- to 5-foot-thick quartz vein in trachite. Vein strikes N. 30° E., dips 35° NW. Ore minerals occur in scattered pods and pockets. Garnet and epidot near contact of trachite and limestone.

Ore minerals: Galena, pyrite, and anglesite; some scattered grains of scheelite and powellite.

Production: Main production around 1890 but probably not much more than 100 tons. Two tons in 1935 yielded 52 ozs. silver, 1,178 lbs. lead, and 14 lbs. copper.

References: Bethune, 1891, p. 76-77; Huntting, 1956, p. 248.

COLVILLE DISTRICT

Location

The Colville district of central Stevens County centers about Old Dominion Mountain, the summit of

which is 7 miles east of Colville (fig. 8). The only significant silver mine in the area is the Old Dominion, which was the first major silver-lead discovery in Washington, and a producer of some of the richest silver ore mined in the state. Old Dominion mine is on the southwest slope of the mountain where elevations are from 2,925 to 3,375 feet above sea level.

Geology and Mineralogy

Ore deposits of the Colville area occur as metallized quartz fissure veins, and as replacement deposits along shear and breccia zones. Host rocks for the ore deposits consist mainly of Cambrian limestone, quartzite, and schist; also, several deposits occur in Precambrian greenstone and Mesozoic granodiorite. The quartz veins range from several inches to 6 feet in thickness, whereas, the metallized shear and breccia zones are up to 10 feet thick. Most deposits are steeply dipping, but at the Old Dominion several ore bodies dip as little as 10 to 20 degrees, and are irregular in size and shape. The principal gangue mineral is massive white quartz, which is often accompanied by calcite, dolomite, and siderite. The common ore minerals are argentiferous galena and sphalerite that are almost always accompanied by pyrite, and occasionally by arsenopyrite. Some deposits contain tetrahedrite and scheelite; near-surface ore from the Old Dominion mine contained cerussite, anglesite, stephanite, and native silver. The ore shoots in most deposits are small; however, several ore shoots in the Old Dominion mine were 6 to 8 feet thick and had strike and dip lengths of several hundred feet. Several ore bodies in the mine appear to have been deposited at the intersection of shear zones.

The average silver content of most veins did not exceed 10 ounces per ton. However, at the Old Dominion, near-surface ore mined in the late 1890's and early 1900's contained as much as 478 ounces per ton in silver, while ore mined from 1906 to 1931 in the lower workings of the mine averaged 87.78 ounces per ton.

Production

The Colville district is the second most productive silver district in Stevens County. From 1902 through 1954, mines of the district produced 6,752 tons of ore that contained 370 ounces of gold, 362,467 ounces of silver, 5,371 pounds of copper, 960,761 pounds of lead, and 405,419 pounds of zinc. Sixty percent of the total metal production came from the Old Dominion, and the value of silver produced at the mine exceeded the value of any other metal. Other major producers were the Longshot and Shoemaker mines, both of which produced several thousand tons of lead-zinc ore.

Major Mines

Old Dominion mine

This property, which is 6 miles east of Colville, was one of the first major silver mines in Washington and operated sporadically from 1885 until 1953. From 1885 to 1895, about $500,000 in high-grade lead-silver ore was mined from near-surface ore shoots that averaged 400 ounces per ton in silver, and 33 percent lead. Ore mined from 1902 through 1953, averaged 83.78 ounces per ton in silver and 9.1 percent lead. In 1952 and 1953, the silver content of the ore had dropped to 13.5 ounces per ton, and the lead content was only 2.15 percent. From 1885 through 1953, the mine produced 6,588 tons of ore that contained 323 ounces in gold, 942,517 ounces

of silver, 2,244,391 pounds of lead, 148,563 pounds of zinc, and 4,132 pounds of copper. The mine has been idle since 1953; some underground workings are caved, and nothing remains of the concentrating mill.

The property is developed by about 8 miles of underground workings on at least 11 levels that extend over a vertical distance of about 600 feet. No. 1 adit is the lowest adit, and its portal is at 2,975 feet elevation. The adit is over 5,500 feet long, and ore has been mined from several thousand feet of sublevels, most of which lie up to 200 feet beneath the No. 1 adit level. Extensive longhole exploratory drilling has been undertaken on all levels in search of ore bodies, and the ore bodies appear to have bottomed at about 200 feet beneath the No. 1 adit level. No. 2 adit is at an elevation of 3,130 feet, and contains about 650 feet of drifts and crosscuts. No. 3 adit is at an elevation of 3,225 feet, and is about 800 feet long. The Bridal Chamber level is at 3,295 feet elevation; and the Ella workings, from which the original high-grade silver ore was mined in 1885, is at about 3,375 feet elevation. The most recent mine workings is the Ophir adit, which is 1,050 feet northeast of the No. 1 adit portal, at an elevation of about 3,160 feet. Extensive work was undertaken in 1952 and 1953, in the Ophir adit, but the extent of the work is unknown to the writer. Judging from the size of the Ophir dump, several thousand feet of workings are present.

In the lower levels of the mine, which were accessible from the No. 1 adit, the ore bodies occurred in sheared and brecciated dolomitic limestone. The mineralized shear and breccia zones are roughly parallel, and within a few hundred feet of a northwest-trending fault that dips 50° to 60° SW. Less than 100 feet east of the main workings, the limestone is in contact with granite. Both the contact and the fault are almost barren of ore. The ore bodies of the sheared and brecciated limestone were irregular in shape and size, and appeared to have been controlled by intersecting fracture zones.

In the uppermost workings of the mine, which are known as the Ella workings, the ore bodies occur along gently dipping shear zones in limestone. The shear zones dip 10° to 20° NE. and are near a steeply dipping (80°), northeast-trending fault zone.

Ore minerals at the Old Dominion were chiefly galena and sphalerite, which were accompanied by minor argentite and native silver. Massive quartz, calcite, dolomite, and siderite were the main gangue minerals. In the Ella workings, the altered ore contained secondary cerussite and anglesite, as well as abundant limonite.

Principal Silver Deposits of Colville District

Longshot

Location: NW¼ sec. 18, T. 36 N., R. 41 E.

Development: 600-foot crosscut adit with several hundred feet of drifts, raises, and stopes.

Geology: Replacement deposit in limy beds in argillite, phyllite, and quartzite. 20-foot bed sparsely metallized, and contained several ore shoots. Ore averaged 20.7 ozs. per ton in silver, 3.3 percent lead, and 4.2 percent zinc. Select samples assayed up to 150 ounces per ton in silver.

Ore minerals: Galena, sphalerite, tetrahedrite, and scheelite.

Production: 1951-1952: 246 tons of ore yielded 5,094 ozs. silver, 3 ozs.

gold, 16,330 lbs. lead, and 20,581 lbs. zinc.

References: Huntting, 1956, p. 244; Washington Division of Geology and Earth Resources field notes.

Middleport

Location: SE$\frac{1}{4}$ sec. 12, T. 36 N., R. 41 E.

Development: 60- and 800-foot adits.

Geology: $\frac{1}{2}$- to 2-foot-thick quartz vein in granodiorite. Ore averages 8 percent lead, 15 percent zinc, 11.8 ozs. silver, and 0.13 oz. gold.

Ore minerals: Galena, sphalerite, chalcopyrite, tetrahedrite, and pyrite.

Production: Minor production in 1929; 1937-1939.

References: Huntting, 1956, p. 379.

Old Dominion

Location: NW. cor. sec. 9, T. 35 N. R. 40 E.

Development: About 40,000 feet of underground workings on at least 11 levels. Main adit over 5,500 feet long.

Geology: Replacement deposits along shear zones and in breccia in dolomitic limestone. Ore averaged 83 ozs. per ton in silver and 9 percent lead. Near-surface ore averaged 400 ozs. per ton in silver and 33 percent lead.

Ore minerals: Galena, sphalerite, argentite, native silver, cerussite, and anglesite.

Production: 1885-1953: 6,588 tons of ore yielded 323 ozs. gold, 942,517 ozs. silver, 2,244,391 lbs. lead, 148,563 lbs. zinc, and 4,132 lbs. copper.

References: Weaver, 1920, p. 171-173; Jenkins, 1924, p. 120-123; Huntting, 1956, p. 330; Bancroft, 1914, p. 126-130.

Ore Cache

Location: Sec. 9, T. 35 N., R. 40 E.

Development: 40-foot shaft and several short adits.

Geology: Replacement deposits in limestone. Ore assayed 52 ozs. per ton in silver.

Ore minerals: Galena.

Production: 1916: 3 tons yielded 156 ozs. silver and 640 lbs. lead.

References: Weaver, 1920, p. 173-174; Huntting, 1956, p. 246.

NORTHPORT DISTRICT

Location

The Northport district is in northeastern Stevens County, and lies between the Columbia River on the west and the Pend Oreille-Stevens County border on the east. Elevations range from 1,333 feet at Northport to 7,200 feet at the summit of Abercrombie Mountain. Most lead and zinc ores of the area contain small amounts of silver; mines where the silver content of the ore exceeds 7 ounces per ton in silver occur mainly in the extreme northeast corner of the area (fig. 12).

Geology and Mineralization

Ore deposits of the Northport district are of three general types: (1) replacement deposits along shear zones in limestone and dolomite; (2) galena in chimney deposits in dolomite; and (3) argentian tetrahedrite in quartz veins in argillite. The richest silver deposits are in the third type, whereas deposits

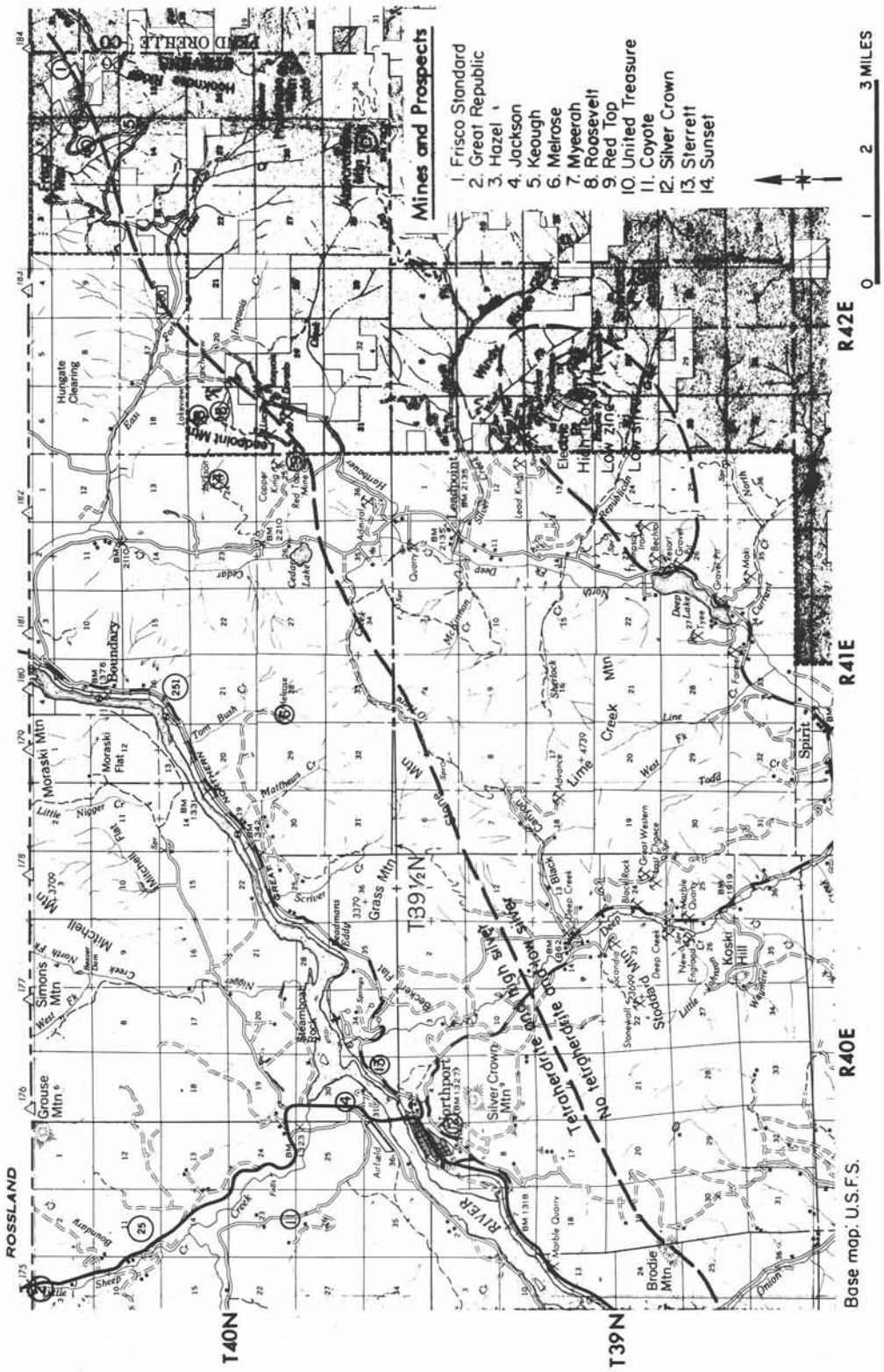


FIGURE 12—Index map of the Northport–Leadpoint district.

of the first type generally have the lowest silver content. However, the bulk of silver produced in the Northport area has come from deposits of the first type because a greater tonnage of ore has been mined from these deposits.

The predominate ore minerals are galena and sphalerite, which are almost always accompanied by pyrite, and occasionally by pyrrhotite. In addition to these minerals, several deposits contain varying amounts of tetrahedrite, chalcopyrite, scheelite, argentite, stannite, malachite, and azurite. The greatest assemblage of silver minerals occurs at the Frisco Standard mine where argentite, pyrargyrite, cerargyrite, and bromyrite have been reported. In general, ores rich in tetrahedrite are rich in silver. Although argentiferous galena is present in the Northport area, the silver content of most galena is low, and does not exceed 1 ounce per ton.

Deposits of high-silver contents are of the quartz vein type, which vary from several inches to as much as 14 feet in thickness; the average thickness is about 4 feet. Most veins of this type occupy shear zones or fissures in middle Paleozoic argillite and limestone that have been intruded by granitic rocks of the Spirit pluton (Cretaceous-Tertiary). Many of the veins have been sheared into small discontinuous lenses by postmineral faulting, and silver rich ore shoots seldom contained over 20 tons of high-grade silver ore. The richest silver ore mined from a quartz vein deposit came from the Jackson mine where 7 tons of ore averaged 188 ounces per ton in silver. The most productive quartz vein deposit was the Red Top from which 2,474 tons of zinc-lead-silver ore has been mined. Although argentiferous galena contained up to 16 ounces per ton in silver, the average silver content of ore mined was only 2.56 ounces per ton.

In the dolomite or limestone replacement deposits, galena, sphalerite, and pyrite are erratically distributed through the ore bodies. High-grade ore is separated from low-grade ore or nearly barren rock, but large-scale mining operations make it possible to mine the metallized rock at low costs. The silver content of the replacement deposits is generally low, with the average being around 0.02 ounce per ton. What little silver is present appears to be carried by the galena. The common host rock for lead-zinc replacement deposits of the Northport area is a middle dolomite member of the Metaline Limestone (Cambrian). The ore bodies appear to be controlled by bedding as well as faults.

In chimney deposits, which also occur in dolomite of the Metaline Limestone, galena forms nodules from a few inches to many feet in diameter. Most chimneys are 10 to 15 feet in diameter, 100 feet deep, and occur at brecciated intersections of shear zones. At the Electric Point mine, the largest chimney had a diameter of 150 feet, and was mined to a depth of 800 feet. At the Electric Point and Gladstone mines, the galena was accompanied by cerussite, anglesite, and abundant limonite. Ore shipped from these mines averaged 30 to 39 percent lead and 0.14 to 0.48 ounces per ton in silver.

According to Yates (1970, p. 22, fig. III-2), the Northport district can be divided mineralogically into areas of (1) tetrahedrite and high silver; (2) no tetrahedrite and low silver; and (3) high lead, low zinc, and low silver. Based on past production records, most significant silver mines are in the northeast part of the area of tetrahedrite and high silver (fig. 12).

Production

Silver produced in the Northport district came mainly from lead-zinc mining operations. From 1902 through 1969, 47 mines in the district produced around

141,000 tons of zinc, 47,000 tons of lead, 254,085 pounds of copper, 239,956 ounces of silver, and 982 ounces of gold. Only seven mines in the district are classed as silver mines. Ore from these mines averaged 7.3 to 200 ounces per ton in silver; however, total production from these mines was less than 1,000 tons.

Most silver produced in the Northport district has come from the Van Stone, Calhoun, Blue Ridge, and Deep Creek mines, which were major lead-zinc mines of Stevens County. These mines produced over 100,000 ounces of silver from ore that averaged only about 0.02 ounce per ton in silver.

After the closure of the Van Stone mine in 1970, silver production in the Northport district has been insignificant. Currently (1975), all major mines are idle, but exploration work in the district continues yearly.

Principal Silver Deposits of Northport District

Bullion

Location: Sec. 8, T. 39 N., R. 39 E.

Development: 160-foot shaft with 180 feet of drifts.

Geology: Quartz veins in schist and argillite.

Ore minerals: Galena, sphalerite, chalcopyrite, bornite, and pyrite.

Production: 11 tons in 1925 yielded 115 ozs. silver and 8,253 lbs. of lead.

References: Huntting, 1956, p. 238.

Burrus

Location: Center N½ sec. 8, T. 37 N. R. 41 E.

Development: 80-foot shaft and several short adits; underground workings totaling 300 feet.

Geology: Shear zone up to 60 feet wide in argillite contains small quartz veins. Ore averaged around 12 ozs. per ton in silver and 2 percent lead.

Ore minerals: Galena, chalcopyrite, and sphalerite.

Production: 1935, 1938, 1939: 81 tons yielded 1,026 ozs. silver, 3,155 lbs. lead, and 197 lbs. copper.

References: Huntting, 1956, p. 376; Colville Engineering Co., 1941, p. 91-92.

Coyote

Location: SW¼ sec. 26 and NW¼ sec. 35, T. 40 N., R. 39 E.

Development: Shallow shaft with short drift.

Geology: Metallized shear zones up to 2 feet thick in argillite and limestone.

Ore minerals: Argentiferous galena.

Production: 29 tons in 1916 and 1917 yielded yielded 156 ozs. silver and 3,696 lbs. lead.

References: Huntting, 1956, p. 239.

Frisco Standard

Location: S½NW¼, sec. 12, T. 40 N., R. 42 E.

Development: Several caved adits with over 1,000 feet of workings; longest adit 500 feet.

Geology: Quartz veins or lenses up to 7 feet thick in sheared graphitic schist. Ore averaged around 8 ozs. per ton in silver, 1.15 percent lead, and 0.3 percent copper. High-grade ore contained 72 ozs. per ton in silver and 17 percent lead.

Ore minerals: Galena, tetrahedrite, chalcopyrite, sphalerite, pyrargyrite, cerargyrite, bromyrite, azurite,

malachite, and stannite.

Production: 1915-1944: 258 tons yielded 1 oz. gold, 2,044 ozs. silver, 1,586 lbs. copper, and 5,973 lbs. lead.

References: Patty, 1921, p. 112-114; Weaver, 1920, p. 304; Bancroft, 1914, p. 58-59; Park and Cannon, 1943, p. 61-62.

Galena Farm

Location: NE¼ sec. 7, T. 37 N., R. 40 E.

Development: 300-foot adit and 2 shafts.

Geology: Metallized lenses of quartz and calcite along shear zone in argillite and dolomite. Assays of up to 9 ozs. per ton in silver reported.

Ore minerals: Argentiferous galena, tetrahedrite, chalcopyrite, and pyrite.

Production: Unknown.

Reference: Huntting, 1956, p. 241.

Great Republic

Location: N¼ cor. sec. 3, T. 40 N., R. 39 E.

Development: 400-foot adit, 110-foot winze, and 120-foot inclined shaft.

Geology: Two quartz-calcite veins up to 4 feet thick along diorite-limy shale contact. Parts of ore vein contain 2.5 to 8.5 percent copper, 19 ozs. silver, and up to 0.4 oz. gold per ton.

Ore minerals: Chalcopyrite, galena, sphalerite, and pyrrhotite.

Production: None.

References: Bancroft, 1914, p. 60-61; Colville Engineering Co., 1941, p. 113-114; Weaver, 1920, p. 318.

Hazel

Location: Center sec. 19, T. 40 N., R. 42 E.

Development: 1,500 feet of adits.

Geology: Quartz vein in argillite ore averaged 32 ozs. per ton in silver, and around 5 percent lead.

Ore minerals: Galena and silver sulfides.

Production: 1922: 24 tons yielded 770 ozs. silver and 2,389 lbs. lead.

References: Jenkins, 1924, p. 102.

Jackson

Location: Center sec. 24, T. 40 N., R. 41 E.

Development: 350-foot adit with 100-foot raise, and three adits each about 175 feet long.

Geology: Quartz vein 4 to 6 feet thick in argillite. Ore averaged 188 ozs. per ton in silver.

Ore minerals: Galena, sphalerite, chalcopyrite, and pyrite.

Production: 1934-1935: 7 tons yielded 1,318 ozs. silver and 181 lbs. lead.

References: Colville Engineering Co., 1941, p. 108; Huntting, 1956, p. 378.

Keough

Location: NE¼ sec. 14, T. 40 N., R. 42 E.

Development: Short adit and open cuts.

Geology: Sparsely metallized quartz lenses in dolomite. Ore averaged 10 ozs. per ton in silver.

Ore minerals: Galena, sphalerite, and tetrahedrite.

Production: 1917: 14 tons yielded 1 oz. gold, 143 ozs. silver, and 3,260 lbs. copper.

References: Bancroft, 1914, p. 59

Melrose (Paragon)

Location: Near W¼ cor. sec. 38, T. 40 N., R. 41 E.

Development: 1,600 feet of underground workings on two levels; 3 adits and a 100-foot shaft.

Geology: 6-foot quartz vein in argillite contains scattered lenses and pods of ore minerals. Small ore shoots contained up to 100 ozs. per ton in silver.

Ore minerals: Tetrahedrite, galena, sphalerite, and pyrite.

Production: 1913-1938: 97 tons yielded 2,973 ozs. silver, 1,255 lbs. copper, 11,176 lbs. lead.

References: Patty, 1921, p. 116-117; Colville Engineering Co., 1941, p. 101; Huntting, 1956, p. 329.

Myeerah

Location: Center NE¼ sec. 11, T. 40 N., R. 42 E.

Development: 475 feet of adits and several open cuts.

Geology: 2-foot-thick quartz vein in argillite and slate. Ore shoots contain up to 20 ozs. per ton in silver, and average ore contained around 14 ozs. per ton.

Ore minerals: Galena and tetrahedrite.

Production: 1926 and 1942: 21 tons yielded 288 ozs. silver and 8,715 lbs lead.

References: Park and Cannon, 1943, p. 62; Colville Engineering Co., 1941, p. 98.

Morning

Location: Center NW¼ sec. 4, T. 37 N., R. 41 E.

Development: 150-foot adit and several small adits; drifts total about 400 feet.

Geology: Quartz vein up to 4½ feet thick in argillite and phyllite. Ore minerals occur in lenses and pods up to 1 foot thick. Ore averaged 90 ozs. per ton in silver. Select samples contained up to 350 ozs. of silver per ton.

Ore minerals: Galena, sphalerite, and pyrite.

Production: 1928-1948: 19 tons yielded 1,712 ozs. silver, 11 lbs. copper, 10,917 lbs. lead, and 4,898 lbs. zinc.

References: Colville Engineering Co., 1941, p. 89; Gage, 1941, p. 114.

Red Top

Location: NE¼SE¼ sec. 25, T. 40 N., R. 41 E.

Development: 2,700-foot adit with 1,500 feet of drifts, raises, and winzes.

Geology: Quartz veins in argillite and limestone. Ore shoots up to 4 feet thick and 18 feet long averaged 2½ ozs. per ton in silver and 4 percent lead. High-grade ore contained up to 60 ozs. per ton in silver.

Ore minerals: Galena, sphalerite, chalcopyrite, pyrite, and scheelite.

Production: 1926-1956: 2,474 tons yielded

6,339 ozs. silver, 207,371 lbs. lead, 140,595 lbs. zinc, and 2,960 lbs. copper.

References: Culver and Broughton, 1945, p. 59-61; Huntting, 1956, p. 247.

Roosevelt

Location: Center N½ sec. 19, T. 40 N., R. 42 E.

Development: 800- and 400-foot adits.

Geology: 4-foot-thick quartz vein in phyllite ore averaged 18 ozs. per ton in silver.

Ore minerals: Galena, sphalerite, and pyrite.

Production: 1937: 48 tons yielded 897 ozs. silver and 1,004 lbs. lead.

References: Colville Engineering Co., 1941, p. 109.

Silver Crown

Location: NE¼SE¼ sec. 5 and NW¼SW¼ sec. 4, T. 39 N., R. 40 E.

Development: 60-foot shaft and 130- and 100-foot adits.

Geology: Narrow quartz veins in limestone. Veins contain up to 90 ozs. per ton in silver.

Ore minerals: Galena, cerussite, sphalerite, smithsonite, and pyrite.

Production: 34 tons in 1925 and 1926 yielded 309 ozs. silver and 5,674 lbs. lead.

Reference: Huntting, 1956, p. 247.

Sterrett

Location: Sec. 33, T. 40 N., R. 40 E.

Development: 500 feet of drifts and raises.

Geology: Veins up to 3 feet thick in limestone.

Ore minerals: Galena and minor sphalerite.

Production: 500 pounds shipped prior to 1941 assayed 56 percent lead, 3 percent zinc, and 34 ozs. silver per ton.

References: Huntting, 1956, p. 248.

Sunset

Location: SW¼ sec. 30, T. 40 N., R. 40 E.

Development: 400-foot inclined shaft with several levels.

Geology: Metallized contact up to several feet thick at contact between diorite and limestone. Contact assays 3 to 39 ozs. silver, 9 to 75 percent lead, and up to 2 ozs. gold.

Ore minerals: Abundant pyrrhotite and minor galena, sphalerite, tetrahedrite, and chalcopyrite.

Production: Unknown.

Reference: Huntting, 1956, p. 248.

United Treasure

Location: Center sec. 11, T. 40 N., R. 42 E.

Development: 800-foot adit and 1,000 feet of shallow adits and cuts.

Geology: Quartz vein up to 4 feet thick in slate, and exposed for 400 feet along its strike. Hand-sorted ore contained 117 ozs. per ton in silver. Average ore contained 45 ozs. per ton in silver. Ore bodies were lenticular, and sporadically distributed in the vein.

Ore minerals: Tetrahedrite, galena, sphalerite, pyrite, malachite, and azurite.

Production: 1916-1953: 84 tons yielded 1 oz. gold, 3,783 ozs. silver, 30,702 lbs. lead, 695 lbs. copper, and 22