of the mountain 30 ft. wide, one halfway down 15 ft. wide, one near down 20 ft. wide, and one near the river 10 to 15 ft. wide. **Dev:** Short crosscut adit on 15-ft. vein. **Assays:** Reportedly $0.28 to $176.00 Au. Ref: 158.

**Sturman and Herringa (1)**

**Loc:** Secs. 8 and 17, (40-3E), near Lynden. **Elev:** 100 ft. **Prop:** Farm land. **Owner:** Thomas Herringa and Mr. Sturman. **Ore:** Iron. **Ore min:** Limonite (bog iron). **Deposit:** Typical of several bog deposits in the vicinity of Bellingham, Ferndale, and Lynden. The Sturman deposit covers an acre or so to an av. depth of 2 ft. The Herringa deposit may cover 5 acres and varies in thickness from 0 to 2 or 3 ft. **Assays:** 39.87% Fe, 19.43% SiO₂, 0.13% P, 0.013% S. Ref: 48, p. 22. 145, pp. 103-164. 158. 179, pp. 42-43.

**Properties—**Lead is a bluish-gray metal, which on rough surfaces has a bright luster that soon tarnishes on exposure to air. It is one of the heaviest metals, is very soft and highly malleable, but has only slight tenacity and low ductility. It is a poor conductor of electricity. 

**Uses—**Lead was probably one of the first metals to be won from its ores by smelting. In 1950 about 52 percent of all lead consumed went into three products—batteries (32 percent), cable coverings (11 percent), and tetraethyl lead (6 percent). Some lead has been mined each year since 1898, with 10,334 tons, which ranked Washington ninth among the states in lead output, and amounted to 2.4 percent of the total United States production for that year. Lead accounted for 26 percent of the value of metallic ore produced in Washington in 1952. Total output from 1898 through 1952 was 124,766 short tons, valued at $25,617,254. Some lead has been mined in each of 10 different counties, but of recent years most has been from the Metaline district in Pend Oreille County and the Bossburg and Northport districts in Stevens County. 

**Prices—**The price of lead has very closely paralleled that of zinc for at least the past 60 years, and the prices of the two metals have been close to the same figure at any given time. During the period 1897 through 1950, the yearly average prices of the two metals have been within 2½ cents of each other each year except for the years 1915, 1916, 1947, 1948, and 1949. The spread was greatest at 8.5 cents in 1915, and the average spread for the years 1947 to 1949 was 3.88 cents. During the 56 years preceding 1953 the lowest price reached was 3.18 cents of each other each year except for the years 1915, 1916, 1947, 1948, and 1949. The spread was greatest at 8.5 cents in 1915, and the average spread for the years 1947 to 1949 was 3.88 cents. During the 56 years preceding 1953 the lowest price reached was 3.18 cents per pound in 1932 and the highest was 21.5 cents in late 1948. From 1900 until World War I, lead prices averaged between 4 and 6 cents per pound. 

**Production—**In 1951 there were 11 lead smelters in the country, 1 each in California, Colorado, Idaho, Illinois, Kansas, Missouri, Montana, New Jersey, and Texas, and in Utah. An important factor in the lead market is secondary lead, the recovery of which has exceeded mine production of new lead each year for many years. The first recorded production of lead in Washington was in 1898, and some lead has been mined each year since then, although the amount has varied greatly from year to year. The record was in 1952, when 11,744 short tons valued at $3,781,586 was produced. The previous record was in 1950, with 10,334 tons, which ranked Washington
Ore minerals—The principal ore of lead is the sulfide, galena, PbS, containing 86.5 percent lead. Two other fairly common ores of lead are the carbonate, cerussite, PbCO₃, containing 77.5 percent lead, and the sulfate, anglesite, PbSO₄, containing 68.3 percent lead. Galena is a primary mineral, but cerussite and anglesite are secondary, as are also the less common, yet well-known, pyromorphite, Pb₃(PO₄)Cl, and wulfenite, PbMoO₄, containing 76.4 and 56.4 percent lead, respectively. All these lead minerals have been found in Washington. The metal rarely occurs as the native element. In all, there are more than 150 minerals known in which lead is an essential constituent.

Geology—Lead minerals typically are associated with zinc and silver minerals, and they occur predominantly in limestone and dolomite, generally as disseminated replacement deposits. Deposits of the less common vein type usually are in sedimentary or metamorphic rocks and are associated with intrusive igneous rocks, but most of the replacement deposits usually are of either (1) lead-zinc ores, with no copper, silver, or gold, in a gangue of calcite, dolomite, pyrite or marcasite, and sometimes barite or fluorite, or (2) lead-silver ores, with similar gangue minerals, sometimes containing small amounts of zinc and gold. The vein deposits of lead usually are more complex, minerallogically. The lead is associated with zinc, and the ore carries appreciable values in gold and silver. Chalcopyrite and pyrite are common in the ore, as are also minerals of antimony, arsenic, bismuth, and other copper and iron minerals.

**Occurrences**

The maps showing the numbered lead occurrences are plates 12, 13, and 14, on pages 35, 37, and 39 in volume 2.

**CHELAN COUNTY**

**Belcher (1)**


**Big Chief**


**Blewett**

(see Peshastin under gold)

**Cascade (24)**

(see under gold)

**Cascade Consolidated (7)**

(see under silver)

**Clagstone (19)**


**Daisy Dean (36)**

(see under gold)

**Davenport (8)**

(see under copper)

**Defender (21)**

(see under copper)

**Doubtfull (9)**


**Ellen**

(see Van Epps under antimony)

**Falls (10)**


**Franklin**


**Galena (Tiger, Kingman) (12)**


**Great Republic**


**Holden (30)**

(see under copper)

**Horseshoe Basin (13)**

Loc: NW¼ sec. 29, (35-15E) and NE¼ sec. 32, (35-15E), Horseshoe Basin area. Elev: 6,600 ft. Access: Road and trail
from Stehekin at head of Lk. Chelan. Prop: 22 unpatented claims, 3 millsites. Owner: Horseshoe Basin Mining & Development Co., Bremerton, Wash. (1946—). Ore: Lead, zinc, copper, silver, gold. Ore min: Galena, sphalerite, chalcopyrite. Deposit: A persistent shear or fracture zone in granodiorite can be traced at least 1,000 ft. and possibly 5,000 ft. The exposed ore shoot is 330 ft. long and av. 3 ft. wide and is composed of quartz-sulfide vein and silicified wall rock. Very little mineralization in the fissure where exposed in the drift 375 ft. below the outcrop. Dev: 1,000-ft. crosscut adit, with about 1,000 ft. of drifts. Improv: Camp buildings, 7,000-ft. tram (1952). Assays: Samples from av. width of 2.9 ft. showed 4.7% Pb, 4.8% Zn, 9.8 oz. Ag, 0.062 oz. Au, 0.35% Cu, 1.78% As. Ref: 133, p. 35. 157. 158.

**Howe Sound**

(see Holden under copper)

**Humbug (35)**


**Indiana**


**Irene**

(see Holden under copper)

**Jefferson and Tennessee**


**Keefer Brothers**

(see under molybdenum)

**King Solomon**

(see Van Epps under antimony)

**Kingman**

(see Galena)

**La Rica**

(see Peshastin under gold)

**Last Chance**

(see under gold)

**Logan (2)**


**Marlin (3)**

(see under copper)

**Maryland**


**Michigan**


**Nevada (23)**

(see under copper)

**North Star (29)**


**Ohio**


**Ombombo (4)**

(see under gold)

**Orphan Boy (25)**

(see under silver)

**Panama No. 2 (14)**


**Peshastin (37)**

(see under gold)

**Quien Sabe (15)**


**Red Mountain (31)**

(see under copper)

**Roscoe Conkling**


**Rouse (16)**


**Royal**

(see Red Mountain under copper)

**Silver Fiend (33)**


**Silver Jack (20)**

Loe: NW1/4 sec. 30, (35-16E), at head of N. Fk. of Bridge Cr. Access: 13 mi. of trail from road at mouth of Bridge Cr. Owner: E. O. Blankenship, Stehekin, Wash. (1940). Ore: Lead,

Silver King (26)
(see under copper)

Silver Trail (28)
(see under copper)

Snook and Ellen
(see Van Epps under antimony)

Spokane Boy and Girl (17)
(see under copper)

Summit (5)

Sunday Morning (27)
(see under silver)

Tennessee
(see Jefferson and Tennessee)

Tiger
(see Galena)

Tiger (22)
(see under gold)

Van Epps (32)
(see under antimony)

White Star (34)

CLARK COUNTY

Silver Star (1)
(see under copper)

COWLITZ COUNTY

Green Mountain (1)
(see under gold)

FERRY COUNTY

Abe Lincoln (125)
(see under copper)

Ada
(see Laura S.)

Addie B (132)
(see under copper)

Addison (136)
(see under copper)

Admiral (53)

Advance (28)
(see under silver)

Ajax (54)

American Granby
(see under copper)

Anchor
(see under silver)

Anderson (116)

Apex
(see Big Chief)

Apollo
(see California under gold)

Big Chief (Axem, Chief) (29)

Big Joker
(see Messenger)

Big Lake (Cuba) (13)
Loc: Secs. 2 and 11, (34-36E), about 1/2 mi. W. of the Columbia R. Elev: 600 ft. above the river. Access: 10 mi. by road from railroad at Kettle Falls bridge. Prop: 12 unpatented claims. Owner: Big Lake Mining Co., Spokane, Wash. (1910-1915), Ferrry Mining Co. (1929-1937). Ore: Lead, zinc, silver, gold, copper. Ore min: Galena, pyrite, sphalerite, chalcopyrite. Deposit: Small irregular quartz veins in a shear zone in schistose gneiss and quartzite. Granite which cuts the metamorphics contains some pyrite. Shear zone said to have an av. width of 3 ft. Dev: 798-ft adit, 3 shafts, 20, 30, and 142 ft. deep. Assays: Nil to 15% Pb, nil to 3% Zn, 0.3 to 40.3 oz. Ag, 0.02 to 0.44 oz. Au. A 6-ft. chip sample from vein at winze showed 4.2% Pb, 2.5% Zn, 0.10% Cu, 0.16 oz. Au, 3.65 oz. Ag. Ref: 46, p. 119. 68, p. 6. 97, 1928, p. 899. 106, 12/19/29. 157. 158.

Black Hawk (30)

Black Tail (51)
quartz stringer contains galena. **Dev:** 12-ft. shaft, several small cuts and pits. **Assays:** AV sample from discovery shaft assayed tr. Au, 0.20 oz. Ag. Ref: 122, p. 109. 163, pp. 51-52.

**Black Thorn (55)**

**Loc:** Near center S. line sec. 27, (32-36E), 1 1/2 mi. NW. of Covada post office. **Prop:** 1 claim. **Owner:** Black Thorn Mining Co. (1912). **Ore:** Lead, silver, gold. **Ore min:** Pyrite, galena. **Deposit:** Quartz vein in granodiorite 3 ft. to 1 ft. wide irregularly banded with galena and pyrite which together make up a small percentage of the whole. **Dev:** Adit 210 ft. in talus and 55 ft. in rock, also a 15-ft. adit. **Assays:** 0.04 oz. Au, 1.4 oz. Ag on sample from 15-ft. adit. Ref: 122, p. 180. 163, p. 70.

**Blevins**

(see Meadow Creek under copper)

**Blue Bird (86)**

**Loc:** NE 1/4 SW 1/4 sec. 1, (31-36E), Covada dist. **Prop:** 1 claim. **Ore:** Lead, silver. **Ore min:** Pyrite, galena. **Gangue:** Quartz, silicified country rock. **Deposit:** Mineralized quartz stringers and silicified limestone near contact with granodiorite. **Dev:** 12-ft. shaft, short adit, discovery hole. **Assays:** Tr. Au, 1.0 oz. Ag. Ref: 122, p. 167. 163, pp. 48-49.

**Blue Horse (8)**

(see under silver)

**Blue Jay (101)**

**Loc:** Near center W. line sec. 30, (32-37E), Covada dist. **Ore:** Lead. **Ore min:** Galena, pyrite. **Deposit:** 5-in. quartz vein in which galena and pyrite are fairly abundant. **Dev:** Shallow pit. Ref: 122, p. 170.

**Blue Mountain**

(see Jennie under gold)

**Boston & New York (4)**

(see under silver)

**Burlington and Delaware (119)**

**Loc:** S 1/2 sec. 15 and N 1/2 sec. 22, (31-34E), 1 mi. E. of Nine mile Cr., Keller dist. **Prop:** 2 patented claims: Burlington No. 2, Delaware No. 2. **Owner:** E. F. Spicer, Colville, and L. G. Warther, Spokane, Wash. (1941). **Ore:** Lead, silver, gold. **Ore min:** Galena, pyrite, cerussite, limonite. **Deposit:** 5-ft. vein composed of porous quartz and limestone is traceable for 1/2 mi. The vein lies between limestone and black argillite. **Dev:** Adit said to be 270 ft. long. **Assays:** One assay shows $25.16 Pb, $16.35 Ag, $1.24 Au. Ref: 46, p. 154. 58, p. 18. 122, p. 138. 158.

**Butterfly (32)**

**Loc:** Near center S. line sec. 36, (32-36E), 1/2 mi. E. of Covada post office. **Prop:** 1 claim. **Ore:** Lead, silver, gold. **Ore min:** Pyrite, galena. **Deposit:** 4- to 12-in. quartz vein cutting granodiorite near contact with quartzite. Other veins nearby. **Dev:** 13-ft. shaft, 200-ft. adit, 12-ft. and 25-ft. open cuts. **Assays:** 0.01 oz. Au, 30 oz. Ag. on av. sample from discovery vein. Ref: 122, p. 187. 163, p. 52.

**Cabin**

(see Advance under silver)

**California (7)**

(see under gold)

**Captain (Gold Cup) (56)**

**Loc:** NW 1/4 sec. 27, (32-36E), Covada dist. **Prop:** 1 claim. **Ore:** Lead. **Ore min:** Galena, pyrite. **Deposit:** 6-ft. quartz-calcite vein in granodiorite. **Dev:** 40-ft. crosscut. Ref: 122, pp. 157-158. 163, pp. 74-75.
Dan Patch (17)  
(see under silver)

Dead Shot (57)  

Delaware  (see Burling and Delaware)

Dill (58)  

Discovery (34)  

Drummond (35)  

Etta (59)  

Frosty Meadow (115)  
Loc: NW1/4 sec. 20, (31-36E). Ore: Lead (?). Ore min: Limonite, Gangue: Limestone. Deposit: Limonite-stained limestone exposed for a width of 40 ft. and considerably greater length. May be surface capping of a lode similar to that at Salamve prospect. Dev: Open pit. Ref: 122, p. 139.

Galena (14)  
(see under silver)

Gold Crown  (see under silver)

Gold Cup  (see Captain)

Gold Twenty (25)  
(see under gold)

Golden Cord (137)  
(see under silver)

Goldsmith (28)  

Good Ore (27)  
(see under silver)

Grandview (81)  

Greasy Run (87)  

Great Eastern (18)  

Great Northern (123)  
(see under silver)

Great Scott (19)  

Gwin (15)  
(see Gwin under silver)

Hall Creek  (see Gwin under silver)

Henneway (117)  

Hines (109)  

Humboldt (128)  
(see under copper)

I. X. L. (88)  

Idora (89)  
Lead Occurrences—Ferry County

Illinois (129)  
(see under copper)

Imperial (60)  

Iron Creek  
(see Shamrock under nickel)

J. H. E. (20)  

Jaybird (102)  

Jennie (6)  
(see under gold)

Joker (36)  

Juliet (Little Tom) (61)  

Juno (10)  
(see under silver)

Kentucky Bell (37)  

Keystone (62)  
(see under silver)

King Fraction (63)  

King Richard  
(see Meadow Creek under copper)

King Solomon (90)  

La Fleur  
(see Comstock under copper)

Lakeview Fraction (38)  

Lancaster (2)  
(see under copper)

Laura S. (Ada) (62)  

Laurier  
(see Talisman under copper)

Legal Tender (39)  

Little Jay (40)  

Little Tom  
(see Juliet)

Lone Pine (41)  

Longstreet (42)  
(see under silver)

Lucky Boy  

McJunkin (110)  
(see under silver)

Mabel T. (114)  
Mayflower (91)

Meadow Creek (127)
(see under copper)

Messenger (Big Joker) (43)

Meteor (64)
(see under silver)

Midnight
(see under silver)

Mineral Hill (124)

Monarch (21)

Mono (122)
(see under zinc)

Montana (65)
(see under silver)

Neglected (80)

New York (66)

Nez Perce (84)

Ninemile Creek (92)

North Star (133)

Number Seven
(see under silver)

Ohio (44)

Oom Paul (67)

Ophir (134)

Oregon (112)
(see under silver)

Oregon
(see Illinois under copper)

Pacific Mutual
(see Addison under copper)

Panama (3)
(see under gold)

Patterson
(see Jennie under gold)

Paulsen (85)

Pilgrim (93)

Plymouth Rock (94)

Polaris (45)
Lead Occurrences—Ferry County


Polepick (130) (see under copper)

Poor Man's Hope (140)


Prescott (68)


Quandary (95)


Rattlesnake (104)


Red Chief (69)


Ren Rice (22)


Reserve (70) (see under silver)

Robert E. Lee (46) (see under antimony)

Romulus (70)


Roulette (23)


Rover Bonanza (135) (see under silver)

Royal Ann (47)


St. Patrick (71)


St. Paul (24)


Salnave (120)


San Poil Monitor (see Meadow Creek under copper)

Several (72)


Several Fraction (73)


Shamrock (118) (see under nickel)

Shoo Fly (48)

Silver Bell (105)

Silver Crown No. 3 (96)

Silver Dollar (97)

Silver King (139)
(see under silver)

Silver Leaf (106)
(see under silver)

Silver Pick
(see under silver)

Silver Plume (98)

Silver Queen (83)

Silver Spar (49)

Silver Tip (11)
(see under silver)

Snowstorm (White Swan) (74)

Stemwinder
(see under silver)

Stray Dog (75)
(see under silver)

Summit (138)
(see under zinc)

Summit (50)

Sunset (99)

Syndicate (76)

Talisman (5)
(see under copper)

Three Pines (51)

Twin Pines (100)

U. S. (113)

Veda W.
(see under silver)

Vernie (77)

Walia Walla (131)
(see under copper)

Wanda Mountain (121)
Lead Occurrences—Ferry County

Welcome
(see Boston & New York under silver)

White Rose (78)

White Swan
(see Snowstorm)

White Tail (52)

Yellowstone (107)

Zearn (108)

KING COUNTY

Aces Up (16)
(see under silver)

Anderson (1)
(see under iron)

Apex (5)
(see under gold)

Baring
(see Anderson under iron)

Bear Basin (18)
(see under silver)

Bondholders Syndicate
(see Apex under gold)

Carmack (32)
(see under gold)

Cleopatra (17)
(see under gold)

Coney Basin (10)
(see under gold)

Copper Chief (29)
(see under copper)

Copper Plate
(see Seattle-Cascade under silver)

Damon and Pythias (6)
(see under gold)

Dawson (11)
Loe: NE¼ sec. 18, (25-10E), on a tributary to Miller R. Access: 5½ mi. by road to railroad at Berlin. Ore: Lead, zinc, silver, gold, copper. Ore min: Galena, sphalerite, chalcopyrite, arsenopyrite, pyrite. Deposit: Strong vein of heavy sulfides in 12-ft. leached zone. Dev: 600 ft. of drift. Assays: 0.4 to 4.06 oz. Au, 4.0 to 30.0 oz. Ag, 3.5% to 41.0% Pb, nil to 3.12% Cu. Ref: 147, p. 184.

Dutch Miller (28)
(see under copper)

Ellis (26)

Galena Chief

Goat Mountain (23)
Loe: N½ sec. 31, (25-10E), on Sunday Cr., on W. side of Goat Mtn., 1 mi. S. of Sunday Lk., Buena Vista dist. Elev: 3,300 to 3,900 ft. Prop: 15 claims. Owner: Robert Pruffer, North Bend, Wash., and George Wagner, Seattle, Wash. (1894-1932). Ore: Lead, copper, zinc, gold, silver, molybdenum. Ore min: Pyrite, chalcopyrite, arsenopyrite, galena, sphalerite, molybdenite. Deposit: A shear zone in granodiorite 35 ft. wide and traceable for about 600 ft. contains stringers of mineralized quartz, most of which are only a few in. wide. Dev: 8 open cuts. Improv: Cabin, blacksmith shop (1951). Assays: 17 asamples showed tr. to 0.16 oz. Au, 0.94 to 50.40 oz. Ag, 0.5% to 47.88% Zn, nil to 11.82% Pb, nil to 6.54% Cu. The av. is 0.08 oz. Au, 15.48 oz. Ag, 9.35% Zn, 7.08% Pb, 1.63% Cu. 6 samples showed nil to 3.24% Mo, and the av. was 0.81% Mo. Ref: 11-A, pp. 202-204. 158.

Guye (30)
(see under iron)

Hawkeye
(see under gold)

Ingersoll

Jack Pot (24)
(see under zinc)

Katie

King and Kinney (12)
(see under copper)

Kinney
(see King and Kinney under copper)

Last Chance (8)
(see under gold)

Lennox (22)
(see under gold)

Lone Star (9)
(see under gold)

Lost Lode (25)
(see under molybdenum)

Lynn (13)
(see under copper)
Mohawk (4)
Loc: Sec. 27, (26-10E), on Money Cr. Ore: Lead, zinc. Ref: 158.

Mt. Logan
(see Guye under iron)

Mount Phelps (20)
(see under zinc)

Mount Si (27)

Neptune (7)
(see under gold)

Philiipi Lake (21)

Pythias
(see Damon and Pythias under gold)

Salmon Creek (2)
(see under gold)

Seattle-Cascade (14)
(see under silver)

Seven-Twenty

Silver Dollar and Copper Plate
(see Seattle-Cascade under silver)

Silver Star (19)
(see under gold)

Sockless Jerry
(see last Chance under gold)

Solomon (31)
(see under gold)

Summit
(see Guye under iron)

Three S Gulch (15)
(see under zinc)

Treasury Lead (3)

Triple S
(see Seattle-Cascade under silver)

Triune
(see under gold)

KITTITAS COUNTY

Brown Bear
(see under gold)

Camp Creek (6)
(see under silver)

Cascade
(see under gold)

Cascade Mining (2)
(see under copper)

Esther and Louisa (4)
(see under silver)

Good Luck (2)

Granite King (1)
(see under silver)

Grizzly Bear (1)
(see under gold)

Majestic
(see under gold)

Mildred
(see under copper)

Ruby King
(see under gold)

Silver Dump (5)
(see under silver)

Standard
(see under gold)

Twin
(see under gold)

LEWIS COUNTY

Eliza (3)

Goldie (4)

Mineral Creek (1)
(see under zinc)

Waterfall (2)
(see under gold)

LINCOLN COUNTY

Crystal (1)

Egypt (4)
Elkhorn (7)
  **Loc:** 1 mi. S. of Iron Crown property in Mill Canyon about 10 mi. SE. of Pinney Butte. **Owner:** C. L. Young, W. K. Snyder, C. G. Snyder, G. E. Brown, J. T. Young (1897). **Ore:** Lead. **Ore min:** Galena. **Dev:** 40-ft. crosscut. **Ref:** 63, p. 116.
  **Fouress (5)**
  **(see under zinc)**
  **John L. (2)**
  **Loc:** Near the site of Fort Spokane. **Owner:** Col. William Ridpath (1897). **Ore:** Lead. **Ore min:** Galena. **Dev:** 125-ft. shaft, an adit. **Assays:** A sample shipment netted $135. **Ref:** 158.
  **Lincoln (3)**
  **(see under copper)**
  **Pitney Butte**
  **(see Fouress under zinc)**
  **Silver Queen**
  **(see under silver)**
  **Valley View (6)**
  **(see under zinc)**

**OKANOGAN COUNTY**

**Alta**
  **(see Chilson)**

**American Rand**
  **(see Spokane under gold)**

**Anchor (125)**
  **(see under silver)**

**Andy O.**
  **(see Andy O'Neil under silver)**

**Andy O'Neil (118)**
  **(see under silver)**

**Anna (123)**
  **(see under silver)**

**Antimony Queen (15)**
  **(see under antimony)**

**Apache (128)**
  **(see under silver)**

**Apex (92)**
  **(see under copper)**

**Arizona**
  **(see Horn Silver under silver)**

**Arlington (84)**
  **(see under silver)**

**Atkins (99)**
  **Loc:** Near SW. cor. sec. 12, (34-31E), Park City dist. **Prop:** Several claims. **Owner:** W. A. Atkins (1913). **Ore:** Lead, silver, zinc. **Ore min:** Galena, sphalerite, pyrite. **Deposit:** 3-ft. quartz vein bedded between schist and argillite contains a 1-ft. layer irregularly banded with ore minerals. **Dev:** Shaft said to be 40 ft. deep. **Assays:** Picked sample from 1-ft. band assayed 2 oz. Ag, tr. Au. **Ref:** 46, p. 180. 122, p. 102.

**Ben Harrison**
  **(see Apex under copper)**

**Billy Goat (3)**
  **(see under copper)**

**Black Warrior**
  **(see under gold)**

**Blue Grouse (75)**
  **(see also Peacock under silver)**
  **Loc:** NE¼ sec. 30, (35-25E), Conconully dist. **Prop:** 1 claim of Peacock mine group. **Owner:** Peacock Mountain Mining & Milling Co. (1924). **Ore:** Lead, copper, silver. **Ore min:** Galena, malachite. **Gangue:** Quartz. **Deposit:** Vein in schist and gneiss consists of sheared quartz and country rock 10 ft. wide. Vein sparsely mineralized and traceable only a short distance. **Dev:** Shallow tunnel. **Ref:** 58, p. 9. 75, pp. 29, 31. 98, 1923, p. 1827. 112, p. 197.

**Bolinger (16)**
  **(see under gold)**

**Bridgeport**
  **(see under silver)**

**Brunswick**
  **Loc:** On Mineral Hill, Conconully dist. **Prop:** 1 claim. **Ore:** Lead, silver. **Ore min:** Galena. **Deposit:** 20-in. quartz vein carrying galena. **Dev:** 120-ft. drift. **Assays:** Av. assay of ore on dump gave 45% Pb, 225 oz. Ag. **Ref:** 12, pp. 60-61. 13, p. 97.

**Buckeye (50)**
  **(see under copper)**

**Bunker Hill**
  **(see Silver King)**

**Butcher Boy (93)**
  **(see under gold)**

**Caaba**
  **(see Kaaba)**

**Cabin (127)**
  **Loc:** Near NE. cor. sec. 27, (31-30E), about 2 mi. W. of Nespelem. **Owner:** Great Metals Mining & Milling Co. (1913-1926). **Ore:** Lead, zinc, silver, gold. **Ore min:** Galena, sphalerite, pyrite. **Deposit:** Mineralized quartz veinlets from less than 1 to 4 in. wide along fracture zones in altered granite. Granite sparsely mineralized. **Dev:** Shallow tunnel. **Ref:** 7, pp. 205-207. 116, no. 12, 1907, p. 16. 122, p. 93. 129, p. 189.
Catherine (20)
(see under silver)

Central
(see Park and Central)

Central (Trinidad) (55)
(see under silver)

Chicago (47)
(see under gold)

Chief Sunshine (57)
(see under silver)

Chilson (Alta)

Cleopatra
(see under gold)

Continental
(see Mazama Queen under gold)

Copper King (61)

Copper Zone
(see under copper)

Cornwall (6)

Crescent
(see Triune under gold)

Crystal Butte (96)
(see under gold)

Curlew (21)
(see under gold)

Daisy (7)
(see under gold)

Delate (61)
(see under copper)

Denver City
(see Leadville under gold)

Dixie Queen
(see Antimony Queen under antimony)

Double Eagle
(see Dry Bone)

Dry Bone (Duke of Windsor, Double Eagle)

Duke of Windsor
(see Dry Bone)

Eagle (22)

Eloise (23)
(see under silver)

Empire (29)
(see under gold)

Esther (62)

Eureka (102)

Eureka (32)

Eureka (58)

Evening (119)
(see under silver)

Fairview

Favorite (24)
Loc: Sec. 13, (40-25E), on E. side of the valley a short distance S. of the Nighthawk property. Owner: Favorite Gold
Lead Occurrences—Okanogan County


Ferris R. Ford (see Wolframite under tungsten)

First Thought (76) (see under silver)

Fluorspar (see Tonasket under copper)

Four Metals (25)

Loe: Secs. 22 and 23, (46-25E), on S. slope of Little Chappak Mtn., on Silikameneen R. Elev: 1,800 ft. Access: 1 mi. by road from railroad at Night Hawk. Prop: 11 claims, including: Silver Queen, Shamrock, Mary, Chappaka, Daniels, Alice, Ollie. Owner: Border Lord Mining Corp., Seattle, Wash., has 50-yr. lease (1952) from James Stack, Oroville, Wash., and John Hancock, Okanogan, Wash. (1938-1952). Four Metals Mining Co. (1919-1922). Ore: Lead, silver, copper, zinc, tungsten. Ore min: Galena, chalcopyrite, pyrite, sphalerite, scheelite, bornite, molybdenite. Gangue: Quartz, garnet, epidote. Deposit: Mineralized quartz veins from a fraction of an inch to 10 ft. wide (av. 4 or 5 ft. wide) exposed for length of several thousand ft. and depth of 250 ft. in granodiorite, limestone, quartzite, argillite. Sulphides are in bands throughout the vein. Scheelite is concentrated in vein near its walls. Dev: 2 shafts, 110 and 150 ft. deep; 3 adits, 340, 235, and 160 ft. long; and several open cuts. Assays: Ext. to av. $5 Pb, Zn, Cu, Ag. Portions of vein 1/2 to 2 ft. thick and 10 ft. long ext. to carry 2% WO3. Prod: 20 or more cars of high-grade ore and concentrates in period 1918-1921, 600 tons milled in 1939. Ref: 37, p. 34, 97, 1919, 1921, 1922, 1940. 98, 1922-1926. 129, pp. 233-236. 141, p. 22. 158.

Frankie Boy (60) (see under silver)

General Miles (111)


Gold Crown (see Spokane under gold)

Gold Hill (41) (see under gold)

Golden Zone (18) (see under gold)

Goodenuf (117) (see under silver)

Gould & Curry (128)


Grand Summit (see Palmer Summit under gold)

Grandview (see Leadville under gold)

Great Divide (120) (see under silver)

Great Metals (see Anchor under silver)

Great Western (115)


Grover Cleveland

Loe: On Mineral Hill, Conconully dist. Ore: Lead, silver, copper. Ore min: Galena. Deposit: 4-ft. vein of galena ore. Dev: 2 shafts, 30 ft. and 50 ft. deep. Assays: Av. assays from bottom of the 2 shafts were 50 oz. Ag, 60% Pb, 6% Cu. Ref: 12, p. 60. 13, p. 97.

Grubacher (see Grubser)

Gubser (Grubcher) (63)


Hanford (103)


Hanks (2)

(see under copper)

Hargrove

(see Silver King)

Hatfield (see Wolframite under tungsten)

Heath (12)


Hercules (112)


**Hiawatha (43)**

(see under gold)

**Hidden Treasure (Sunshine) (17)**

(see under gold)

**Hilo**

(see St. Paul under silver)

**Homestake (64)**


**Kaaba-Texas**

(see under Kaaba)

**Kankakee (121)**

(see under copper)

**Kansas (77)**

(see under copper)

**Key (65)**

(see under silver)

**Kimberly (40)**


**King Solomon**

**Loc**: Okanogan County. **Ore**: Lead. **Prod**: 1924. **Ref**: 97, 1924, p. 293.

**Lady of the Lake (73)**

(see under silver)

**Lakeview**

(see Prize)

**Last Chance (78)**

(see under silver)

**Lead Horse (5)**

**Loc**: Sec. 16, (38-20E), on S. side of Billy Goat Peak. **Elev**: 6,000 ft. **Access**: 3 mi. by trail from Eightmile Cr. road. **Prop**: 1 claim. **Owner**: Fred Floyd, Twisp, Wash. (1952). Mr. Kenney (1943). **Ore**: Lead, copper, zinc. **Ore min**: Galena, cerussite, anglesite, malachite. **Gangue**: Barite. **Deposit**: A bleached zone in altered volcanic rock extends intermittently for 1,500 ft. 2 faults along the W. end of the zone are 6 to 8 in. wide and contain a few irregular masses of galena. **Dev**: Open cut. **Ref**: 158.

**Leadville (51)**

(see under gold)

**Leonora (79)**

**Loc**: Sec. 30, (35-25E), on S. slope of Peacock Hill, Con­|

conully dist. **Prop**: 1 claim. **Owner**: J. T. McDonald and J. C.

Little Chopaka (Six Eagles) (27)

Lone Pine (33)
(see under silver)

Lone Star (Star) (59)
(see also Gubser under lead, and Mineral Hill under silver)

Maquae
(see under gold)

Marguerite (80)
(see under copper)

Mazama Queen (8)
(see under gold)

Mineral Hill (Washington Consolidated, Seven Devils) (66)
(see under silver)

Minnehaha (67)
(see under silver)

Mohawk

Molson
(see Poland China under gold)

Monitor (68)

Monterey (95)
(see under copper)

Montgomery
(see Tonasket under copper)

Mother Lode
(see Crystal Butte under gold)

Mountain Boy (104)
(see also Castle Creek, Snowshoe, Summit, Three L’s)

Multnomah (116)
(see under copper)

Myrtle
(see St. Paul under silver)

Nevada (81)
(see under silver)

New Deal
(see Antimony Queen under antimony)

Nighthawk (28)

Number One (30)
Loc: Sec. 23, (40-25E), on S. face of Little Chopaka Mtn. W. of the Little Chopaka group, 1½ mi. S. of Nighthawk. Prop: Group of claims. Owner: Lead, silver, gold, copper. Ore min: Galena. Deposit: Quartz vein 3 to 12 ft. wide. Vein is a fault zone along the contact of granite with slate and conglomerate. Dev: 200-ft. adit; several shafts, deepest one (60 ft.) connects with the adit. Assays: Av. assay somewhat less than $10 per ton. Ag content may increase to water table. Ref: 154, pp. 91-92.
Okanogan Belle (69) [see under silver]

Okanogan Free Gold (36) [see under gold]

Olentangy (90) [see under gold]

Opal [see under gold]

Oversight (129)

Overtop (see Poland China under gold)

Owasco (see Okanogan Free Gold under gold)

Palmer Mountain Tunnel (42) [see under gold]

Palmer Summit (48) [see under gold]

Park and Central (105)

Peacock (74) [see under silver]

Peoria (14) [see under gold]

Phil Sheridan (see Sheridan under silver)

Pinnacle (52) [see under gold]

Pittsburg (122) [see under silver]

Poland China (88) [see under gold]

Poorman (106) [see under zinc]

Poorman

Premier (see under gold)

Prize (Lakeview) (37)

Pyrrargyrite (see Ruby under silver)

Rainbow (49) [see under gold]

Ramore (114)
Loc: Near center sec. 14, (32-31E), 1,600 ft. NE. of Hercules mine, Park City dist. Elev: 3,950 ft. Prop: 1 patented claim of 4 in the Ramore group. Owner: Ramore Mining Co. (1909-1918). Ore: Lead, silver, gold, copper, zinc. Ore min: Sphalerite, galena, pyrite, chalcopyrite, pyrrhotite, tetrahedrite. Gangue: Quartz, fluorite, calcite. Deposit: 10-ft. ore body along contact of granite and metamorphics. Chiefly quartz in which sulfides are disseminated. Dev: A 440-ft. adit from which have been driven a 600-ft. crosscut, several short crosscuts, a drift, and a 45-ft. winze. Assays: 4 assays show 2.7% to 9.6% Pb, 13 to 59 oz. Ag, 0.05 to 0.07 oz. Au. Prod: No large shipments of ore reported. Ref: 7, pp. 207, 208-209; 46, pp. 138-140; 105, 1/21/05, p. 46; 112, p. 103. 114, no. 5, 1909, pp. 198; 114, no. 5, 1909, pp. 74-75; 122, p. 99.

Rattlesnake (13) [see under gold]

Reedy (see Antimony Queen under antimony)

Republic (82) [see also Peacock under silver]

Rich Bar (34) [see under copper]

Ruby (31) [see under silver]

St. Paul (130) [see under silver]

Salmon River (70) [see under silver]

San Francisco

Security (40) [see under copper]

Seven Devils (see Mineral Hill under silver)

Sharp (see Silver King under silver)

Sharp and Balthus (107) [see under zinc]

Shelby (see under silver)

Sheridan (98) [see under silver]
Sherman (Standard) (87)
- Loc: SW1/4 SE1/4 sec. 20 and sec. 29, (34-26E).
- Elev: 1,500 ft.
- Access: 3 mi. from railroad at Omak by un surfaced road.
- Prop: 15 unpatented claims, including: Lizzie Bell, Standard, Brook.
- Ore: Lead, zinc, silver, gold.
- Ore min: Pyrite, arsenopyrite, galena, sphalerite.
- Gangue: Breccia, hydrothermally altered rock.
- Deposit: A 2-ft. breccia zone along the contact of granite and rhyolite is sparsely mineralized.
- Dev: 100-ft. inclined shaft, 40-ft. incline, 15-ft. open cut.
- Assays: 10 samples showed 0.01 to 0.08 oz. Au, nil to 17.9 oz. Ag, 0.1% to 3.6% Pb, 2.5% to 22.0% Zn.
- Ref: 157, 158.

Silver Cliff (132)
- (see under silver)

Silver King (9)
- (see under copper)

Silver King (Bunker Hill, Hargrove) (71)
- Elev: 2,700 ft.
- Access: 1 mi. N. of Conconully on Salmon Cr. road.
- Prop: 13 claims.
- Ore: Lead, silver, copper.
- Ore min: Galena, pyrite, sphalerite, chalcopyrite, tetrahedrite.
- Gangue: Quartz, gouge.
- Deposit: Mineralized quartz veins up to 3 ft. wide in granite.
- Dev: 240-ft. adit, 100-ft. inclined shaft, 130-ft. drift, 2 other adits several hundred ft. in length, and several open cuts.
- Prod: Reportedly 50 tons of galena.
- Ref: 157, 158.

Silver Mountain (53)
- (see under silver)

Silver Point (124)
- (see under copper)

Silver Seal (124)
- (see Antimony Queen under antimony)

Silver Star
- (see under silver)

Silver Star
- (see Silver Mountain under silver)

Six Eagles
- (see Silver Mountain under silver)

Six Eagles
- (see under copper)

Snowshoe (108)
- (see also Castle Creek, Mountain Boy, Summit)
- Loc: Sec. 12, (33-31E), on NW. slope of Old Glory Mtn.
- Elev: 4,225 ft.
- Access: 1 mi. by road from Park City.
- Prop: 1 claim: Snowshoe, part of Mountain Boy group.
- Owner: Castle Creek Mining Co. (1918-1922).
- Colville Mining & Smelting Co. (1907).
- Ore: Lead, silver, copper, zinc, gold.
- Ore min: Galena, pyrite, chalcopyrite, sphalerite, tetrahedrite, malachite, azurite, anglesite.
- Gangue: Quartz, gouge.
- Deposit: Shear zone 18 in. wide in granite contains mineralized lenses of quartz along with much gouge.
- Dev: 350-ft. adit, 1,000-ft. adit, 100-ft. adit, 150-ft. adit, surface cuts.
- Assays: 50-ton shipment said to av. 30% Pb, 20 oz. Ag. Ore from stope in adit said to assay 0.06 to 0.12 oz. Au, 35 to 90 oz. Ag, 30% to 40% Pb.
- Prod: Reportedly 50 tons of galena.

Summit (29)
- (see under silver)

Sunshine
- (see Hidden Treasure under gold)

Sunshine Chief
- (see Chief Sunshine under silver)

Three L's (110)
- (see also Mountain Boy)
- Loc: Near N. line sec. 12, (33-31E), Park City dist.
- Prop: Part of Mountain Boy group.
- Owner: Castle Creek Mining Co. (1918-1922).
- Colville Mining & Smelting Co. (1907).
- Ore: Lead, silver, copper, zinc, gold.
- Ore min: Galena, sphalerite.
- Gangue: Quartz.
- Deposit: Open pits expose veinlets of quartz and galena in a 6-ft. shear zone in granite.
- Veinlets 1 in. to 2 in. wide.
- Dev: 200-ft. adit, open pits.
- Ref: 123, p. 96.

Tip Top (131)
- (see under copper)

Tomlinson
- (see under copper)

Tonasket (56)
- (see under copper)

Tough Nut (72)
- (see under copper)

Triangle
- (see Hidden Treasure under gold)

Trinidad
- (see Central under silver)

Triune (45)
- (see under gold)

Twisp View (11)
- (see under gold)

Uncle Sam
- (see under silver)

Viola
- Loc: Conconully dist.
- Owner: Viola Copper-Gold Mining Co. (1906-1908).
- Ore: Lead.

War Eagle
- (see under silver)
Wasco (100)  
(see under silver)

Washington  
(see under silver)

Washington Consolidated  
(see Mineral Hill under silver)

West King  
(see under silver)

Whitestone (97)  
(see under gold)

Wolframite (1)  
(see under tungsten)

Woo Loo Moo Loo (86)  
(see under silver)

Wyoming (83)  
(see under silver)

Yakima (94)  
(see under copper)

PACIFIC COUNTY

Naselle (1)  

PEND OREILLE COUNTY

Ace Ten Spot (96)  
(see under zinc)

D. Aldrich  
(see Lead King)

Alger and McCullough (117)  
(see under copper)

American Zinc, Lead and Smelting Co.  
(see under zinc)

Auburn (26)  

Bailey-Hanson  
(see Red Top)

Baker City (114)  
(see under silver)

Barefoot (110)  
(see under silver)

Beaty (42)  

Bella May (99)  
(see under zinc)

Berkin  
(see Wolf Creek)

Blue Bucket (97)  
(see under zinc)

Blue Jim (105)  
(see under silver)

Bluebird  
(see Dumont under zinc)

Bob Tail and Four Flush (90)  
(see under zinc)

Boundary (20)  

Bromide  
(see La Sota under silver)

Bunker Hill  
(see Lead Hill under zinc)

Buzzell  
(see Lucky Strike under zinc)

Campbell (123)  
(see under copper)

Caribou (1)  

Clark  
(see Josephine under zinc)

Cliff (11)  
(see under zinc)

Coffin (107)  
(see under zinc)

Columbia Lead & Zinc Mining Co. (9)  
(see under zinc)

Comstock (120)  
(see also Bead Lake)


**Conquest**
(see Kootenai Conquest)

**Corzine (106)**

**Cougar (75)**
(see under copper)

**Dan Fieldner**
(see under silver)

**Davenport-Troyer**
(see Gem under iron)

**Diamond Eagle (93)**
(see under zinc)

**Diamond R. (94)**
(see also Metaline Mining & Leasing Co. under zinc)

**Doherty**

**Dreadnaught-Emily**
(see Hoage under zinc)

**Dumont (29)**
(see under zinc)

**Eagle (33)**
(see under zinc)

**Eagle**
(see Ries)

**Elliot (74)**

**Emily**
(see Hoage under zinc)

**Eureka (31)**
(see under zinc)

**Fairview Copper**
(see Skippy and Queen Bess)

**Fairview-Hoosier (95)**
(see under zinc)
Inventory of Washington Minerals—Part II, Metallic Minerals

Grandview Mines, Inc.
(see under zinc)

Gray Eagle
(see Hawkeye-Gray Eagle-Last Chance under copper)

Gray Goose

Haleday (36)

Hanley (4)
(see under zinc)

Hansen (130)
(see under gold)

Hanson
(see Red Top)

Hardtack
(see Gold Coin-Hardtack under silver)

Hawkeye-Gray Eagle-Last Chance (124)
(see under copper)

Hemlock (67)

Hidden Treasure (59)
(see also Grandview Mines, Inc. and Metaline Mining & Leasing Co. under zinc)
Loe: Secs. 11 and 12, (40-44E), Metaline dist. Access: Forest Service road. Prop: 10 unpatented claims. Owner: Grandview Mines, Inc. and Metaline Mining & Leasing Co. are jointly leasing from Thomas Dougherty and associates, Metaline Falls, Wash. (1932). Ore: Lead, zinc. Ore min: Sphalerite, galena. Depos: Replacement deposit in silicified limestone has been traced by cuts and trenches for 2,500 ft. or more along the strike. Dev: Considerable trenching and a number of open cuts. Improv: Cabin. Assays: 21 samples taken over the mineralized area assayed tr. to 16.49% Pb, tr. to 6.0% Zn. Prod: None. Some ore in dumps. Ref: 29, p. 60. 188.

Hoage (13)
(see under zinc)

Hoosier
(see Fairview-Hoosier under zinc)

Hortense (89)
(see also Josephine under zinc)

Huffman
(see Mule Deer)

Independence (125)
(see under silver)

Ira Troyer
(see Troyer)

Iron Cap (63)
Loe: Secs. 14 and 15, (40-44E), Metaline dist. Access: 1¼ mi. by trail from good road. Prop: 10 unpatented claims. Owner: Miss E. Thompson and associates, Ione, Wash. (1941). Ore: Lead, zinc. Depos: Replacement deposit in silicified limestone has been exposed by trenching for a length of 2,000 ft. and as much as 40 ft. in width. Dev: Numerous open cuts and trenches, 300 ft. of diamond drilling. Ref: 29, p. 56.

Iron Crown (45)

Jenny Dee-Snowshoe (65)

Jim Creek (106)

Jordan

Josephine (87)
(see under zinc)

K. K.

Katydid
(see Ries)

Key Fraction (121)
(see also Alger and McCullough)

King Tut (Velvet Lode) (54)

Kootenai Conquest (Bead Lake, Conquest) (118)
(see also Bead Lake)
Lead Occurrences—Pend Oreille County


Kroll
(see Blue Bucket under zinc)

Kurlew (55)

Lakeview (16)
(see under zinc)

La Sota (Bromide, Silver Crest) (109)
(see under silver)

La Sota (Troyer)
(see Troyer)

Last Chance (37)

Last Chance (57)

Last Chance
(see Hawkeye–Gray Eagle–Last Chance under copper)

Lead Hill (61)
(see under zinc)

Lead Hill Extension (71)
(see under zinc)

Lead King (D. Aldrich) (40)

Lead Metal (62)
(see under iron)

Lead Queen (Scandinavian) (5)

Little Noisy (70)
(see under zinc)

Lloyd (128)

Lucky Boy (56)

Lucky Boy Rex (28)
(see under zinc)

Lucky Strike (46)
(see under zinc)

M M (17)

McCullough
(see Alger and McCullough under copper)

Mack (68)

Mammouth
(see Morning and Mammmoth)

May Thomas

Maybeso (69)
Meade (47)

Metaline Contact (91)
(see under zinc)

Metaline Falls (83)
(see also Pend Oreille Mines & Metals Co. under zinc)

Metaline Metals (72)
(see under zinc)

Metaline Mining & Leasing Co. (101)
(see under zinc)

Meteor (116)
(see under silver)

Midas
(see under silver)

Mockingbird (43)

Mohawk (81)
(see also Grandview Mines, Inc. under zinc)

Morning and Mammoth (80)

Mount Pisgah (129)

Mountain Goat (15)

Mule Deer (Huffman) (112)

Nelroe (38)

O. K. (98)
(see under zinc)

Ore Hill (103)
(see under zinc)

Oriole (92)
(see under zinc)

Pacnor Mines
(see under zinc)

Pat (77)

Pay Day (10)
(see under zinc)

Pearson (102)
(see under zinc)

Peewee (8)
(see under zinc)

Pend Oreille Iron, Lead, and Zinc (18)
(see under zinc)

Pend Oreille Mines & Metals Co. (86)
(see under zinc)

Pindle (131)
(see under copper)

Pine Cone-Z Canyon (24)
(see under zinc)

Poorman and Sullivan Lake (78)

Proudy (76)
(see under silver)

Queen Bess
(see Skippy and Queen Bess)
Red Crown (48)

**Loe:** Sec. 35, (40-43E), Metaline dist. **Access:** 1 mi. from road. **Prop:** 9 unpatented claims. **Owner:** E. O. Dressel and associates, Metaline Falls, Wash. (1941). **Ore:** Lead, zinc, iron. **Deposit:** Replacement of silicified limestone. Zone has been exposed for 200 ft. on the surface and about 40 ft. in width in the adits. **Dev:** 200 ft. of adits, 400 ft. of stripping, numerous open cuts. **Assays:** Low-grade ore. **Ref:** 29, pp. 43-44.

Red Top (Bailey-Hanson) (52)

(see also Grandview Mines, Inc. and Metaline Mining & Leasing Co. under zinc)

**Loc:** Secs. 1 and 2, (40-44E), Metaline dist. **Elev:** 4,500 ft. **Access:** Forest Service road. **Prop:** 19 unpatented claims. **Owner:** Grandview Mines, Inc. and Metaline Mining & Leasing Co. are jointly leasing from Raymond Bailey and associates, Metaline Falls, Wash. (1952). **Ore:** Lead, zinc. **Ore min:** Sphalerite, galena, smithsonite. **Gangue:** Dolomite. **Deposit:** Replacement deposit in silicified dolomite has been exposed in open cuts for 1,500 ft. along the strike. **Dev:** 150 ft. of adits, numerous open cuts. **Improv:** Several buildings. **Assays:** Ore shipped said to av. 40% Pb. **Prod:** 5 tons of crude lead ore. **Ref:** 29, p. 59. 104, 3/30/22, p. 28. 128, pp. 63-64. 133, p. 30. 158.

Ries (Gold Arrow, Eagle, Midas, Golden Anchor, Katydid) (127)

**Loc:** N1/2NW1/4 sec. 12, (31-45E), on W. bank of Pend Oreille R. **Elev:** 2,200 ft. **Access:** 2 mi. from road N. of Newport. Milwaukee railroad crosses the property. **Prop:** 2 claims: Eagle, Owl; and 40 acres of deeded land. **Owner:** Hartman A. Ries, Metaline Falls, Wash. (1941). **Ore:** Lead, silver, gold, copper. **Ore min:** Galena, pyrite, some chalcopyrite. **Deposit:** Mineralized quartz vein in quartz diorite porphyry near its contact with quartzite. Vein said to be 6 ft. wide. **Dev:** 80-ft. shaft on Owl claim and 215-ft. shaft on Eagle claim, also a 40-ft. adit. **Improv:** 2 buildings (1926). **Assays:** A carload of ore shipped in 1922 to Bunker Hill smelter assayed 0.16 oz. Au, 15.5 oz. Ag, 9.8% Pb. **Prod:** 1 carload of ore shipped in 1922 to Bunker Hill smelter. **Ref:** 29, p. 65. 73, pp. 46-47. 97, 1919, p. 294; 1922, p. 254. 98, 1920-1926. 104, 6/15/33, p. 18; 9/15/36, p. 34. 129, pp. 80-81. 141, p. 22. 158.

Riverside (49)

(see also Pend Oreille Mines & Metals Co. under zinc)


Riverview (39)

(see under zinc)

Robert E. Lee (50)

**Loc:** NW1/4 sec. 35, (40-43E), 1/4 mi. W. of mouth of Slate Cr., Metaline dist. **Access:** 1 mi. of trail from Ledbetter Lk. road. **Prop:** 5 patented claims, including Robert E. Lee. **Owner:** Sullivan Mining Co., Wallace, Idaho (1950-1952). San Ramone Mining Co. (1924). Drumheller Investment Co. (1937). Columbia Lead & Zinc Mining Co. (1943). **Ore:** Lead, zinc. **Ore min:** Galena, sphalerite. **Gangue:** Dolomite. **Deposit:** Disseminated sphalerite and galena in dolomite. Mineralized zone has been traced for 2,600 ft. along the strike. **Dev:** Short inclined shaft, a few open pits. **Ref:** 29, p. 54. 69, p. 14. 73, p. 63. 113, 6/17/37, p. 7. 128, p. 70.

Rocky Creek (111)

(see under silver)

Saddle (22)

(see under zinc)

Salmon (58)

**Loc:** Sec. 11, (40-44E), Metaline dist. **Access:** 1 mi. from road. **Prop:** 4 patented claims. **Owner:** Messrs. Bailey and Johnson, Metaline Falls, Wash. (1941). **Ore:** Lead, zinc. **Deposit:** Replacement deposit in silicified limestone has an exposed length of 20 ft. and a width of 2 ft. **Dev:** Open cuts and trenches. **Ref:** 29, p. 55.

Sanborn (53)

**Loc:** Near Portland boundary W. of Bailey-Hanson group, Metaline dist. **Ore:** Lead, galena. **Deposit:** High-grade streak of galena. **Ref:** 128, p. 64.

Scandinavian

(see Lead Queen)

Schellenberger (Schellenberg) (73)

**Loc:** 2 1/2 mi. N. of Metaline Falls on E. side of Pend Oreille R., approx. sec. 11, (39-43E). **Elev:** 2,550 ft. **Prop:** May be part of present holdings of Pend Oreille Mines & Metals Co. **Ore:** Lead. **Gangue:** Dolomite breccia. **Deposit:** Mineralized dolomite breccia along fault planes. **Dev:** Surface trenches 1 to 5 ft. deep and 6 to 100 ft. long. **Prod:** Small shipment in 1918. **Ref:** 5, pp. 198-199. 7, pp. 40-50. 97, 1918, p. 507.

Schellenberg

(see Schellenberger)

Silver Crescent (21)

**Loc:** Sec. 11, (40-43E), Metaline dist. **Access:** Road. **Prop:** 2 unpatented claims. **Owner:** J. D. Nelson, Metaline Falls, Wash. (1941). **Ore:** Lead, zinc. **Deposit:** Replacement of silicified limestone. A slightly mineralized area is exposed for 200 ft. **Dev:** 90 ft. of adits, numerous open cuts. **Ref:** 29, p. 37.

Silver Crest

(see La Sota under silver)

Silverado

(see Z Canyon)

Skippy and Queen Bess (Fairview Copper) (113)

**Loc:** Sec. 23 and SW1/4 sec. 14, (34-44E), Newport dist. **Elev:** 4,000 ft. **Access:** Road. **Prop:** 2 unpatented claims. **Owner:** Jack Gallagher and associates, Newport, Wash. (1941-1946). **Ore:** Lead, silver, copper, gold. **Deposit:** Upper adit exposes 14 ft. of quartz vein 10 to 12 in. wide highly mineralized with argentiferous galena. Lower adit shows breccia zone with quartz and galena. **Dev:** 105-ft. adit and caved 80-ft. adit. **Assays:** Picked sample assayed 18% Pb, 7 oz. Ag, 4% Cu, $1.50 Au. **Ref:** 23, pp. 68-69. 139, pp. 53-54.

Slate Creek

(see Whoopie-Galena Hill under zinc)

Snowbird and Stanley (122)

**Loc:** NE1/4 sec. 22, (32-45E), Newport dist. **Access:** 1/4 mi. from road, by which it is 8 mi. to railroad at Newport. **Prop:** 2 patented claims: Snowbird, Stanley. **Owner:** Newport Mining & Leasing Co. leasing from Ed Alger, Newport, Wash. (1951). Newport Mining Co. (1919-1926). Dr. Sutherland, Newport, Wash. (1941). **Ore:** Lead, silver, copper, arsenic. **Ore min:** Galena. **Deposit:** Mineralized quartz veins 4 to 6 in.

Snowshoe
(see Jenny Dee-Snowshoe)

Snyder
(see Gold Coin-Hardtack under silver)

Sphinx
(see Torrential-Sphinx under zinc)

Stanley
(see Snowbird and Stanley)

Star (34)

Star (32)

Star (Campbell)
(see Campbell under copper)

Star (Independence)
(see Independence under silver)

Sterling (100)
(see under zinc)

Sullivan (88)
(see also Josephine under zinc)

Sullivan Lake
(see Poorman and Sullivan Lake)

Sunshine (70)

Tamarack (51)

Texas Slim
(see Georgia Rose-Texas Slim under zinc)

Tom Cat (3)
(see under zinc)

Torrell

Torrential-Sphinx (6)
(see under zinc)

Troyer (Davenport-Troyer, Gem)
(see Gem under iron)

Troyer (La Sota, Ira Troyer) (65)

Twin Lakes (14)

Uncas (35)
(see under zinc)

Velvet

Velvet Lode
(see King Tut)

Washington (Washington Rock) (84)
(see also Pend Oreille Mines & Metals Co. under zinc)

Washington Rock
(see Washington)

West
(see Blue Jim under silver)

Whoopie-Galenia Hill (64)
(see under zinc)

Wolf Creek (Berkin) (104)
Woodpecker (41)  
(see under zinc)

Yellowhead  
(see under zinc)

Z Canyon (Pine Cone-Z Canyon)  
(see Pine Cone—Z Canyon under zinc)

Z Canyon (Silverado) (7)  
(see also Pend Oreille Mines & Metals Co. under zinc)


Z Canyon Mutual (19)  
(see under zinc)

Pierce County

Silver Creek (2)  
(see under gold)

Silver Creek Gold & Lead (1)  
(see under gold)

Skagit County

Alta (12)  

Black Canyon  

Boston (13)  

British  
(see Skagit Queen under silver)

Buchanan  
(see Queen under copper)

Cascade (24)  

Cascade Minerals  

Cerrico  

Chicago (14)  

Dorothy  
(see Thunder Creek)

Eldorado (11)  
(see under silver)

Epoch (25)  

Everett  
(see Willis and Everett under silver)

Everett Extension  
(see under silver)

Friend (16)  
(see under silver)

Grand Republic (27)  

Granite (22)  
(see under silver)

Hartford (3)  

Icegate  

Iowa-Olympia  
(see under silver)

Johnsburg (29)  
Johnsburg Mining & Milling Co., Mount Vernon, Wash. (1949-1954). **Ore:** Lead, silver, copper, zinc, gold. **Ore min:** Galena, cerussite, angleite, chalcopyrite, sphalerite, mimetite, malachite, azurite. **Gangue:** Leached silicified schist, calcite. **Deposit:** Mineralized shear zone in schist. A lens of galena ore 50 ft. long and from 4 to 30 in. wide is exposed at one place on the vein. **Dev:** 200-ft. drift, 50-ft. adit, 15-ft. open cut. **Improv:** Cabin, aerial tram under construction (1955). **Assays:** 5 samples across the vein from 10 to 28 in. long over a distance of 35 ft. along the vein showed an av. value of 0.077 oz. Au, 42.64 oz. Ag, 50.74% Pb. 1953 shipments av. 56.9% Pb, 0.4% Zn, 0.42% Cu, 0.067 oz. Au, 40.4 oz. Ag. **Prod:** 1953 (19,638 lb. ore), 1955 (18,056 lb. ore). Ref: 13, p. 140, 22, p. 4. 63, p. 56. 133, p. 35. 158.

Kildare (17)  
**Loc:** Sec. 25, (35-13E), Cascade dist. **Prop:** 2 claims: Kildare, Harrison. **Ore:** Lead, silver, zinc. **Deposit:** A cross vein of the West Seattle said to be similar to the Boston. **Ref:** 13, p. 140.

Lakeside  
**Loc:** On S. side of Silver Basin on the S. Fk. of Thunder Cr. **Access:** Trail. **Prop:** Many claims. **Owner:** Silver Tip Mining & Power Co. (1919-1926). Silver Trail Mining Co. (1922). **Ore:** Lead, zinc, copper, gold, silver. **Ore min:** Galena, chalcopyrite, sphalerite, pyrite. **Gangue:** Quartz. **Deposit:** Said to be 10 veins of varying size in granite and metamorphic rocks. **Assays:** A typical mineral analysis said to show 23.66% galena, 16.32% sphalerite, 28.14% pyrite, 2.38% chalcopyrite, 51.96 oz. Ag, 0.18 oz. Au. **Ref:** 46, p. 227. 88, pp. 51-52. 98, 1916-1926. 158.

Logan No. 2 (6)  
(see under silver)

Marine  
(see under gold)

Michigan (26)  
(see under silver)

Midas (18)  
(see under silver)

Olympia  
(see iowa-Olympia under silver)

Ontario (4)  
**Loc:** Near center sec. 19, (35-14E), on eastern extension of the Boston vein. **Prop:** 1 claim. **Owner:** Grant, Ferguson, Getchell and Co. (1892). **Ore:** Lead, silver, gold. **Deposit:** Presumably similar to the Boston. **Ref:** 13, p. 139.

Pioneer (28)  
(see under silver)

Protection (7)  
**Loc:** Approx. in NE. cor. sec. 16, (35-14E), 1/4 mi. or less W. of the Thunder Cr. mine cabin. **Elev:** 5,000 ft. **Access:** Trail. **Owner:** Protection Mining Co. (1940). **Ore:** Lead, zinc, copper. **Ore min:** Galena, sphalerite, chalcopyrite, pyrite. **Deposit:** Fault in diorite is mineralized to a max. width of 6 in. Mineralization is rich over this narrow width. **Dev:** 500-ft. adit. **Ref:** 158.

Queen and Buchanan (19)  
(see under copper)

Sierra Grande (5)  
**Loc:** Extension of the Hartford claim in sec. 19, (35-14E), Cascade dist. **Prop:** 1 claim. **Owner:** Grant, Ferguson, Getchell and Co. (1892). **Ore:** Lead, silver, gold. **Ore min:** Galena, pyrite. **Gangue:** Quartz. **Deposit:** Presumably similar to Boston and Hartford claims. **Ref:** 13, p. 139.

Silver Tip (8)  
**Loc:** Across Thunder Cr. from the Skagit Queen property in secs. 16 and 17, (35-14E). **Access:** Trail. **Prop:** 4 patented claims: Imperial, English No. 3, Liberty, Lakeview. Also 8 unpatented claims and 2 millsites. **Owner:** Silver Tip Mining Co. (1941). Silver Tip Mining & Development Corp. (1918-1934). **Ore:** Lead, silver, zinc, gold. **Ore min:** Galena. **Deposit:** Reportedly a 3- to 4-ft. vein containing 1 to 2 ft. of ore. Other veins reported. **Dev:** Open cuts, short adits, 40-ft. shaft. **Assays:** Sample across 12 to 16 in. of ore showed 20.5% Pb, 6.8% Zn, 19.9 oz. Ag, 20% Cu. **Ref:** 119, no. 2, 1912, p. 1. 158.

Skagit Queen (2)  
(see under silver)

Soldier Boy (20)  
(see under gold)

Standard  
(see under silver)

Stenmo (9)  
**Loc:** At Park Cr. Pass, at head of Thunder Cr. **Access:** Trail. **Prop:** 2 claims. **Owner:** John Stenmo, Seattle, Wash. (1934). **Ore:** Lead, silver, zinc. **Ore min:** Galena. **Deposit:** Vein 2 to 4 ft. wide in granite. **Ref:** 158.

Thunder Creek (Dorothy) (10)  
**Loc:** 2 mi. W. of Park Cr. Pass. Approx. in sec. 16, (35-14E). **Elev:** 4,100 to 6,000 ft. **Access:** Branch trail from Thunder Cr. trail. About 22 mi. by trail from highway at Diablo Dam. **Prop:** 6 patented claims: Dorothy Nos. 1 to 6, and a millsite. **Owner:** Thunder Creek Mining Co. (1928-1952). **Ore:** Lead, silver, zinc, copper, gold. **Ore min:** Galena, sphalerite, chalcopyrite, pyrite. **Gangue:** Quartz, altered diorite. **Deposit:** Vein 5 in. wide along a fault in diorite. Vein composed of breccia cemented by gouge and ore minerals. A ton or so of ore on the trail below the mine. **Dev:** 425-ft. adit, 760-ft. adit. **Assays:** Sample across mining width showed 10% Pb, 4% Zn, 0.7 oz. Au. **Ref:** 46, p. 227. 97, 1929, p. 427. 106, 7/16/31. 157. 158.

Ventura (21)  
(see under silver)

West Seattle (15)  
**Loc:** Parallel to the Boston group in sec. 24, (35-13E), Boston Basin. **Prop:** 3 claims: Mitus, Diamond, West Seattle. **Ore:** Lead, silver, zinc. **Deposit:** Said to be similar to the Boston in size and character. **Ref:** 13, p. 141.

Willis and Everett (1)  
(see under silver)

SKAMANIA COUNTY

Athens  
(see under copper)

Bonanza (4)  
**Loc:** Sec. 12, (10-5E), Mt. St. Helens dist. **Ore:** Lead. **Ore min:** Galena. **Deposit:** 2-ft. vein with an 8-in. paystreak. **Ref:** 63, p. 50.

Bumble Bee  
(see under copper)

Chief  
(see Ripper and Chief under copper)

Commonwealth (7)  
(see under copper)
Copper Bottom
(see under copper)

Golconda (6)
(see under gold)

Gold Creek
(see Zinc Creek under zinc)

Grizzly Creek (5)
(see under copper)

Independence (2)
(see under copper)

Last Chance (10)
(see under copper)

Minnie Alice (1)
(see under copper)

Mount Fairy (8)
(see under gold)

Rainbow (11)
(see under vanadium)

Ripper and Chief
(see under copper)

Snowflake (3)

Zinc Creek (9)
(see under zinc)

SNOHOMISH COUNTY

Ala-Dickson (27)
(see under copper)

Alleghany
(see Foggy under copper)

Alta (47)
(see under gold)

Anacortes

Arlington (15)
(see under copper)

Bald Mountain (16)
(see under copper)

Baltimore (32)
(see under gold)

Bear (48)
(see under gold)

Beatrice
(see Sunset and Beatrice)

Bell and Crown (24)
(see under copper)

Big Four (28)

Billy Lee (49)

Blue Bird (75)
(see under gold)

Bluebell (50)
(see under gold)

Bonanza
(see Mineral Center under gold)

Bullion King
(see under gold)

Calumet
(see Glacier Peak under copper)

Calumet (72)
(see under gold)

Champion (61)
(see under gold)

Clara Thompson
(see Jasperson under gold)

Cleveland (19)
(see under copper)

Cleveland

Commonwealth
(see Jasperson under gold)

Cooperative (83)
(see under copper)

Copper Chief (52)
(see under copper)

Cornucopia (28)
(see under gold)

Courtney (8)
(see under copper)

Crown
(see Bell and Crown under copper)

Crown Point (53)

Daisy (45)
(see under gold)

Darrington
(see Gold Mountain under copper)

Deerfly (14)
Delta
(see under copper)

Dominion

Edison
(see Mineral Center under gold)

Editor (76)
(see under silver)

Elmo
(see Gold Bar and Elmo)

Emma Moore (38)

Emma No. 2

Etruria

Eureka (18)
(see under copper)

Feldt (4)
(see under silver)

Florence Rae (73)
(see under copper)

Foggy (34)
(see under copper)

"45" (25)
(see under silver)

Four Brothers (54)

Garfield

Gettysburg (55)

Glacier Peak (13)
(see under copper)

Golconda

Gold Bar (69)
(see under copper)

Gold Bar and Elmo

Gold Mountain (12)
(see under copper)

Good Hope (38)
(see under gold)

Granite and Maud (20)
(see under copper)

Gray Eagle (77)
(see under copper)

Gray Mare (5)
(see under copper)

Gypsy Queen (56)

Hidden Treasure
(see under silver)

Howard
(see Cooperative under copper)

Hunter (9)
(see under copper)

Idaho (57)

Imperial (21)
(see under copper)

Index Gold Mines, Inc. (78)
(see under gold)

Iowa
(see Washington-Iowa under copper)

J.B. (40)
(see under gold)

Jasper

Jasperson (58)
(see under gold)

Jones (74)
(see under silver)
Kazian (79)
(see under copper)

Keystone (33)
(see under gold)

Lalla Rookh
(see Tobique and Lalla Rookh under gold)

Larson (3)

Last Chance (80)
(see under gold)

Le Roy (66)
(see under silver)

Lockwood (59)

Louise
(see Mineral Center under gold)

Lulu (22)
(see under gold)

McCombs
(see Jasperson under gold)

Magus
(see “45” under silver)

Martin Engdahl (60)
Loe: NE¼ sec 7, (28-11E), on W. side of Silver Cr. Access: 3 mi. up Silver Cr. road from Galena. 11 mi. from railroad at Index. Ore: Lead, silver, zinc, copper, gold. Ore min: Galena, sphalerite, chalcopyrite, arsenopyrite, pyrite, molybdenite (?). Gangue: Quartz. Deposit: 3 mineralized shear zones as much as 4 ft. wide in argillite, quartzite, and limestone. Ore is mainly finely disseminated throughout the shear zones. Dev: Lower adit 425 ft. long, middle adit of unknown length, upper adit 150 ft. long. Assays: Vein 2½ ft. wide showed 0.18 oz. Au, 0.9 oz. Ag, 2.1% Zn. Ref: 14, pp. 34-35. 111, p. 10. 158.

Maud
(see Granite and Maud under gold)

Milwaukee (26)
(see under zinc)

Mineral Center (70)
(see under gold)

Mineral Mines (61)
(see under copper)

Monte Cristo (37)
(see under gold)

Morning Star (48)
Seventy Six (42)

Silver Coin (17)
(see under gold)

Silver Horseshoe (20)
(see under silver)

Silver Lake (43)
(see under gold)

Silver Queen (44)
(see under gold)

Standard

Sunrise (6)
(see under gold)

Sunset and Beatrice (82)

Threadwell
(see under gold)

Tobique and Lalla Rook (68)
(see under gold)

Trade Dollar

Vandalia (65)

Victory
(see under copper)

Washington-Iowa (71)
(see under copper)

Wayside (1)
(see under copper)

Webster
(see Jasperson under gold)

Whistler (36)

Whitehorse (7)
(see under zinc)

Yankee Boy (2)
(see under copper)

SPOKANE COUNTY
Silver Hill (1)
(see under tin)

STEVENS COUNTY
A and C (142)
(see under copper)

Abe Lincoln
(see Comstock)

Acme (Acme-Dora) (161)

Acme-Dora
(see Acme)

Acorn

Admiral (193)
(see under copper)

Admiral Consolidated (91)
(see under zinc)

Advance (55)
(see under zinc)

aguila (Eagle-Newport) (160)

Aichan Bee (213)
(see under silver)

Al Ki (145)
Aladdin (120)


Aladdin (Blue Ridge, Sierra Zinc)

(see Sierra Zinc under zinc)

Alma (162)

(see under silver)

Anaconda (86)

(see also Red Top)


A. Anderson (66)

(see under zinc).

Anderson (103)


Anderson (67)

(see under zinc)

Ark (157)

(see under silver)

Austin

(see Aichan Bee under silver)

Avondale-Dome (Tenderfoot, Gillette) (132)


Bald Eagle (13)

(see under gold)

Banshee (189)

(see under copper)

Baxter

(see Snyder and Baxter under silver)

Bear Mountain (171)


Bechtol (W. J. Bryan, Woohaa) (108)

Loo: Secs. 23 and 26, (39-41E), halfway between the Thompson property and Deep Lk. Elev: 2,400 to 2,800 ft. Access: 1/2 mi. by trail NE. of road at S. end of Deep Lk. Prop: 3 claims: W. J. Bryan, Kismet, Manantering; a fractional claim; and 20 acres of patented land. Owner: Estate of William Bechtol and B. J. Hofer, Northport, Wash. (1949). Ore: Lead, silver, iron. Ore min: Galena, cerussite, limonite, siderite, anglesite. Gangue: Siderite, dolomite, calcite, breccia. Deposit: Galena and cerussite occur as nodules in a matrix of soft limonite, clay, and decomposed dolomite along faults of diverse orientation. Dev: Crooked adit 1,090 ft. long, 150-ft. adit, 100-ft. incline, 370 ft. of drifts and crosscuts, 50-ft. surface stope, many cuts and pits. Assays: Shipments in 1917 and 1918 returned 73.0% to 73.1% Pb, 0 to 1.2 oz. Ag. Prod: Reportedly 90 tons of galena ore prior to 1924. 6,034 tons in 1917 and 5,307 tons in 1918 are known to have been shipped by wagon to the Northport smelter. Shipments reported in 1925, 1937, 1939, 1940 (77 tons), and 1943. Ref: 7, p. 59. 21. 22. 4, p. 36. p. 59. 73, pp. 99-99. 87, 1917, 1925, 1938, 1940. 142, pp. 48-50. 158.

Beecher (15)

(see under gold)

Belcher (176)

(see under copper)

Bertha M. (173)


Big Chief (Tenderfoot, Royal, Silver Key) (133)


Black Canyon


Black Cat (94)


**Black Rock** (58)
(see under zinc)

**Black Witch**
(see Alma under silver)

**Bland**

**Bliss**
(see Galena Hill)

**Blue Lime (Sauvola)** (96)

**Blue Ridge**
(see Sierra Zinc under zinc)

**Blue Star**
(see Eagle under silver)

**Bluegrouse** (155)
(see under silver)

**Bonanza** (145)

**Botts** (128)

**Boucher**
(see Wildcat)

**Boundary Silver Lead**
(see Lucile under zinc)

Coyote (see Coyote)

Coyote (Coyote) (40)


Coyote (see Coyote)

Crackerjack (139)


Copper-Gold

(see Coffer under copper)

Copper King (113)


Copper Queen (177)

(see under copper)

Coyote (Rightside)

(see under Rightside under copper)

Coyote (Coyote) (40)

Cottonwood (25)

(see under copper)

Columbia (see Iroquois under zinc)

Columbia Queen (see Chloride Queen)

Clugston (see Silver Trail)

Comstock (10)

(see under copper)

Comstock (Abraham Lincoln) (36)


Contention (see Mountain View under silver)
Crystal (101)

Daisy
   (see Daisy-Tempest under silver)

Daisy-Tempest (165)
   (see under silver)

Dead Medicine
   (see Silver Trail)

Deep Creek (57)
   (see under zinc)

Deep Lake
   (see Farmer under zinc)

Deer Trail (205)
   (see under silver)

Defender (22)
   (see under zinc)

Delmonico
   (see Jay Dee under silver)

Dome
   (see Avondale-Dome)

Dora
   (see Acme)

Double Eagle (192)

Double Standard (37)
   (see under copper)

E. M. C. (158)
   (see also Ark under silver)

Eagle (180)
   (see under silver)

Eagle-Newport
   (see Agula)

Easter Sunday (20)
   (see under gold)

Easy Money
   (see Magma under zinc)

Echo (134)
   (see under zinc)

Eldorado (87)

Eldorado (Magma)
   (see Magma under zinc)

Electric Point (106)
   (see also Lucky Four under silver)

Elk (97)

Elvick (39)
   (see under gold)

Emerald

Empire (59)
   (see under zinc)

Enterprise
   (see Jay Dee under silver)

Eureka (4)
   (see under gold)

Eureka (Uncle Sam)
   (see Uncle Sam)

Eureka and Orient
   (see Eureka under gold)
Evergreen (77)


Excelsior


Farmer (111)

(see under zinc)

Finley


Fish (159)

(see under silver)

Flannigan

(see Iroquois under zinc)

Flat Creek (32)

(see under zinc)

Fred B. (Chewelah Silver, Nabob) (184)

(see also Jay Gould under silver)


Frisco Standard (72)

(see under silver)

Galena Farm (Sec. 22, (39-38E), Orient dist. Ore: Lead. Ore min: Galena. Gangue: Quartz. Deposit: Argillite and limestone cut by basic dikes. Outcrops of quartz associated with the basic dikes or along the contact of the dikes and argillite carry galena. Dev: Several shafts and open cuts. Ref: 164, p. 255.

Galena Hill (Kettle River, Bliss) (17)


Galena Knob (126)


Galena Ridge (see Galena Farm)

Georgie (26)

(see under copper)

Germania (214)

(see under tungsten)

Giant Silver (see Red Cloud under copper)

Gillele (see Avondale-Dome)

Gladstone (107)


Globe (24)  
(see under copper)

Gold Bar (149)  
(see under gold)

Gold Hill  
(see under gold)

Good Enough  
(see Sandiego under silver)

Gorien Zinc  
(see under zinc)

Gray Eagle  
(see Rightside under copper)

Great Northern (99)  

Great Republic (38)  
(see under copper)

Great Western (62)  

Grubstake  
(see under silver)

H & B  
(see Aichan Bee under silver)

Ham (Steel Galena, Iron Cap) (166)  

Hartbauer (82)  

Hartford  
(see Krug under copper)

Hazel (81)  
(see under silver)

Helena Johnson (60)  

Hi Cliff  
(see Uncle Sam)

High Grade  
(see Jay Dee under silver)

Highland (75)  

Highland Chief  

Homebuilder (31)  

Homestake (28)  
(see under gold)

Honest John (191)  
(see under silver)

Hoodoo (206)  
(see under silver)

Hubbard (Royal Gold) (34)  

Hunter  
(see Jackson under zinc)

Ibex (53)  
Indian
(see Eureka under gold)

Iron Cap
(see Ham)

Iron Mask (14)
(see under zinc)

Iroquois (84)
(see under zinc)

Jackson (80)
(see under zinc)

Jay Dee (179)
(see under silver)

Jay Gould (182)
(see under silver)

Jayhawker (19)
(see under copper)

Joe Creek (125)
(see under zinc)

John Day (178)
(see under silver)

John Hays (163)
(see under silver)

Johnny Boy
(see Moonshine-Johnny Boy under silver)

Jupiter
(see Last Chance)

Just Time (Star) (76)

Keough (74)

Kettle River
(see Galena Hill)

Keystone (98)
(see under iron)

King Tut

Koyotte
(see Rightside under copper)

Krug (170)
(see under copper)

Lake View
(see Hazel under silver)

Lakeview
(see Roosevelt under silver)

Last Chance (Jupiter) (61)

Lead King (100)

Lead Trust (93)

Leadhill

Leadville (137)

Legal Tender (203)
(see under silver)

Leon C. (102)
Little Frank (202)


Little Giant (6)


Lone Star (46)

(see under silver)

Longshot (Newland, Pioneer) (122)


Lucile (82)

(see under zinc)

Lucy Boy (129)


Lucy Charlie (8)

(see under copper)

Lucy Four (104)

(see under silver)

Lucy Stone (136)


Lynn (156)


McDonald

(see under copper)

McKinley (5)

(see under gold)

McKinley (29)


McNally (18)

(see under copper)

Magma (115)

(see under zinc)

Maki (112)


Maple Leaf

(see Melrose under silver)

Margarette (1)


Mayflower (180)


Melrose (68)

(see under silver)

Mexico

(see Queen under silver)

Michigan Boy (124)


Middleport (121)
(see under zinc)

Mineral Belt (47)

Mineral Hill
(see Aichan Bee under silver)

Monarch (140)

Monday Morning (117)
(see also Morning under silver)
Note: Probably this is the same as the Morning property.

Montana and Washington (7)
(see under copper)

Montgomery (187)
(see under copper)

Monumental
(see Treadwell)

Moonlite
(see Morning under silver)

Moonshine-Johnny Boy (209)
(see under silver)

Morning (116)
(see under silver)

Mountain View (48)
(see under silver)

Mountain View Extension (49)
(see under silver)

Mullen (185)

Myrtle

Nabob
(see Fred B.)

Neglected (135)

Nevada (168)

New England (63)
(see under zinc)

New Leadville (Yo Tambien) (141)

Newland
(see Longshot)

Newport (Eagle-Newport)
(see Aguilla)

Niles (183)

Noble Four
(see under copper)

Norman King

North Monitor (197)
(see under silver)

Northern Light (50)
Loc: NE¼SE¼ sec. 5 and NW¼SW¼ sec. 4, (39-40E), adjoining Silver Crown property on the N., on the outskirts

**Northport**

(see Deep Creek under zinc)

**Norway King**


**Oakshott (118)**


**Occidental (64)**

(see under zinc)

**Old Dominion (153)**

(see under silver)

**Olympia (78)**


**O’Neal**

(see Rightside under copper)

**Onion Creek**


**Orazada (215)**

(see under silver)

**Orchid (196)**

(see under silver)

**Ore Cache (Oro Cache) (154)**


**Orient-Eureka**

(see Eureka under gold)

**Oro Cache**

(see Ore Cache)

**Owen**

(see Lucille under zinc)

**Paragon**

(see Melrose under silver)

**Perry (2)**


**Pioneer**

(see Longshot)

**Plata Fino (210)**

(see under silver)

**Plata Rica (211)**

(see under silver)

**Plug (109)**

(see under zinc)

**Pomeroy (21)**

(see under zinc)

**Prosperity (85)**


**Providence (204)**

(see under silver)

**Providence (45)**


**Queen (208)**

(see under silver)

**Queen and Seal**

(see Queen under silver)

**R. J. (143)**

(see also Uncle Sam)


**Rainbow**

(see under silver)

**Ranch View (79)**


**Red Cloud (201)**

(see under copper)

**Red Iron (95)**


Red Top (90)
(see also Anaconda, Copper King)

Robena
(see under zinc)

Rockcut (3)

Rocky Creek
(see Burrus under zinc)

Roosevelt (69)
(see under silver)

Rosebud (164)

Royal
(see Big Chief)

Royal Gold
(see Hubbard)
Silver Key
(see Big Chief)

Silver King

Silver Mountain
(see Daisy-Tempest under silver)

Silver Queen (Ark)
(see Ark under silver)

Silver Queen (Queen)
(see Queen under silver)

Silver Summit (Summit) (167)

Silver Trail (Clugston, Dead Medicine) (146)

Silver Wave

Smokey Bullion
(see A and C under copper)
Surprise  
(see Uncle Sam)

Tempest  
(see Daisy-Tempest under silver)

Tenderfoot (Avondale-Dome)  
(see Avondale-Dome)

Tenderfoot (Big Chief)  
(see Big Chief)

Three Orphans (9)  

Togo (200)  
(see under copper)

Tom Moore (12)  

Treadwell (Iron Mask)  
(see Iron Mask under zinc)

Treadwell (Monumental) (92)  

Trojan (23)  
(see under gold)

Tungsten King (190)  
(see under tungsten)

Turquoise  

Uncle Sam (27)  
(see under copper)

Uncle Sam (Hi Cliff, Eureka, Surprise) (144)  

United Treasure (70)  
(see under silver)

Van Stone (127)  
(see under zinc)

Vanasse (150)  
(see under silver)

Venus  
(see Deer Trail under silver)

Victory  
(see Vanasse under silver)

Viking (16)  
(see under copper)

Washington  
(see Montana and Washington under copper)

Washington Black Rock  
(see Black Rock under zinc)

Wellington  

Wells Fargo (194)  
(see under antimony)

White Horse (25)  
(see under copper)

Wildcat (Boucher) (105)  

Wilkie Lode (175)  

Windfall (186)  
(see under copper)

Winslow (174)  

Woohau  
(see Bechtol)

Yo Tambien  
(see New Leadville)

Young (110)  
WHATCOM COUNTY


Young America (147)
(see under zinc)

WHATCOM COUNTY

Allen Basin (6)
(see under gold)

Azurite (12)
(see under gold)

Baltimore Mines, Inc. (7)
(see under gold)

Chancellor (8)
(see under gold)

Evergreen (4)
(see under gold)

Galena
(see Verona under gold)

Gargett (2)
(see under gold)

Gold Hill (9)
(see under silver)

Golden Arrow
(see Tacoma under gold)

Great Excelsior (1)
(see under gold)

Indiana
(see Chancellor under gold)

Lincoln
(see Great Excelsior under gold)

Mammoth (10)
(see under gold)

Northern Cascade
(see Gold Hill under silver)

Peterson
(see Gold Hill under silver)

President
(see Great Excelsior under gold)

Saginaw (3)
(see under gold)

Tacoma (11)
(see under gold)

Verona (5)
(see under gold)

Willow Lake


YAKIMA COUNTY

Chinook (3)
(see under copper)

Elizabeth Gold Hill (2)
(see under gold)

Gold Hill (1)
(see under gold)

Keystone (5)
(see under copper)

Richmond (4)

Loc: NE1/4 sec. 32, (16-13E), on Martha Cr. near headwaters of N. Fk. of Battlesnake Cr. Elev: 4,600 ft. Access: 3 mi. by trail from Clover Spring. Prop: 25 unpatented claims. Owner: George V. Rankin, Frank Hardy, William Eamon, and Lin B. Bissell, Yakima, Wash. (1946). Ore: Lead, silver, zinc, copper, gold. Ore min: Galena, tetrahedrite, sphalerite, pyrite, malachite, azurite, arsenopyrite, bornite, chalcopyrite. Gangue: Siderite, calcite, quartz. Deposit: A 2-ft. shear zone in andesite. Brecciated rock has been cemented by calcite and ore minerals. Ore minerals occur in small local shoots. Dev: 3 adits, one 50 ft., another 10 ft. long, and a longer one caved. Also a shaft and an open cut. Improv: Cabin (1946). Assays: 5 assays on picked samples show 22.5 to 248.0 oz. Ag, 0.02% to 5.02% Pb, 0.03% to 1.06% Zn, 0.02% to 1.87% Cu. Ref: 58, p. 58. 158.

LITHIUM

Properties—Lithium is the lightest element which is solid at ordinary temperatures, and only the gases hydrogen and helium have lower atomic weights. It is less than one-third as heavy as aluminum and half as heavy as water. It is silver white and has a brilliant luster on fresh surfaces but slowly tarnishes when exposed to air. It is ductile, readily extrudable, and soft (H=0.6), being harder than sodium and potassium but softer than lead and softer than talc. Chemically, it is similar to the other alkali metals, sodium, potassium, rubidium, and cesium. It has a valence of 1, and forms salts analogous to those of sodium and potassium. Lithium reacts with water to form the hydride and hydrogen. Pound for pound, it is the most effective metallic reducing agent, and it is not only an efficient deoxidizer but it also has a high affinity for nitrogen, hydrogen, sulfur, phosphorus, carbon, and silicon. Other properties are shown in the table on page 12.

Uses—Lithium metal, alloys, and compounds have a wide variety of uses, although as yet only in comparatively small quantities. The principal use of the metal is as a scavenger for degasification and deoxidation of high-conductivity copper and other nonferrous metals. Similarly, it is used as a “getter” in vacuum tubes. The metal is used in certain organic chemical reactions, and is reported to be used in the production of tritium for the thermonuclear bomb (“hydrogen bomb”) project of the United States Atomic Energy Commission. Lithium may be alloyed with aluminum, lead, copper, zinc, iron, calcium, beryllium, and magnesium; even in very minor amounts it imparts the qualities of hardness, toughness, tensile strength, ductility, and improved uniformity to its alloys. In high-pressure castings it densifies the grain in the metal and eliminates porosity. It is used to improve the qualities of certain steels and is used, as a substitute for tin, to harden bearing alloys. Lithium minerals and compounds have an even wider use than the metal and alloys, in the glass, optical, ceramic, chemical, and air-conditioning industries. Lithium chloride is one of the most efficient desiccants known. In addition, various lith-
ium salts are used in high-temperature greases (an important and rapidly expanding use), in medicines (a declining use), in photographic developers, alkaline storage batteries, and pyrotechnics. Lithium hydride (LiH) is a convenient source of hydrogen. One cubic foot of the hydride, when combined with water, will produce 2,300 cubic feet of hydrogen.

Production—The only two plants in the United States producing the metal in 1950 were in New Jersey and Minnesota. Their total output usually is only a few tens of thousands of pounds per year. Annual shipments of lithium ore from domestic mines averaged 1,327 tons (equivalent to 88 short tons of Li₂O) valued at $48,280 per year in the years 1935-1939. The 1940 shipments were nearly one-third larger, and by 1944 they were 10 times larger. By 1947 production dropped back to only about one-fifth of the war-time peak, but this was still twice as great as pre-war, and production increased rapidly again, so that by 1950 the tonnage almost equaled the war-time high, and the value was greater.

No lithium minerals have been mined in Washington, nor are there any plants in the state producing the metal or its compounds.

Prices—Lithium metal was valued at $96 per pound in 1929, but at only $18 in 1931, and near $15 for the next 10 years. Metal of 99 percent purity was quoted at $12.50 per pound in 1945, at $9.85 to $11 in 1950, and $11 to $14 in 1955. Prices quoted for lithium ore in 1950 were: (1) amblygonite, air floated, carlots, $10 to $15 per ton; (2) lepidolite, 4 percent Li₂O, powdered, carlots, $8 to $10 per ton; and (3) spodumene, 6 percent Li₂O, carlots, $6 to $8 per short ton unit of contained Li₂O.

Occurrences

Ore minerals—Lithium has been found in more than 140 minerals, mostly silicates and phosphates, in quantities ranging from spectroscopic traces to more than 50 percent. Lithium is more abundant in the earth's crust than tin, lead, or zinc. It is widely distributed in minute quantities, but only 3 minerals have been important ores of lithium: the phosphate, amblygonite, LiAl(F,OH)PO₄, containing 8 to 9 percent Li₂O; and the silicates, lepidolite, KL(H₂O)₃Al₂Si₃O₁₀(OH), (lithium mica), containing 2 to 4 percent Li₂O; and spodumene, LiAl(Si₂O₆)₂, containing 2 to 4 percent Li₂O. Zinwaldite, a variety of lepidolite, containing 2 to 3 percent Li₂O, and triphylite, LiFePO₄, containing 2 to 6 percent Li₂O, have also been mined for their lithium content. In recent years lithium compounds have been recovered in important quantities from the brines of Searls Lake in California. These brines contain about 0.0115 percent Li₂O, and it is likely that other playa lake brines, brines, and salts may prove valuable for their lithium content. Many mineral springs contain lithium in very low concentration. Although much lithium ore is processed to make the metal and compounds, much ore also is used by industry without treatment other than concentration and purification.

Geology—Except for the playa lake brines, salts, and muds, the lithium deposits are restricted to pegmatites. Most pegmatites contain few if any lithium minerals, and where these do occur it is seldom in any considerable quantity. The lithium minerals apparently come in as a late phase in the formation of complex pegmatites, such as those that contain tin or columbium-tantalum. Pegmatites rich in lithium are likely to be poor in feldspar. Usually the lithium minerals occupy the central portion of pegmatite bodies.

Lepidolite has been reported to occur in a dike a few miles west of Riverside, Okanogan County, and an occurrence at the Royal Development mine in Chelan County is mentioned (under mica) in Part I of this report. It is probable, however, that the report of the latter occurrence is erroneous. Lithium has been detected spectroscopically in water from Summit Creek Soda Springs in eastern Lewis County.

MAGNESIUM

Properties—Magnesium is a silver-white metal having a bright luster; it slowly oxidizes in moist air, the thin oxide coat protecting the metal from further action. Magnesium is light in weight (37 percent less than aluminum), the only lighter metals being lithium, potassium, sodium, and calcium. It is ductile, malleable, and fairly tough. It has excellent machinability (best of the industrial metals) but has a low modulus of elasticity and is incapable of being easily cold-worked. Only silver, copper, and aluminum have higher electrical conductivity, and in mass conductivity it is second only to aluminum. Magnesium is bivalent in all its chemical compounds. It is a powerful reducing agent, and in ribbon or powder form it ignites on heating and burns with a brilliant white flame. Other properties are shown in the table on page 12.

Uses—In 1950, transportation equipment used the greatest quantity of magnesium, principally as aircraft and automotive parts. Magnesium was used in about equal amounts in castings, sheet, structural shapes (extrusions), and aluminum alloys, and in somewhat smaller quantities as cathodic protection against corrosion—a rapidly increasing use. During war times magnesium consumption is largely for aircraft parts and for incendiary bombs. The metal is used in metallurgy as a deoxidizing and desulfurizing agent in smelting nickel and making nickel alloys, and as a reducing agent in the production of titanium and zirconium. The addition of only 0.1 percent of magnesium to cast iron produces the equivalent of malleable iron, and this use accounted for more than a million pounds of magnesium in 1952. The powdered metal has long been used in pyrotechnics, signal lights, and photoflash lights. Magnesium has been used in place of zinc in dry batteries. Increasing uses are being developed in household appliances, tools, machinery, office equipment, sporting goods, and transportation equipment. Most magnesium is alloyed—aluminum, zinc, manganese, copper, zirconium, and cerium being the more common alloying metals. Magnesium is used in the chemical industries, especially in the synthesis of complex organic compounds. Magnesium compounds are used in medicine and for a wide range of industrial uses.

Production—The first commercial production of magnesium metal in the United States was 44 tons in 1915. Under the impetus of World War I, production rose to
142 tons in 1918, then later dropped back to less than 80 tons annually for a few years. It gradually rose to 6,361 tons in 1940, and 48,963 tons in 1942, then jumped to 183,584 tons as a result of military demands in 1943, only to again drop far back to 5,317 tons in the post-war year of 1946. The output in 1950 (all from 1 plant) had risen to 15,726 tons, and 2 years later it had reached 105,386 tons (from several plants). In 1943, the peak year, 63 plants, nearly all government owned, were in operation or preparing to operate. One of these, having an annual capacity of 24,000 short tons, was near Spokane, at Mead, but it operated only about a year and produced only 12,000 tons of magnesium and an equal amount of ferrosilicon before being closed and "put in mothballs" in November 1944. This plant was again in production from August 1951 to May 1953. During both its periods of operation the Mead plant used dolomite from a quarry at Marble in Stevens County.

Prices—The first metallic magnesium produced in this country in 1915 sold for $5 per pound. By 1918 the price was down to $1.81 per pound and by 1927, to 69 cents. The decline continued, reaching 30 cents in 1933 and 26 cents in 1934, but there was an increase to 30 cents in 1935. Again the price dropped, and from 1943 through 1949 it remained at 20 ½ cents per pound for ingots, 99.8-percent purity, in casks. Several increases in 1950 brought the price to 24½ cents, where it remained through 1952. In June 1953 the price was 27 cents per pound.

Ore minerals—Manganese is a very common element and constitutes 2.1 percent of the earth's crust. It is the third most abundant of the engineering metals, being surpassed in quantity only by aluminum and iron. It never occurs free in nature, but its compounds are very abundant, and a great many of the common rock-forming minerals contain manganese. Minerals which have been mined as ores of manganese are: magnesite, MgCO₃, containing 28.7 percent magnesium; dolomite CaCO₃•MgCO₃, containing 13.1 percent magnesium; brucite, Mg(OH)₂, containing 41.6 percent magnesium; and carnallite, KMgCl₃•6H₂O, containing 8.7 percent magnesium. For many years underground brines containing about 3 percent magnesium chloride were the only source of the metal utilized in this country, but sea-water bitterns are now an important source. Natural sea water contains about 0.13 percent magnesium. A method to recover the metal from the silicate mineral olivine, (Mg,Fe)₂SiO₄, containing 26 to 30 percent magnesium, has been developed but never tried on a commercial scale.

Geology—The several ore minerals of magnesium occur in a great variety of deposits. Dolomite occurs as thick beds of sedimentary rock or its metamorphosed equivalent. It is abundant in the Paleozoic and pre-Cambrian rocks of northeastern Washington. Magnesite is found as replacements of dolomite or limestone, as veins in serpentine, and as chemical precipitates. Some of the largest deposits of the replacement type known in this country are in the pre-Cambrian Stensgar dolomite belt near Chewelah in Stevens County. The largest magnesite producer in the United States has been operating in these deposits almost continuously since 1916, but the products of this plant have been refractories rather than magnesium metal.

Olivine has several modes of occurrence. One of the largest deposits in the country is in the Twin Sisters Mountains in Whatcom and Skagit Counties, where an ultrabasic intrusive, constituting a mountain mass about 10 miles long by 5 miles wide, includes fresh, nonserpentinized olivine, free of other minerals, cropping out in an area of several square miles. The rest of the ultrabasic rock is a mixture of olivine and pyroxene, and a small area of serpentine.

Manganese metal is steel gray or gray white and has a slightly ruddy tinge. It is lustrous, hard, and brittle. Three allotropic forms of the metal are known. It resembles iron both physically and chemically. It is superficially oxidized when exposed to air. In its compounds manganese shows valences of 2, 3, 4, 6, and 7. Other properties are shown in the table on page 12.

Uses—In 1950 more than 96 percent of the consumption of manganese in this country was in the metals industries; 2½ percent went to dry batteries; and 1½ percent, to chemicals. It is used as a scavenging agent or as an alloying component in more alloys, probably, than any other element. Its principal combinations are with iron, copper, aluminum, magnesium, and nickel as bases. Manganese is an essential constituent of all grades of commercial steel, being used as an oxidizer and desulfurizer in the manufacturing process. Also, when added to steel in larger amounts it increases the hardness, toughness, and strength, as well as allowing the steel to be more easily rolled and forged. Consumption of manganese in the steel industry averages 14 pounds per ton of steel. Manganese chemicals are used in the manufacture of glass and ceramics, paint, dyes, fertilizer, leather, medicines, disinfectants, and such gases as oxygen, chlorine, and bromine.

Production—Normally about 90 percent of the manganese consumed in this country is imported. During the 50 years following 1900, imports have risen steadily from about 200,000 short tons of ore to 1,800,000 tons annually. Domestic production was essentially nil from 1900 to 1915, but rose to a peak of 342,573 short tons in 1919 during the first world war, only to drop back to an average of about 50,000 tons annually until the beginning of the second world war. A second peak of 247,616 tons was

Occurrences

The magnesite ore minerals which are known to occur in commercial quantities in Washington are described in Part I of this report, under dolomite and magnesite. Other magnesium minerals described in Part I are olivine, brucite (under miscellaneous nonmetallic minerals), and epsomite and brines (under saline compounds).
reached in 1944, and the post-war production through 1952 has averaged about 125,000 tons per year.

The first recorded production of manganese ore in Washington was 101 tons in 1916. The next production was 18,228 short tons from 1924 through 1926, then 11 tons in 1939, and 33,596 tons from 1941 through 1946. A few carloads were shipped in 1952 and 1953. During the 1941 to 1946 period, Washington's production amounted to about 3½ percent of the total United States output. Production has been reported in Clallam, Grays Harbor, Jefferson, Mason, and Okanogan Counties, but by far the most of the ore has come from the Crescent mine at the west end of Lake Crescent, Clallam County.

Prices—The price schedule for manganese metal, alloys, and ore are quite complex, the price varying with such factors as grade, impurities, and place of origin. In general, prices are comparatively low during normal times. During World War I they rose to a sharp peak, but, during World War II prices were stabilized by government order. In 1952, prices of imported ore of metallurgical grade were $1.20 to $1.25 per long-ton unit (22.4 pounds of contained manganese), 48 percent manganese, duty extra. Chemical-grade ore was quoted at $200 per long ton, minimum 60 percent MnO₂; Brazilian or Cuban ore, carlots, in barrels. Domestic chemical-grade ore, 70 to 72 percent MnO₂, f.o.b. mines, was $45 per long ton. Ferromanganese alloy was quoted at $200 per net ton, 74 to 76 percent manganese, f.o.b. Pennsylvania plants; and manganese metal, at 36 to 37½ cents per pound, 96 percent manganese, carlots, bulk, delivered. Buyers' specifications regarding impurities in manganese ores vary somewhat, but, in general, metallurgical-grade ore should have high manganese (45 to 50 percent) and low silicon, oxygen, phosphorus, sulfur, and nonferrous metals, but the calcium oxide content may be high. Chemical-grade ore requires high manganese dioxide content, may have a considerable amount of silicon and phosphorus, but must be low in calcium oxide.

Ore minerals—Manganese is the twelfth most abundant element in the earth's crust. It is present in small amounts as a primary element in all igneous rocks, and is an essential constituent of more than 120 minerals. Pyrolusite, MnO₂, containing 63.2 percent manganese, is the most important ore mineral, followed by psilomelane, an oxide containing 45 to 60 percent manganese and various amounts of adsorbed water and barium, potassium, and sodium oxides. Other ore minerals are braunite, 3MnO₂·MnSiO₃, containing 69.0 percent manganese; hausmannite, MnO₂, containing 72.1 percent manganese; manganese, MnO₂·H₂O, containing 62.5 percent manganese; wad, impure hydrous oxides of manganese of varying composition; and rhodochrosite, MnCO₃, containing 47.8 percent manganese. Recently, consideration as possible ores of manganese has been given to the silicates, rodonite, MnSiO₃, containing 42.0 percent manganese, and bementite, 2MnSiO₃·H₂O, containing about 32 percent manganese and 35 percent silica. Most, if not all, of the above minerals are found in ore deposits in Washington, and bementite, a rare mineral elsewhere in the world, comprises most of the manganese mineralization in the Olympic Peninsula. Other manganese minerals of more or less incidental interest found in the Olympics are neotocite, ineisite, ephoite, managanophyllite, managanocalcite, piedmontite, and jacobsite.

Geology—Most of the world's supply of manganese comes from sedimentary and residual deposits. Other types are hydrothermal open-space fillings or replacement deposits and metamorphosed deposits. Of particular interest in Washington are the deposits in the Olympic Peninsula, where bementite is the principal ore mineral; it is commonly accompanied by jasper and usually occurs closely associated with red argillaceous limestone intercalated with submarine lavas. The ores here appear to have been derived from the rapidly cooling lavas and deposited on the ocean floor, possibly as a gel, at the time the lavas were extruded beneath the sea.

The map showing the numbered manganese occurrences is plate 15, on page 41 in volume 2.

**CHELAN COUNTY**

**Black**

Loc: NW. of Wenatchee. Owner: C. A. Black, Seattle, Wash. (1949). Ore: Manganese. Ore min: Psilomelane, pyrolusite. Deposit: Said to be a 2- to 10-ft. vein of ore of unknown length and depth. Dev: Scant. Assays: Grab sample: 49% to 52.6% Mn, 2.02% to 2.4% Fe, 15% SiO₂, 0.066% P. Ref: 158.

**Peterson**


**CLALLAM COUNTY**

**Associated (17)**


**Aurora Ridge (48)**


**Barbara (12)**

Loc: SW ¼ sec. 23, (30-11W). Elev: 2,200 ft. Access: 600 ft. of the Kloshe Nanich trail. Ore: Manganese. Ore min: Bementite, Hausmannite. Deposit: 2 bementite bodies enclosed in greenstone, one 20 ft. long and 5 ft. av. width, the other 16 ft. by 5 ft. Assays: 16.5% to 18.8% Mn, 11.9% to 21.7% Fe, 30.01% to 44.65% SiO₂. Ref: 45-A, p. 27, 94, p. 17.

**Barnes Creek (49)**

Loc: Near headwaters of S. tributary to Barnes Cr. in what would be about sec. 7, (29-8W) if area were surveyed. Elev: 4,200 ft. Access: Trail to Lizard Head Peak. Prop: 2 claims: Lakeview, Victory. Ore: Manganese. Ore min: Bementite, psilomelane, braunite. Gangue: Chaledony. Deposit: 3 deposits; one exposed on face of a high bluff has an est. height of 175 ft., width of 50 ft., and length of 125 ft. Assays: U. S. Bureau of Mines sample from Lakeview claim: 11.4% Mn,
21.4% Fe, 34.8% insol., 31.7% SiO₂, 9.5% Ca, 0.05% S, 0.8% Al₂O₃, 0.050% P, 0.85% MgO, nil Ba, nil Zn. U. S. Bureau of Mines sample from Victory claim: 26.0% Mn, 14.6% Fe, 30.7% insol., 28.9% SiO₂, 6.9% CaO, 1.35% S, 0.4% Al₂O₃, 0.054% P, 1.0% MgO, nil Ba, nil Zn. Ref: 48-A, p. 32. 94, p. 19. 109.

Beans (44)


Bear Creek

(see Victor)

Bear Ridge (4)


Bear Creek

(see State Loose)

Bertha (47)


Blue Eyes (11)


Bright Angel (41)


Broken Shovel (59)

(see also Idaho, Broken Shovel, and Ella)

Loc: Sec. 20, (29-6W). Ore: Manganese. Deposit: 40- by 500-ft. ore body. Assays: 25.8% Mn, 15.2% Fe, 34.1% SiO₂. Ref: 158.

Cedar (45)

(see also Thompson)

Loc: Sec. 34, (30-8W). Prop: 1 claim of Thompson group. Ore: Manganese. Assays: 18.2% Mn, 5.4% Fe, 39.9% SiO₂. Ref: 158.

Chappie (54)

Loc: On a spur connecting Hurricane Ridge and Unicorn Peak. Approx. sec. 24, (29-TW). Elev: 3,600 to 5,500 ft. Prop: 8 claims. Ore: Manganese. Ore min: Predominantly bementite. Deposit: Outcrops exposed in the face of vertical serrated cliffs 100 to 300 ft. high. Ore bodies 2 to 5 ft. thick. Assays: 17.4% Mn, 15.0% Fe, 22.8% SiO₂. Ref: 48-A, p. 34. 94, p. 20. 158.

Charles A. (37)

Loc: Sec. 19, (30-6W), on southward-facing slope on which Crescent mine is located but at lower elev. Prop: 1 claim. Charles A. Ore: Manganese. Deposit: Reportedly a good showing. Ref: 125, pp. 19-20.

Charles G. (38)

Loc: Sec. 19, (30-6W), on southward-facing slope on which Crescent mine is located but somewhat lower in elev. Prop: 1 claim: Charles G. Ore: Manganese. Deposit: Reportedly a good showing. Ref: 125, pp. 19-20.

Clallam (8)

Loc: NW¼NW¼ sec. 28, (30-11W). Elev: 1,615 to 1,675 ft. Access: 1 mi. N. of Snider Ranger Station on U. S. Highway 101. No trail. Ore: Manganese. Ore min: Bementite, cinnabar, neotocite, hausmannite. Deposit: 5 lenses of manganese ore lying between greenstone and red argillaceous limestone—54 ft. long, 10 ft. wide; 20 ft. long, 4 ft. wide; 26 ft. long, 5 ft. wide; 12 ft. long, 3 ft. wide; and 26 ft. long, 5¼ ft. wide. Dev: 5 trenches. Assays: 5.57% to 30.92% Mn, 8.90% to 29.89% Fe, 19.80% to 58.54% SiO₂. Ref: 48-A, p. 27. 94, p. 17. 127, p. 445.

Crescent (33)

(see also Peggy)


Daddy and Mother (40)


Daisy (39)

av. thickness of about 6 ft. over lateral distance of 300 ft. They are not parts of a continuous body. Dev: 30-ft. adit. Ref: 48-A, p. 32. 94, p. 14. 158.

**Divide (28)**


**East Extension**


**Ed B (Madeline, Eureka) (19)**


**Ella (60)**

(see also Idaho, Broken Shovel, and Ella)

Loc: Sec. 20, (29-6W). Ore: Manganese. Assays: 13.2% Mn, 8.4% Fe, 68.3% SiO₂. Ref: 158.

**Eureka**

(see Ed B)

**Eureka Creek (13)**


**F. and L. (61)**


**Fir**


**Griff Creek (51)**


**Happy Lake Ridge**


**Heckle**


**Helen (27)**


**Hemlock (42)**

(see also Thompson)


**Hurricane (52)**


**Hurricane Hill Lookout (55)**


**Idaho, Broken Shovel, and Ella (62)**

(see also Broken Shovel, Ella)


**J and J and Sunset (56)**


**Johnnie M.**

(see Peacock and Johnnie M.)

**June (21)**


**Kate (6)**


**King**

Lady Norma (50)

Last Chance (22)

Lena (29)

Littleton (23)
(see also Peacock and Johnnie M.)

Lookout (34)

Lost Kremer (18)
Loc: Sec. 25, (30-11W). Ore: Manganese. Ore min: Cinnabar was found in NW ¼ sec. 25, (30-11W), in the E. bank of small stream, possibly at the Lost Kremer property. Assays: 2.73% Mn, 19.88% Fe, 70.14% SiO;. Ref: 158.

Lucky Strike (20)

Madeline (see Ed B)

Mark Twain

Maybee (9)

Mother (see Daddy and Mother)

Mount Angeles (63)
Loc: On S. side of Third Peak of Mt. Angeles, probably in sec. 20, (29-6W). Ore: Manganese. Deposit: Ore exposures of substantial size are reported. Ref: 158.

Oberg

Old Gold Quartz (35)

Olympia Star (24)

Peacock and Johnnie M. (25)
(see also Littleton)
Loc: On Littleton Cr. in sec. 20, (30-10W). Elev: 1,400 and 1,700 ft. Access: About 1¼ mi. NE of Heckles. Prop: Part of Littleton Cr. group. Ore: Manganese. Ore min: Bementite, neotocite. Deposit: 4 exposures—14 ft. long and 10 ft. wide, 9 ft. long and 5 ft. wide, 10 ft. long and 6 ft. wide, and another small exposure. Assays: 33.08% to 33.20% Mn, 7.17% to 7.42% Fe, 23.86% to 25.54% SiO;. Ref: 48-A, pp. 29–30. 94, p. 15.

Peggy (36)
(see also Crescent)
Loc: NW ¼ sec. 24, (30-10W), 1,300 ft. NE of portal of main Crescent adit. Elev: 2,100 ft. Prop: 1 claim: Peggy (part of Crescent property). Owner: E. F. McTarnahan, Port Angeles, Wash. (1952). Ore: Manganese. Ore min: Hausmannite, pyrolusite. Gangue: Calcite. Deposit: Body of ore similar to that at Crescent mine encountered 65 ft. below the surface, 4 ft. thick and 15 ft. long. Dev: Drill hole. Shaft to depth of drill hole now caved. Assays: 45.60% Mn, 8.21% Fe, 17.6% SiO;.

Pine Ridge (14)

Riverside (10)

Royal (2)

St. Regis (26)

Seattle (7)
Loc: SE ¼ sec. 21, (30-11W), on S. slope of Snake Peak about 1 mi. NW of Snider Ranger Station. Elev: 1,845 ft. Ore: Manganese. Ore min: Bementite. Deposit: Manganese ore body 25 ft. long and 12 ft. wide surrounded by altered vesicular basalt. Dev: Trench. Assays: 14.65% to 32.49% Mn, 15.63% to 27.76% Fe, 16.58% to 46.12% SiO;.

Section 23 (15)

Sekiu River (1)

Skookum (53)
Loc: Sec. 12, (29-7W), 4,000 ft. NW of the 6 mi. post on the Little R. trail, on a ridge extending northward from Unicorn Bridge. Access: By trail either up river from the Little R. road or from the Hurricane Lookout road to the S. Prop: 1 claim. Ore: Manganese. Ore min: Bementite.
Manganese Occurrences—Clallam County

Three Musketeers
Loc: Sec. 34, (30-10W). Ore: Manganese. Deposit: Av. 4 ft. thick. Ref: 158.

Thompson (Sutherland) (46)
(see also Cedar, Hemlock)
Loc: Due S. of center of Lk. Sutherland in what would be about sec. 27, (30-8W) if surveyed. Elev: 3,400 ft. Access: Not accessible by trail or road; reached by 3 mi. of overland travel. Prop: 6 claims; Cedar, Hemlock, and 4 others. Ore: Manganese. Ore min: Bementite, neotocite, hausmannite. Deposit: Lenses of manganese minerals have been found for 600 ft. along strike of tuff and limestone which lie between basalt flows generally less than 3 ft. thick. Dev: 135-ft. shaft, sunk by U. S. Bureau of Mines, and some open cuts. Assays: 30.60% to 34.20% Mn, 6.20% to 9.20% Fe, 19.20% to 34.20% SiO₂. Ref: 48-A, p. 33. 94, p. 19. 127, pp. 446-447. 158.

Three Musketeers (31)
Loc: Sec. 34, (30-10W). Ore: Manganese. Deposit: Av. 4 ft. thick. Ref: 158.

Sunset
(see J and J and Sunset)

Sunrise (16)
Loc: SW¼NE¼ sec. 24, (30-11W), 1 mi. N. of U. S. Highway 101, 1 1/2 mi. W. of Neckles. Elev: 2,176 to 2,194 ft. Prop: 1 claim: Sunrise. Ore: Manganese. Ore min: Bementite. Deposit: Bodies of bementite ore—50 ft. long, 4 ft. av. width; 28 ft. long, 3 ft. av. width; and 21 ft. long, 4 ft. av. width. Dev: 3 trenches. Assays: 4.64% to 29.55% Mn, 12.76% to 34.85% Fe, 18.36% to 63.93% SiO₂. Ref: 48-A, p. 29. 94, p. 16. 158.

Storm King (43)

Summit (30)

State Lease (Beaver Creek) (3)

Sooes River


Sutherland
(see Thompson)

Thompson (Sutherland) (46)
(see also Cedar, Hemlock)
Loc: Due S. of center of Lk. Sutherland in what would be about sec. 27, (30-8W) if surveyed. Elev: 3,400 ft. Access: Not accessible by trail or road; reached by 3 mi. of overland travel. Prop: 6 claims; Cedar, Hemlock, and 4 others. Ore: Manganese. Ore min: Bementite, neotocite, hausmannite. Deposit: Lenses of manganese minerals have been found for 600 ft. along strike of tuff and limestone which lie between basalt flows generally less than 3 ft. thick. Dev: 135-ft. shaft, sunk by U. S. Bureau of Mines, and some open cuts. Assays: 30.60% to 34.20% Mn, 6.20% to 9.20% Fe, 19.20% to 34.20% SiO₂. Ref: 48-A, p. 33. 94, p. 19. 127, pp. 446-447. 158.

Victoria

West Extension

Whistler Flats South (57)

Whistler Flats Southwest (58)

Wildcat

Ferry County

Humboldt (3)
(see under copper)

Last Chance (2)
(see under copper)

Meteor (1)
(see under silver)

Ray

Grays Harbor County

Antlers (8)
(see also Egge)

Black Wonder (9)

Burnt Mountain
(see Burnt Peak)

Burnt Peak (Burnt Mountain) (15)

Cook Creek (2)

Coon Creek

East Cook Creek (3)

Egge (Quinault) (4)
(see also Antlers, Pioneer)

Esther-Irene (5)

Excelsior (16)

Fishe1 (1)

Fosburg (22)

A. E. Graham (23)

Grays Harbor Title (24)

W. H. Hopkinson (25)

Hydman (26)

Irene
(see Esther-Irene)

Knowles (21)

Lizaud (6)

Norma

Paramont (17)
Loc: Sec. 6, (20-12W). Ore: Manganese. Ref: 158.

Pioneer (10)
(see also Egge)

Polson (30)

Quinault
(see Egge)

Ralphson (27)

Reed & Sims

Richards (11)

Robinson (28)

Sims
(see Reed & Sims)

Skunk-Cook Creek Divide (7)

Spurr

Star (12)
Stevens Creek (13)

Stevens Creek, North Fork (14)

Supreme (19)
Loc: Sec. 6, (20-12W). Ore: Manganese. Ref: 158.

Thomas Svendsen (29)

Wynoochee (20)

JEFFERSON COUNTY

Albino Rodriguez (6)
Loc: Near center NW¼ sec. 25, (26-3W), on tributary to Dosewallips R. Ore: Manganese. Ore min: Manganese silicate. Deposit: Manganese deposit in greenstone is 1 to 2 ft. wide and traceable for 100 ft. Ref: 158.

Black Hump (9)

Duckabush River (8)

Elk Horn (4)
(see also Karnes)

Karnes (5)
(see also Elkhorn)

Lucky Creek (7)

Mount Claywood (1)

North Pole Quartz (10)

Tubal Cain (2)

Tull City (3)
Loc: Approx. ½ mi. NW. of Tubal Cain adit. Prop: May be part of Tubal Cain group of claims. Ore: Manganese. Deposit: Manganese ore crops out on E. side of the craggy ridge between Tull City and Tubal Cain prospects. Ref: 48-A, p. 34. 125, p. 430.

KITTITAS COUNTY

Denney (1)
LEWIS COUNTY

Chehalis River (1)


MASSON COUNTY

Apex (Black Rock) (9)


Black Hump (4)


Black Queen (5)


Brown Mule

(see Triple Trip)

Hi Hope (6)


India (Steel Creek) (12)


Keller Smith (see Luck) Lucky Jack


Old Crow (15)


Rose Aster (7)


Russian No. 1

Loc: T. 23 N., R. 6 W., Lk. Cushman area. Ore: Manganese. Ore min: Bementite. Assays: 25.20% Mn, 28.90% SiO₂, 11.09% Fe, 0.09% P. Ref: 158.

Smith (Keller Smith) (3)

**Steel Creek**

(see Bosnia, India)

**Triple Trip (Brown Mule)** (8)

(see also McKeen)

Loc: Secs. 4 and 8, (33-5W), on Copper Cr., about 1/2 mi. above its confluence with Skokomish R. Elev: 1,000 ft. Access: 1/2 mi. up Copper Cr. from Skokomish R. road near Lincoln Guard Station. Prop: Includes McKeen claim. Owner: C. E. Brown and C. E. Russell, Olympia, Wash., hold the property by possessionary title (1942). Triple Trip Mining & Milling Co. (1910). Mt. Elinor Manganese Mining & Smelting Co. (1921-1924). Ore: Manganese, iron. Ore min: Bementite, manganese-magnetite (?). Deposit: Elongated lens along a basalt-red limestone contact is 50 ft. long and 1 to 4 ft. wide. Dev: 50-ft. adit composed of hard black oxide material similar to that in some deposits in Skokomish R. area. Sooty bed reportedly av. 4 ft. thick. Assays: Analyses of 6 samples showed 6% to 25% Mn, 8% to 21% Fe, 11% to 37% SiO2, 4% to 36% CaO. Prod: Reportedly a carload of ore during World War I; said to contain 35% to 45% Mn, 17% to 30% Fe, 11% to 37% SiO2. Reportedly a deposit of 98,130 tons in 1936 reported by owner. Ref: 111, 157.

**Pend Oreille County**

**Silver Cliff** (3)

(see under silver)

**Three Buttes**

(see Pogue Flat)

**Skagit County**

**Belleville (Koehler)** (4)


**Fidalgo** (1)


**Iron Mountain**

(see Hamilton under iron)

**Koehler**

(see Belleville)

**Last Chance** (6)

(see under iron)

**Mountain Home** (2)


**Pittsburg**

(see under iron)

**Samish Bay** (3)


**Tennessee No. 3**

(see under iron)

**Snohomish County**

**Cicero (Paddock)** (1)

Loc: Sec. 4, (32-6E), on S. slope of Bald Mtn. Access: About 1 1/2 mi. by trail up Grant Cr. Prop: 1 unpatented claim. Owner:
SPOKANE COUNTY

French Creek (3)
Loc: Near center sec. 16, (32-8E), in cuts along French Cr. road, 4 mi. from railroad. Access: Road. Ore: Manganese. Ore min: Rhodinite, rhodochrosite (?), manganese oxide. Deposit: Road cut exposes a lens or faulted vein of rhodonite and possibly rhodochroite in schistose greenstone. The lens or vein is 8 to 10 ft. long and 3 ft. wide. It is weathered to black manganese oxide for about 1 ft. below the surface. Dev: None. Assays: One sample gave 39.39% Mn. Ref: 158.

Lake Riley (2)

Paddock
(see Cicero)

STEVENSON COUNTY

Dartford (1)

Lake Riley

YAKIMA COUNTY

Ironstone Mountain (1)

MERCURY

Properties—Mercury, called quicksilver by most miners, is a silver-white heavy metal (heavier than lead) which is liquid at ordinary temperatures. It solidifies at -39°C and is then tin-white, ductile, malleable, and soft enough to be cut with a knife. Mercury when pure does not tarnish on exposure to air. It has low vapor pressure and has a regular coefficient of expansion. It is a fair conductor of heat and electricity, the thermal heat conductivity being about two-thirds that of silver. Its vapor conducts electricity and, in doing so, emits radiations rich in ultraviolet rays. Mercury alloys with most metals except iron and platinum, and it combines with sulfur at ordinary temperatures. It is next to silver in the electromotive series and resembles copper in its chemical behavior. It is both bivalent and univalent, and its compounds are poisonous, but in small doses they are medicinal. Other properties are shown in the table on page 12.

Uses—The various uses from year to year consume markedly different proportions of the total United States mercury consumption. In 1950 the most important uses were for electrical apparatus, pharmaceuticals, industrial and control instruments, and agriculture (disinfectants and fungicides), which used respectively 24, 12, 11, and 9 percent of the total consumption. Other uses, in declining order of importance, were in antifouling paint for ship bottoms, catalysts, dental preparations, electrical preparation of chlorine and caustic soda, fulminate for silver ores, vermillion paint, and minor uses in mirrors and for mercury salts for wood and fabric preservation, printing, staining, and photography. An increasing use is in a new type of dry battery, and another interesting use is in mercury-vapor boiler power plants, replacing water vapor.

Production—During periods of high mercury prices domestic mines have been able to supply the demands for the metal, but normally this country is a large importer of mercury. United States production was high during the two world wars and from 1928 to 1931, but since 1943 (highest production since 1882) domestic production dropped off each year until 1950, when the output was lower than in any year since before 1850. With increasing prices in 1951 and 1952, production increased somewhat.
Cinnabar, the ore of mercury, is known to occur in 13 of Washington’s 39 counties, but the only production of any consequence has come from the Morton district of Lewis County. The first recorded production there was in 1916. The district later produced 6,438 flasks (76 pounds per flask) valued at $669,656 during the period 1926 through 1942, with production in each year except 1939.

Prices—For many years the price of mercury has been controlled by international cartels, but the Spanish-Italian cartel which had dominated the market was reported to be dissolved in 1950 and to be inoperative throughout the year. Average yearly mercury prices stayed very close to $40 per flask from 1876 to 1913, then rose to $120 during World War I, dropped to $45 in 1921, and gradually rose to a high of $124 in 1928, only to slip back to $56 in 1932. During World War II the average yearly price rose to $198 in 1942. After 1943 the price dropped off to a low of $70 in June 1950, then rose to $225 in January 1951, a more than three-fold increase in price. Such violent price fluctuations as these are controlled by international cartels, but the market is subject to many influences. Many of the large mining companies are reluctant to engage in mercury mining. In 1954 the General Services Administration announced a 3½-year purchase program, with a floor of $225 per flask, to purchase 125,000 flasks of mercury from domestic producers.

Ore minerals—More than 95 percent of the world’s supply of mercury comes from the sulfide, cinnabar, HgS, which contains 80.2 percent mercury. Some ores contain native mercury, others contain metacinnabarite, Hg2S4, and a few other minerals have occasionally been mined for their mercury content. In all, about 25 mercury minerals are known.

Geology—Mercury ores are widespread in their occurrence and are found in rocks of all ages and kinds, but most commonly are in regions of late Tertiary or Recent volcanic activity. They are shallow, less than 2,000 feet deep, and usually much less than that, and were deposited from low-temperature alkaline waters in highly fractured veins and bodies of irregular shape. Common accessory minerals are marcasite, pyrite, and stibnite; and the gangue minerals may be quartz, chaledony, opal, calcite, dolomite, or barite. The tenor of ore mined in this country in 1950 ranged from 0.15 to 5.1 percent (3 to 102 pounds of mercury per ton of ore), and averaged 0.465 percent, or 9.3 pounds per ton. For comparison, ore mined in 1850 averaged 740 pounds per ton; in 1863, 360 pounds; in 1885, 20 pounds; and in 1928, 7.9 pounds.

Occurrences

The map showing the numbered mercury occurrences is plate 16, on page 43 in volume 2.

CHelan County

Bartlett (2)


Black Jack (6)

(see under gold)

Blewett (see Black Jack under gold)

Cinnabar King

(see under gold)

King Creek (7)

Loe: At head of King Cr., probably in sec. 10, (22-17E). Ore: Mercury. Deposit: Veinlet of cinnabar 0.1 in. thick cuts serpentine. Can be traced 20 ft. Ref: 161, p. 78.

La Rica

(see Black Jack under gold)

Leavenworth

(see Orondo)

North Pole (4)

(see under gold)

Orondo (Leavenworth) (1)


Shoshone (5)


Squaw Saddle (8)


Tom Burke


Velma (3)


Clallam County

Beaver Creek

(see State Lease under manganese)

Clallam (4)

(see under manganese)

Crescent (8)

(see under manganese)
June (6)  
(see under manganese)

Lost Kremer (5)  
(see under manganese)

Royal (2)  
(see under manganese)

St. Regis (7)  
(see under manganese)

Sekiu River (1)  
(see under manganese)

State Lease (3)  
(see under manganese)

CLARK COUNTY

Golden Wonder (1)  

Silver Tip (1)  
(see also H-O-M-E)

Ellensburg  

Elsener (3)  

H-O-M-E (6)  
(see also Silver Tip)

Keyeside (2)  

COWLITZ COUNTY

Green River (1)  

Red Star  

KING COUNTY

Byrd (1)  
Loc: Sec. 9, (21-7E), near Byrd. Ore: Mercury. Ref: 158.

WASHINGTON QUICKSILVER  

LEWIS COUNTY

Apex (Gallagher, Miller, Consolidated) (8)  

Barnum-McDonnell (9)  


Chapman

Charlotte Ann
(see Lytle-Lynch)

Consolidated
(see Apex)

Eight-Seventeen (14)

Fisher
(see Roy)

Fisher Lease (4)

Gallagher
(see Apex)

Gillispie
(see Roy)

Kropolis
(see Lytle-Lynch)

Ladd (1)
Loc: Sec. 12, (14-4E), N. of Morton. Access: Road. Ore: Mercury. Deposit: Cinnabar float was found when a new road was built to the upper adit of the Ladd coal mine. Ref: 158.

Lynch
(see Lytle-Lynch)

Lytle-Lynch (Charlotte Ann, Kropolis) (10)

McDonnell
(see Barnum-McDonnell)

Miller
(see Apex)

Morton
(see Roy)

N. P. (3)

Parmenter (11)

Roy (Fisher, Morton, Gillispie) (12)

Roy No. 5 (13)

Section One (5)

Section Thirty-Six (5)

Seventeen
(see Eight-Seventeen)
MOLYBDENUM

Properties—Molybdenum is usually prepared as a gray metallic powder, but the pure metal is silvery white and is soft, tough, malleable, and has high tensile strength. Very small amounts of certain impurities make the metal brittle, hard, and darker in color. It can be filed, polished, machined, forged when hot, and drawn into wire, although it was formerly thought to be non-ductile. The properties of strength, toughness, and resistance to repeated shocks are retained at relatively high temperatures. Its melting point is higher than that of all but four other elements: tantalum, rhenium, tungsten, and uranium. Its electrical conductivity is fair but is less than one-third that of copper. Molybdenum is closely related chemically to chromium, tungsten, and uranium. It has
valences of 2, 3, 4, 5, and 6, but the compounds in which it acts in the 6 state are the most important. Other properties are shown in the table on page 12.

Uses—In 1950 more than 90 percent of the molybdenum consumption was for metallurgical uses, about 70 percent going into steel and 20 percent into cast iron. The remaining 10 percent was used as the pure metal and in nonferrous alloys and nonmetallic products. Molybdenum may be used as a substitute for tungsten in many steels. Used alone in steel it gives a product which is strong and easily welded, and used with other steel-forming elements it enhances the effects of those elements on the steel. Molybdenum steels are put to such uses as boiler plate, rifle barrels, auto parts, propeller shafts, and tool steel. Added to cast iron, molybdenum adds strength, toughness, and machinability. Nonferrous alloys of molybdenum are not very important, but an alloy with cobalt is useful in having a coefficient of expansion equal to that of glass, and alloys with tungsten make good incandescent filaments. A few other alloys are chromium-molybdenum; nickel-chromium-molybdenum; and the alloy illium, that contains 4 percent molybdenum plus chromium, nickel, copper, manganese, tungsten, and iron. Pure molybdenum metal is used as supports for filaments in electric lights and radio tubes, for X-ray tube elements, for winding resistance units for electric furnaces, and for electrical contact points. Molybdenum compounds are finding increasing uses in lubricants, pigments, printer's ink, leather tanning, enameling of iron and steel, fabric dyeing, and as a catalyst in the hydrogenation of coal and mineral oil.

Production—Molybdenum is the only alloying element used in steel-making in which the United States is self-sufficient, and production in this country in the past 20 years has averaged about 90 percent of world output during that period. Domestic reserves have been estimated to be sufficient to last for 400 years at the 1935 to 1939 rate of use. A few very large mines dominate the production. Of the nine mines producing molybdenite concentrate in this country in 1950 only two were mining molybdenum as the principal product; molybdenum was a byproduct at the other seven mines, six of which were copper mines and one tungsten. United States molybdenum ore production rose from 1,397 pounds of contained molybdenum in 1914 to 861,537 pounds in 1918, dropped to 22,267 pounds in 1923, and rose to an all-time high of 61,405,000 pounds in 1943. Production had dropped to 18,047,000 pounds in 1947 but had risen again to 38,655,000 pounds by 1951.

Washington has numerous occurrences of molybdenum in at least 16 counties, but only a few of the occurrences have been in production, and these only in very small amount. Some production from the Castleman mine in Whatcom County was reported in 1899. During 1901 and 1902 about 20 to 24 tons of molybdenite was produced at the Crown Point mine in Chelan County; this mine for a few years was the only molybdenum producer in the United States. The same mine produced unrecorded amounts in 1903, 1906, 1907, 1914, and 1917. Some of the finest molybdenite specimens to be found in museums all over the country came from this property. One large crystal or cluster of crystals which was recovered weighed 300 pounds. About 22 tons of molybdenite concentrate was produced at the Deer Trail Monitor mine in Stevens County from 1936 to 1939, and in 1941 the Juno-Echo mine in the same county milled 300 or 400 tons of ore, but the molybdenum concentrate produced did not meet purchaser's specifications.

Prices—In 1900 the price was reported to be about $400 per ton of 50- to 55-percent ore. (Only about 10 tons of molybdenum metal had been produced in the world prior to 1900.) From 1908 to 1912 the price was only 30 cents per pound of contained MoS₂ in 92-percent ore. In 1914 the price varied between 70 cents and $2.00, and in 1915 to 1919, from over $3.00 to about 30 cents. The 1920 average of 74 cents per pound rose to 84 cents in 1923 and dropped to 36 cents in 1933. In 1936 it was 42 cents, from 1938 to January 1949 it remained unchanged at 45 cents, from January 1949 to December 1950 it remained at 54 cents, and from that date through 1953, at 60 cents per pound of contained MoS₂ in 90-percent concentrate, f.o.b. mines. In December 1954 the price rose to $1.05 per pound of contained Mo in 90-percent concentrate. Small shippers are likely to receive several cents less than the published price quotations. In 1954 pure molybdenum metal sold at from $6.35 to $16.70 per pound.

Ore minerals—Molybdenum never occurs free in nature, and its compounds are not numerous. The sulfide, molybdenite, MoS₂, containing 60.0 percent molybdenum, is the only important ore mineral, but minor ore minerals are the lead molybdate, wulfenite, PbMoO₄, containing 26.2 percent molybdenum; the oxide, molybdite, Fe₉O₆·3MoO₃·8H₂O, containing about 39 percent molybdenum; and the calcium molybdate, powellite, Ca(Mo,W)O₄, containing about 40 percent molybdenum. All these minerals have been found in Washington.

Ore at the Climax mine in Colorado, the largest molybdenum mine in the world, averaged about 0.5 percent MoS₂ in 1947, but a small deposit having molybdenum as its only recoverable value would have to be several times as rich as this in order to be minable at a profit. Some of the large disseminated copper ore bodies in this country carry about 0.04 percent MoS₂ as a recoverable byproduct.

Geology—Molybdenite almost always is associated with acid igneous rocks. In its economically most important concentrations it occurs as disseminations in replacement deposits. It also occurs in fissure veins, in contact metamorphic deposits, and in pegmatites. Molybdenite is of widespread occurrence in Washington and is found in each of the above types of deposits here, but generally not in sufficient quantity to be profitably recovered. Probably the most common associated mineral is chalcopyrite. Molybdite is an oxidation product of molybdenite, and wulfenite is found in the oxidized parts of some lead veins.
The map showing the numbered molybdenum occurrences is plate 17, on page 45 in volume 2.

CHelan County

Aurelia Crown
(see Crown Point)

Copper King
(see Robischaud)

Crown Point (Aurelia Crown, Crown Power) (1)


Crown Power
(see Crown Point)

Holden (2)
(see under copper)

Howe Sound
(see Holden under copper)

Irene
(see Holden under copper)

Jack Creek (6)


Keef er Brothers (4)

Loc: On W. slope of Red Mtn., near headwaters of Chiwawa R., about 1 mi. S. of Lyman Glacier. Elev: 6,200 to 6,800 ft. Access: Road to Royal Development mine, then 7 mi. by trail along Chiwawa R. Prop: Many unpatented claims. Owner: Lloyd and Boyd Keefer, 1918 N. Prescott, Portland, Oreg. (1948——). Ore: Molybdenum, copper, gold, silver, tungsten, uranium. Also reported are lead, zinc, nickel, cobalt, bismuth, antimony, chromium. Ore min: Molybdenite, chalcopyrite, arsenopyrite, pyrite, uraninite, gummite, scheelite. Gangue: Quartz, tourmaline, chlorite. Deposit: Narrow fissures with some hydrothermal alteration of the wall rock, which is granodiorite intruding schist and gneiss. Dev: Several hundred feet of workings divided among many claims. Assays: A channel sample taken at the most radioactive spot known on the veins assayed 0.1% UO₂. A pitchblende sample of unknown origin assayed 18.00% U₂O₅. The Ag content of the ore runs about 2 oz. for each 1% of Cu. Ref: 156. 158.

Merritt (Smith) (5)


Robischaud (Safety Harbor Creek, Copper King) (3)


Safety Harbor Creek
(see Robischaud)

Smith
(see Merritt)

Ferry County

Abe Lincoln (7)
(see under copper)

Addie B (10)
(see under copper)

Apex
(see Big Chief under lead)

Barstow (Lucky Five and Lakeview) (2)

Loc: Sec. 36, (38-36E), on Boulder Cr., 8 mi. N. of Boyds. Access: 2 mi. from railroad. Prop: 21 claims. Owner: Dayton Stewart and Joe Dilly, Spokane, Wash. (1942). Ore: Molybdenum. Deposit: Drill holes spaced as much as 2,000 ft. apart are said to have encountered molybdenum in amounts as high as 13%. Dev: 12 drill holes to 10 ft. deep. Assays: Samples from 12 holes said to av. 1% Mo. Ref: 157. 158. Note: Former owner states that the reported molybdenite has been proven to be graphite.

Big Chief (4)
(see under lead)

Blevins
(see Meadow Creek under copper)

California (12)
(see under copper)

Chief
(see Big Chief under lead)

Clay (8)
(see under copper)

Cold Spring (3)
(see under lead)

Consolidated Mines and Smelting Co., Ltd.
(see under copper)

Great Western (6)
(see under silver)

Handspike (13)
(see under copper)

Iconoclast (14)
(see under copper)

Illinois (15)
(see under copper)
Jumper (16) 
(see under copper)

Kelly Camp (1) 
(see under tungsten)

King Richard 
(see Meadow Creek under copper)

Lakeview 
(see Barstow)

Lucky Five and Lakeview 
(see Barstow)

Meadow Creek (9) 
(see under copper)

Mount Tolman (11) 
(see under copper)

Oregon 
(see Illinois under copper)

Polepick (17) 
(see under copper)

Rosario (5) 
(see under copper)

San Poil Monitor 
(see Meadow Creek under copper)

Schminski (19) 

Walla Walla (18) 
(see under copper)

GRANT COUNTY

Big Four 
(see Electric City)

Black-Rosauer (1) 
(see under silver and see also Electric City)

Daniels 
(see Electric City)

Electric City (Big Four, Daniels, Black-Rosauer) (2) 
(see also Black-Rosauer under silver)


LEWIS COUNTY

Eagle Peak (1) 
(see under copper)

Short Canyon 
(see under copper)

LINCOLN COUNTY

Egypt 
(see Pitney Butte)

Pitney Butte (Spokane Molybdenum, Egypt) (1) 
Loc: NE¼SE¼ sec. 32, (26-37E), on NE. side of Pitney Butte. Elev: 1,850 to 2,100 ft. Access: Road. Prop: 40 acres deeded land and 8 claims: Spokane, Isabella, Prosperity No. 1, Bayley Fr., and 4 others. Owner: Spokane Molybdenum Mines, Inc., Spokane, Wash. (1941—). Ore: Molybdenum, gold, silver. Ore min: Molybdenite, pyrite, pitchblende. Gangue: Quartz, fluorite. Deposit: A 3- to 4-ft. quartz vein in granite is fairly well mineralized but is badly faulted. Much of the vein is barren. Molybdenite occurs in scattered crystals through the quartz. In the main level a cross-fracture in the main vein contains a black radioactive lens 4 in. or more thick. Dev: 655-ft. adit. A 100-ft. crosscut with a 200-ft. drift cuts the vein 147 ft. higher than at the longer adit (1955). Assays: 0.03 to 0.10 oz. Au, 0.20 to 0.60 oz. Ag, tr. to 2.34% MoS2. Small reserve of ore est. at 0.3% MoS2 (1942). Prod: 1941. Ref: 82-A, 97, 1934, p. 429. 113. 7/1/37, p. 16. 133-B, pp. 31-34. 158.

KING COUNTY

Bear Basin (2) 
(see under silver)
Spokane Molybdenum  
(see Pinney Butte)

OKANOGAN COUNTY

Adams  
(see Monco silgo under copper)

American Graphite  
(see under gold)

American Rand  
(see Spokane under gold)

Arnold Peak  
(see Horseshoe Basin)

Billy Goat  
(2)  
(see under copper)

Bi-Metallic  
(17)
Loe: NW1/4 sec. 26, (39-29E), near Havillah. Elev: 4,100 to 4,800 ft. Access: 22 mi. by road from railroad at Tonasket. Prop: 4 patented claims, on NE ridge of Bi-Metallic Min. Owner: R. C. Mulligan, R. J. Pulley, M. F. Fowler, John Healem, Okanogan, Wash., leasing (1946—) from John B. Stanton, South Pasadena, Calif. (1946—). Ore: Molybdenum, copper, silver, gold, tungsten. Ore min: Molybdenite, molybdate, powellite, scheelite. Gangue: Kaolinitized and sericitized granite porphyry. Deposit: Molybdenite in zone 1 to 5 ft. wide and 50 ft. long in fractures and intersecting faults in Moly adit. Also ore in 2 other fault zones in Moly adit. Slight radioactivity (up to 4 times background count) in ore zones. Oxidized copper mineralization in oval fractured zone 200 ft. long and 70 ft. wide. Deposit is in granite porphyry near contact with metasediments. Dev: 2 adits totaling 600 ft., several shafts, and trenches. Moly adit is at 4,580-ft. elev. Assays: Weighted av. of 4 samples in ore zone is 3.07% Mo across av. width of 4.9 ft. 27 assays by U. S. Bureau of Mines show tr. to 3.87% Mo, 0.02% to 1.26% Cu, tr. to 0.50 oz. Ag, tr. Au. 12 other assays of representative samples av. 1.68% MoS2. Prod: Several tons of copper-gold ore in 1918. 500 lb. of high-grade molybdenum ore was shipped. Ref: 63, p. 110. 97, 1918, p. 506. 98, 1925, p. 1805. 133-B, pp. 34-44. 151, 158.

Boundary  
(see Sheep Mountain)

Buck Mountain  
(24A)  
(see under tungsten)

Buckhorn  
(see Buck Mountain under tungsten)

Caaba  
(see Kaaba under lead)

Campbell  
(see Holden-Campbell under gold)

Carr  
(3)  
(see under copper)

Corson  
(25)  

Crescent  
(see Triune under gold)

Dodd  
(see Sheep Mountain)

Dutch John  
(28)  
(see under tungsten)

Eagle  
(18)  
(see under gold)

Fluorspar  
(see Tonasket under copper)

Four Metals  
(9)  
(see under lead)

Frankie Boy  
(22)  
(see under silver)

Golden Chariot  
(12)  
(see under copper)

Golden Zone  
(8)  
(see under gold)

Green Lake  
(24)  

Hanks  
(4)  
(see under copper)

Holden-Campbell  
(30)  
(see under gold)

Hoot Owl  
(21)  

Horseshoe Basin (MacPhearson, Arnold Peak)  
(7)  

Hudnut (Hudnutt)  
(36)  
(see under zinc)

Independence  
(29)  
(see under gold)

Jim Dodd  
(see Sheep Mountain)

Kaaba  
(11)  
(see under lead)

Kaaba-Texas  
(see Kaaba under lead)

Lady of the Lake  
(23)  
(see under silver)

Lodge  
(see Dutch John under tungsten)

Luke  
(see Molly under copper)

MacPhearson  
(see Horseshoe Basin)
Malott (28)  
(see under copper)

Mineral Hill (21)  
(see under silver)

Molly (6)  
(see under copper)

Molly (Sheep Mountain)  
(see Sheep Mountain)

Moncosilgo (14)  
(see under copper)

Montgomery  
(see Tonasket under copper)

O. K. (13)  
(see under copper)

Pioneer  


Rustler (27)  
(see under gold)

Seven Devils  
(see Mineral Hill under silver)

Sheep Mountain (Molly, Dodd, Jim Dodd, Boundary) (1)


Sherwood  
(see Dutch John under tungsten)

Silver Tip  
(see Starr)

Spokane Tip (15)  
(see under gold)

Starr (Silver Tip) (19)

Loc: SE1/4 sec. 8 or NE1/4 sec. 16, (37-26E), on E. flank of Aeneas Mtn. between Aeneas Cr. and Horse Springs Coulee. Elev: 3,200 ft. Access: 1 mi. of road from Aeneas Cr. road in NE1/4 sec. 17, (37-20E). 12 mi. from railroad at Tonasket. Prop: 1 claim: Silver Tip. Owner: Wilbur Starr, Tonasket, Wash. (1942-1945). Molybdenum Products Co. (1928). Molybdenum Corporation of America (1928). Titanium Alloy Manufacturing Co. (1936). Ore: Molybdenum, tungsten. Ore min: Pyrite, molybdenite, scheelite, chalcopyrite, and rarely arsenopyrite and pyrrhotite. Gangue: Quartz. Deposit: Mineralized fracture zone in granite 80 by 400 ft. in plan and at least 240 ft. in depth. Est. 800,000 tons of 0.30% MoS2 ore. Dev: Main adit of 1,800 ft., 2 short adits and several open cuts total nearly 3,000 ft. of workings. Deposit has been developed to depth of 250 ft. Assays: Fraction of one percent scheelite, and 0.165% to 0.7% MoS2. Av. of 29 general samples was 0.42% MoS2. Av. of 8 other samples was 0.53% MoS2. Prod: 3,000 tons of ore from dump shipped to mill at Nighthawk in 1939 reported to assay 1% MoS2. Ref: 34, 37, p. 42. 64. p. 83. 97. 1927, pp. 398-399. 106, 8/2/28, p. 3. 130, p. 81. 133-B, pp. 51-62. 141, p. 95. 157. 158.

Sterling (34)  

Summit (10)  
(see under silver)

Swayne (5)  
(see under copper)

Texas Creek  
(see Dutch John under tungsten)

Tonasket (20)  
(see under copper)

Triune (16)  
(see under gold)

Twin Pine (35)  
(see under zinc)

Wasco (33)  
(see under silver)

Washington Consolidated  
(see Mineral Hill under silver)

Washington Nickel  

PEND OREILLE COUNTY

Coffin (2)  
(see under zinc)

Little Noisy (3)  
(see under zinc)

Molybdenite Mountain (4)  

Polly Molly (1)  

PIERCE COUNTY

Golden Rule (1)  
(see under zinc)

White River  
SKAGIT COUNTY

Bornite
(see North Coast under gold)

British
(see Skagit Queen under silver)

North Coast (2)
(see under gold)

Skagit Queen (3)
(see under silver)

Thunder Creek
Loc: On Thunder Cr., a headwater tributary of Skagit R. Ore: Molybdenum. Ore min: Molybdenite. Deposit: Said to be a promising deposit. Note: Investigation in this area by the Division of Geology (1940) did not reveal any molybdenite. Ref: 139, p. 82, 141, p. 96.

Washington (1)

SKAMANIA COUNTY

Columbia Gold and Copper
(see Miners Queen under copper)

Miners Queen (1)
(see under copper)

Spirit Lake

SNOHOMISH COUNTY

Armament (17)
(see under copper)

Bergensen
(see Taylor & Nunn under gold)

Bonanza
(see Mineral Center under copper)

Calumet
(see Glacier Peak under copper)

Copper Lake (6)

Edison
(see Mineral Center under copper)

Engdahl
(see Martin Engdahl under lead)

Glacier Peak (3)
(see under copper)

Golden Eagle (14)

Hicks
(see Sultan King under copper)

Hustler (7)
(see under copper)

Iowa (10)
(see under copper)

Jones
(see Kromona under copper)

Kromona (16)
(see under copper)

Louise
(see Mineral Center under copper)

Martin Engdahl (13)
(see under lead)

Mineral Center (12)
(see under gold)

Mint
(see Iowa under copper)

Molly (18)
(see under uranium)

Nesta (3)
(see under copper)

North Star
(see Sunrise under gold)

Nunn
(see Taylor & Nunn under gold)

Oldfield
(see Sunrise under gold)

Rustler (8)
(see under copper)

St. Theresa (15)

Scriber
(see Kromona under copper)

Silver Horseshoe (5)
(see under silver)

Sultan King (11)
(see under copper)

Sultan Queen
(see Sultan King under copper)

Sunrise (1)
(see under gold)

Sunrise (9)
(see under copper)

Taylor & Nunn (2)
(see under gold)
Tum Tum
(see Taylor & Nunn under gold)

Washington-Iowa
(see Mineral Center under gold)

Wayside
(see Armament under copper)

STEVENS COUNTY

Aladdin
(see Sierra Zinc under zinc)

American (2)

Black Horse
(see Columbia Tungsten under tungsten)

Blue Ridge
(see Sierra Zinc under zinc)

Blue Star
(see Eagle under silver)

Chewelah Eagle
(see Sierra Zinc under zinc)

Chewelah Standard (14)
(see under copper)

Columbia River (8)
(see under copper)

Columbia Tungsten (11)
(see under tungsten)

Constitution
(see Lawrence)

Coyote
(see Rightside under copper)

Deer Trail Monitor (17)

Easy Money
(see Magma under zinc)

Eldorado
(see Magma under zinc)

Germania (18)
(see under tungsten)

Germania Consolidated (19)
(see under tungsten)

Gray Eagle
(see Rightside under copper)

Industrial Tungsten
(see Germania Consolidated under tungsten)

Judd
(see Lawrence)

Juno-Echo (15)
(see under copper)

Keeth
(see Germania Consolidated under tungsten)

Koyotte
(see Rightside under copper)

Lawrence (Constitution, Judd) (3)

Magma (7)
(see under zinc)

Nellie S.
(see Chewelah Standard under copper)

New Leadville (5)
(see under lead)

Norton
(see Germania Consolidated under tungsten)

O'Neal
(see Rightside under copper)

Ray Cox Moly (4)

Redwood
(see Eagle under silver)

Rightside (9)
(see under copper)

Rocky Lake (10)
Sand Creek (20)  
(see under tungsten)

Schenk  
(see Rightside under copper)

Short Wait (1)  
(see under lead)

Sierra Zinc (6)  
(see under zinc)

Stockwell  
(see Columbia Tungsten under tungsten)

Tungsten King (16)  
(see under tungsten)

Washington Metals (12)  
(see under tungsten)

Western Molybdenum  
(see Juno Echo under copper)

Yo Tambien  
(see New Leadville under lead)

WHATCOM COUNTY

Castleman


Midas (1)


Shuksan  
(see Sulphide Creek)

Silver Creek (2)

Loc: 5 1/2 sec. 8, (40-13E), on Silver Cr., 2 mi. S. of Canadian boundary. Elev: 2,200 ft. Access: Boat up Ruby Lk., thence by trail up Silver Cr., or by road through Canada to mouth of Silver Cr. Prep: 4 claims, including Molybdenum, Lost Mine. Owner: Roy Davis, George Hunt, A. E. Blockberger, Shelton, Wash. (1908). H. E. Davis and Dr. Harry Deegan, Shelton, Wash. (1939). Ore: Molybdenum, copper, gold, silver. Ore min: Molybdenite, chalcopyrite. Deposit: On S. side of Silver Cr. in granodiorite near contact with volcanic rock is zone 10 ft. wide containing 3% to 1-in. quartz stringers with scattered chalcopyrite and clusters of molybdenite. On N. side of creek an open cut and an adit 64 ft. lower show a bleached and silicified zone in volcanic breccia 50 ft. in dia. containing scattered molybdenite and chalcopyrite. Dev: 65-ft. adit, open cuts. Assays: Chip sample of zone at face of adit showed Au nil, Ag 0.60 oz., Cu 1.50%, molybdenite 0.15%. In open cut 64 ft. higher the ore is est. to carry 1% molybdenite and 2% to 3% Cu. Ref: 133-B, pp. 87-88. 158.

Sulphide Creek (Shuksan) (3)


YAKIMA COUNTY

Bird (2)  
(see under tungsten)

Chinook (1)  
(see under copper)

Copper Mining Co. (3)  
(see under copper)

Crosetti (4)


NICKEL

Properties—Nickel is a lustrous white metal capable of taking a high and lasting polish. It is harder than iron and is tenacious and very malleable and ductile. It is somewhat magnetic and is a fair conductor of heat and electricity, its electrical conductivity being about one-fifth that of copper. Nickel imparts to its alloys toughness and strength as well as desirable anti-corrosion and thermal properties. Chemically, it is closely allied with cobalt and iron. Nickel has valences of 2 and 3, but in most of its compounds it is bivalent. The metal is stable in air at ordinary temperatures. Other properties are shown in the table on page 12.

Uses—Although the pure metal is used for electro-plating, nickel is chiefly valuable for the alloys it forms with other metals. Over 3,000 alloys of nickel with iron and copper have been developed. Other metals with which it has been alloyed are silver, zinc, tin, beryllium, magnesium, aluminum, and cobalt. The steel and iron industry used about 43 percent of the nickel consumed in the United States in 1950. The leading uses in their order of importance were for nonferrous alloys, stainless steel, electroplating, other steels, high-temperature and electrical-resistance alloys, cast iron, catalysts in hydrogenating organic substances, and ceramics. Minor uses are in coinage, in Edison alkaline storage batteries, and in pharmaceuticals and dyes.

Production—There are few nickel smelters in the world, and most of them do little, if any, custom smelting. Although the United States accounts for more than half of the world nickel consumption, domestic production of the metal amounts to less than 1 percent of that of the world. About 80 to 85 percent of the world production normally comes from Canada. The small domestic output in 1950 was in the form of nickel sulfate and came entirely as a byproduct of copper smelting from five smelters, one of which was the copper smelter of the American Smelting and Refining Company, at Tacoma, Washington.

Although nickel occurrences have been reported in at least 13 counties in Washington, no ore has ever been mined for its nickel content in this state. Some of the lateritic deposits in the Cle Elum River-Blewett area in Kittitas and Chelan Counties are of sufficient size and...
grade to indicate a potential value as ores of nickel, especially in view of the development of the Riddle, Oregon, deposit (somewhat similar metallurgically), where three electric furnaces in 1954 started production of nickel from local ore.

**Prices**—For many years the price of nickel has been comparatively stable. From 1929 to 1944 the price was 35 cents per pound for the metal, and from 1944 to 1946 it was 31.25 cents per pound, including duty, for electrolytic nickel in carlots, f.o.b. Port Colborne, Ontario. In 1946 the price rose to 36 cents and remained there for more than a year, but it dropped a little to 33.1/2 cents in 1948 and rose to 40 cents in the same year. The price remained the same until two rises in 1950 brought it to 50.25 cents and further rises in 1951 brought the price to 56 cents, where it remained through the following year. In June 1955 the price was 64.25 cents per pound.

**Ore minerals**—Nickel occurs native in meteorites and is combined with sulfur, arsenic, iron, and antimony in many ores. At least 35 nickel minerals are known. The most important nickel ores are nickelliferous pyrrhotite and chalcopyrite, containing up to 6 percent nickel, usually in the form of minute particles of pentlandite, (Fe-Ni)S, which contains about 22 percent nickel. Another nickel sulfide is millerite, NiS, containing 64.7 percent nickel. Garnierite, another important ore mineral, is a hydrated silicate of magnesium and nickel having an extremely variable composition. All these above-named minerals occur in Washington in addition to the secondary hydrous nickel sulfate, morenosithe, NiSO₄·7H₂O.

The important ores of Sudbury, Canada, average about 1½ percent nickel and 2 percent copper. The New Caledonian silicate ores run from 2 to 6 percent, and 1940 production averaged 3.8 percent nickel. Cuban laterites, similar to the Cle Elum River-Blewett ores, comprise large ore bodies averaging 0.8 to 1.5 percent nickel and 1 to 2 percent chromium.

**Geology**—There are relatively few workable deposits of nickel in the world, because, although nickel is more abundant in the earth’s crust than copper, zinc, or lead, it generally is not concentrated but is widely and diffusely distributed, especially in magnesium-rich rocks. There are only two important types of nickel deposits—residual nickel silicate concentrations from the weathering of nickel-bearing ultrabasic rocks, and sulfide deposits of nickel and copper formed either by replacement or magnetic injection. The Sudbury deposit is of the latter type. It contains pentlandite closely associated with pyrrhotite and chalcopyrite in the outer, basic, edge of a large spoon-shaped intrusive body of norite-micropegmatite 36 miles long and 20 miles wide. Of much less importance as a source of nickel are the silver-cobalt-nickel vein deposits such as those at Cobalt, Ontario.

### Nickel Occurrences—Chelan County

**Chelan County**

**Black Republican**

(see under copper)

**Blewett** (24)

(see under iron)

**Bonanza and Deadwood**

(see under gold)

**Chelan**

(see Dick)

**Cinnabar King**

(see under gold)

**Davenport**

(see Nigger Creek under iron)

**Deadwood**

(see Bonanza and Deadwood under gold)

**Dick (Chelan, Winesap)** (6)

Loe: S1/2, NE1/4, sec. 8, (25-21E), on a northward-trending spur on the N. side of Winesap (Oklahoma) Canyon. Elev: 1,400 ft. Access: 0.9 mi. by road from railroad and highway U. S. 97. Prop: 30 acres of deeded property. Owner: E. N. Patty, Seattle, Wash., leasing from Mrs. Hazel E. Growden and associates, Yakima, Wash. (1942-1946). Condi Dick (1898). Ore: Nickel, cobalt, copper. Ore min: Pyrrhotite, pentlandite, chalcopyrite, pyrite, malachite, nickel sulfate. Gangue: Peridotite. Deposit: Body of peridotite about 400 ft. long and 100 ft. wide, enclosed in quartz diorite and gneiss, contains disseminated primary and secondary ore minerals. Oxidation zone extends to 40-ft. depth. Dev: 4 adits, two 50 ft. and one 80 ft. in length, also some trenching, and 7 diamond drill holes by U. S. Bureau of Mines totaling 1,016 ft. Assays: 2 assays showed 0.05% Co. Av. assay from 80-ft. adit gave 1.5% Ni and 0.3% Cu. A gossan above the No. 3 adit assayed 0.5% Ni. Reserves: Est. 30,000 tons of 0.6% to 1.7% Ni and up to 0.7% Cu. Ref: 35. 67, pp. 25-26. 131. 138.

**Ellen**

(see Van Epps under antimony)

**Excelsior**

(see Nevada and Excelsior under gold)

**Garnierite** (20)


**Goman** (5)


**Gordon** (25)

(see under gold)

**Hardcash** (8)


Holden (3)
(see under copper)

Howe Sound
(see Holden under copper)

Irene
(see Holden under copper)

Keefer Brothers (4)
(see under molybdenum)

King Solomon
(see Van Epps under antimony)

Meridian (12)
(see under gold)

Monarch (18)
(see under gold)

Nevada and Excelsior
(see under copper)

New York (17)
(see under gold)

Nigger Creek
(see under iron)

North Pole (11)
(see under gold)

Ontario (16)
(see under gold)

P. P. Nickel (13)
(see under gold)

Peshastin Creek (21)

Peshastin Creek

Rainier (10)
(see under gold)

Red Butte (19)
(see under gold)

Red Cloud and Tralee
(see under copper)

Sevenmile Creek (3A)
(see under antimony)

Shoshone (9)
(see under mercury)

Snook and Ellen
(see Van Epps under antimony)

Stephens (22)

Tralee
(see Red Cloud and Tralee under copper)

Van Epps (7)
(see under antimony)

Velma (14)
(see under mercury)

War Eagle (15)
(see under gold)

Washington Nickel
(see Biewett under iron)

Winesap
(see Dick)

CLARK COUNTY

Silver Star (1)
(see under copper)

FERRY COUNTY

Big Four

Congress (4)
Loe: W 1/4 SE 1/4 sec. 35, (32-33E), on Bridge Cr. Elev: 2,700 to 2,900 ft. Access: 4 mi. by dirt road E. of Sanpoil highway (State No. 4). 40 mi. by road to railroad at Wilbur. Prop: 4 patented and 2 unpatented claims. Owner: George Wilson, Wilbur, Wash., and Frank Hines, Keller, Wash. (1942). Congress Gold & Copper Mining Co. (1907). Great Northern Mining Co. (1915-1924). Ore: Nickel, cobalt, copper, silver, gold. Ore min: Nickelferous pyrite, chalcopyrite, malachite, nickel carbonate, limonite. Gangue: Quartz, dolomite, barite, epidote. Deposit: Ore body 35 to 40 ft. wide along a shear zone in serpentine at contact with schist. Zone is mineralized by quartz, dolomite, pyrite, and chalcopyrite. Dev: 1,800 to 2,000 ft. of workings on 3 adit levels expose the deposit to depth of 300 ft. below outcrop. Assays: 0.17% to 5.17% Ni, 0.013% to 0.35% Co. Av. said to be about 0.53% Ni, 0.02% Co. Sample showed 5.5 oz. Ag and tr. Au. Ref: 7, pp. 182-185. 28, pp. 52-56. 33, 1907, p. 495. 98, 1918, p. 71; 1925, p. 1818. 105, 1/20/12, pp. 144-145. 112, p. 181. 122, pp. 134-136. 130, p. 84. 141, pp. 99-101. 157. 158.

Iron Creek
(see Shamrock)

McJunkin (3)
(see under silver)

Pin Money (1)
(see under gold)

Shamrock (Iron Creek) (5)
malachite, cerussite, lead oxide. **Gangue:** Limestone. **Deposit:** Silicified limestone surrounded by granodiorite. Silver-lead ore is 8 in. to 8 ft. wide and 700 ft. long. Nickel occurs in a mineralized zone 100 ft. wide in which there is a high-grade zone 55 ft. wide. **Dev:** More than 4,000 ft. of underground workings. **Assays:** Sample across 55-ft. width showed 0.7% Ni, and selected samples gave as much as 3.28% Ni. A 43-ton carload gave 1.7% Zn, 11.3% Pb, 0.035 oz. Au, and 51 oz. Ag.

**ref:** 158.

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**LEWIS COUNTY**

**Cowlitz River**

**Loc:** Near head of Cowlitz R. **Ore:** Nickel reported. **Ref:** 43, 8/29/96, p. 20, or p. 207. 158, p. 84.

**Summit Creek (2)**

**Loc:** Near head of Summit Cr. where Summit Cr. trail forks, one branch leading to Carlton Pass, the other to Cowlitz Pass. Probably in N-1/4 sec. 14, (14-10E). **Ore:** Nickel. **Ore min:** Nickel sulfide. **Deposit:** Said to be a 2-in. vein of nickel sulfide exposed in the trail. **Ref:** 158.

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**MASON COUNTY**

**Black and White (1)**

(see under copper)

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**OKANOGAN COUNTY**

**Alta Lake (6)**

**Loc:** NW1/4 sec. 22, (29-23E), 3/4 mi. S. of Alta Lk. **Elev:** 600 ft. above valley floor. **Owner:** Forrest Wooten, Azwell, Wash. (1951). **Ore:** Nickel, copper. **Ore min:** Pyrrhotite, chalcopyrite. **Gangue:** Silicified gneiss. **Deposit:** 2- to 4-ft. shear zone in schist and gneiss. **Dev:** 66-ft. adit. **Assays:** 1.48% Ni, 0.41% Cu, nil Au, nil Ag. **Ref:** 158.

**Brown Lake (3)**

**Loc:** SW1/4 sec. 6, (34-26E), in small gullies about 1/4 mi. NE. of ranch house. **Ore:** Nickel. **Ore min:** Nickel-bearing sulfide. **Gangue:** Ultrabasic rock. **Ref:** 158.

**Cabin**

(see Stepstone)

**Idell (8)**

(see also Stepstone)

**Loc:** NE1/4 sec. 6, (32-31E). **Access:** 2.8 mi. up Stepstone Cr. road from Park City road. **Prop:** 3 claims: Idell Nos. 1 to 3. **Owner:** Mrs. Mamie Bowman owns one or all of these claims (1943). **Ore:** Nickel. **Ore min:** Genthite (?). **Deposit:** Small ramifying quartz veinlets cutting argillite and serpentine. Both vein and wall rocks are slightly nickel stained. **Dev:** Several open pits. **Ref:** 122, p. 95.

**Johnson Creek (4)**

**Loc:** NE1/4 sec. 5, (34-26E), about 150 ft. NE. of Johnson Cr. road. **Ore:** Nickel. **Ore min:** White sulfide. **Gangue:** Ultrabasic rock. **Ref:** 158.

**Jumbo (9)**

(see under chromium)

**Lilman (11)**

(see under silver)

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**Section Twelve (7)**

**Loc:** NE1/4 sec. 12, (32-30E). **Access:** 8 mi. N. of Naches by road. **Ore:** Nickel. **Ore min:** Genthite. **Gangue:** Quartz, calcite, tremolite. **Deposit:** A slightly crushed quartz lode 4 ft. wide, seams of which are coated with genthite. Wall rock also nickel stained. **Dev:** Small pit. **Ref:** 122, p. 85.

**Stepstone (Cabin) (10)**

(see also Idell, also Jumbo under chromium)

**Loc:** Near center N. line sec. 5, (32-31E), Naches dist. **Access:** 2.8 mi. up Stepstone Cr. road from Park City road. 29 mi. by road to railroad at Grand Coulee. **Prop:** 3 claims: Cabin, Jumbo, Idell. **Owner:** Mrs. Mamie Bowman and Frank
Inventory of Washington Minerals—Part II, Metallic Minerals

Funkhauser, Spokane, Wash. (1949). Ore: Nickel, chromium. Ore min: Chromite, fuchsite, pyrite, pyrrhotite, genticite, zaratite, pentlandite. Gangue: Quartz. Deposit: 8-ft. bed of limestone and 15-ft. body of serpentine enclosed in quartzite and argillite. Quartz lenses in limestone 1 to 12 in. wide are mineralized. Pyrite, pyrrhotite, and chromite disseminated in serpentinite. Dev: 2 shafts, one 60 the other 35 ft. deep, and an open cut. Assays: A weighted av. of 3 channel samples, each 5 ft. long, from the inclined shaft shows 1.22% Ni, 2.97% Cr₂O₃. An assay on a quartz lens showed 1.56% Ni. A specimen of unoxidized ore from the dump assayed 2.65% Ni. Ref: 122, p. 84, 141, p. 101. 157, 158.

Wolverine (2)
(see under gold)

PEND OREILLE COUNTY

Grandview (Reuther) (1)
(see under silver)

Reuther
(see Grandview under silver)

SKAGIT COUNTY

Alvard (16)

Alverson (2)

Bingham (15)

Boschart
(see Stephens)

Cavanaugh Lake (13)

Clear Lake (7)

Cultus Mountain (9)

Cultus Mountain (Stephens)
(see Stephens)

Devils Mountain
(see Mount Vernon)

Diobsud Creek (Germaine)

Finney Creek (14)

George Scott (4)

Germaine
(see Diobsud Creek)

Jordan Creek
(18)

La Conner (1)

McMyrl-Wilson (17)

Mt. Josephine (3)

Mount Vernon (Devis Mountain, Pacific) (12)

Nookachamps Creek (10)
SNOHOMISH COUNTY

Granite Falls (4)  

Powell Creek (5)  

Scott (6)  

Sedro Woolley  
Loc: Near Sedro Woolley. Ore: Nickel reported. Ref: 130, p. 84.

Stephens (Cultus Mountain, Boschert) (8)  

Walker Valley (11)  
Loc: NE 1/4 sec. 33, (34-5E), on W. slope of Cultus Mtn. Access: About 1 mi. from Walker Valley on road up Cultus Mtn. Ore: Nickel. Ore min: Magnetite. Gangue: Road cut exposes a zone of crushed serpentine 100 ft. wide. Also considerable float in the area to the N. and E. Assays: 3-ft. sample showed 0.23% Ni. Ref: 158.

Wilson (see McMyrl-Wilson)

Hancock (11)  
(see under copper)

Little Chief (6)  
(see under copper)

Mackinaw (8)  
(see under copper)

Mountain Cedar (9)  
(see under copper)

Non Pareil (13)  
(see under copper)

Palmer  

Rudebeck-Florence Rae (see Florence Rae under copper)

Verd  

Weden Creek  
(see Mackinaw under copper)

Wild Rose (12)  
(see under copper)

STEVENS COUNTY

A. Anderson (2A)  
(see under zinc)

Cedar Canyon  

Daisy  
(see Daisy-Tempest under silver)

Daisy-Tempest (7)  
(see under silver)

Marcus (5)  

Morning Star (6)  

Mose  

Mullen (4)  
WHATCOM COUNTY

Mount Baker


PLATINUM

Properties—Platinum is a silver-gray lustrous metal which is tenacious, malleable, and ductile. It is very heavy and moderately hard. The metal takes a very high and permanent polish. It has a high melting point and low vapor pressure, is a poor conductor of heat and electricity, and has a low coefficient of linear expansion, approximately equal to that of glass. The metal has a high-temperature coefficient of electrical resistivity and has high resistance to spark erosion. It is relatively inert chemically, being highly resistant to corrosion and oxidation; it does not tarnish on exposure to air and is not affected by single mineral acids. Other properties are shown in the table on page 12.

Uses—For many years about half the platinum used in this country has gone into jewelry. Lesser amounts are used in about equal parts in dentistry, electrical apparatus, and chemical industries. The metal and its alloys are used in thermocouples, resistance thermometers, electrodes, electrical contacts, acidproof containers, and laboratory apparatus. It is used as a catalyst in manufacturing high octane gasoline, some acids, and other important chemicals. Minor uses are for pen nibs and for spinnersets for glass fiber and rayon spinning. Platinum compounds have limited uses for platinum electroplating, photographic paper, platinum mirrors, fluorescent screens for X-ray work, etching zinc, and in ceramics.

Production—The United States yearly production of platinum has always been less than one-tenth of the world production and is only a small part of domestic consumption. Alaska has a considerable output of crude platinum, and a small amount is produced as a byproduct of placer-gold operations in California, but much of the domestic production is a byproduct of copper and gold smelting and refining. A very small production of platinum was reported in Washington in 1904, and intermittent small production up to 1934 totaled probably more than 25 ounces, all as a byproduct of placer-gold mining.

Prices—Until 1902, platinum sold for only $4 to $6 per fine troy ounce. The price then began a rise which reached $46 by 1913, and during World War I it reached a high of $154.23 per ounce. Since that time the price has fluctuated between wide limits. After being held by government order at $35 per ounce during World War II it rapidly rose to $90 in 1946, then rose and fell repeatedly in the next 6 years, the price at times being as low as $56 and at other times as high as $103, the highest since 1927. The 1953 price varied between $90 and $93 per ounce. In June 1955 the price was $78 per ounce. The prices quoted are for refined metal; the prices for crude platinum vary with the amounts of the different platinum-group metals present, and are usually substantially below the price for the refined metal.

Ore minerals—The principal source of platinum is natural alloys with one or more of the other members of the platinum group—iridium, osmium, palladium, rhodium, and ruthenium—and with copper and iron. Of the native alloys, only three platinum minerals are known—the arsenides, sperrylite, PtAs₂, and cooperite Pt(As,S)₂—and the sulfide, braggite, (Pt,Pd,Ni)S.

Geology—Platinum is widely distributed over the world, but in only a few places is it sufficiently concentrated to be recovered commercially. Most primary platinum is intimately associated either with nickel or chromite in deposits formed by magnetic processes in ultrabasic rocks such as peridotite, pyroxenite, and their metamorphosed equivalent, serpentinite. The platinum in placer deposits was derived from rocks of this type.

Occurrences

Two very small particles of platinum from a cleanup. Ref: 120, p. 10.

Mad River Placer (1)

Silver Mountain
(see Daisy-Tempest under silver)

Tempest
(see Daisy-Tempest under silver)

Wall Street (1)
(see under copper)

Windfall (6)
(see under copper)

WHATCOM COUNTY

Mount Baker

Loe: Said to be 18 mi. from Glacier in the Mt. Baker dist.
Deposit: Ore said to occur in limestone. Assays: Reportedly 2% to 4% Ni. Ref: 114, 6/09, p. 88. 158.

Yellow Aster (1)

Gangue: Quartz, ankerite, magnesite. Deposit: "Nickel ledge" 50 to 75 ft. wide, 2,800 ft. long, and at least 875 ft. deep in serpentinite and gabbro. Dev: Adit 80 ft. long, open cuts. Ref: 1, 9/17, p. 84. 98, 1918, p. 111. 114, no. 5, 1909, p. 87. 158.

YAKIMA COUNTY

Indian Creek (1)
(see under mercury)

Wildcat Creek (2)
(see under mercury)

PLATINUM

Num was reported in Washington in 1904, and intermittent small production up to 1934 totaled probably no more than 25 ounces, all as a byproduct of placer-gold mining.

Prices—Until 1902, platinum sold for only $4 to $6 per fine troy ounce. The price then began a rise which reached $48 by 1913, and during World War I it reached a high of $154.23 per ounce. Since that time the price has fluctuated between wide limits. After being held by government order at $35 per ounce during World War II it rapidly rose to $90 in 1946, then rose and fell repeatedly in the next 6 years, the price at times being as low as $56 and at other times as high as $103, the highest since 1927. The 1953 price varied between $90 and $93 per ounce. In June 1955 the price was $78 per ounce.

The prices quoted are for refined metal; the prices for crude platinum vary with the amounts of the different platinum-group metals present, and are usually substantially below the price for the refined metal.

Ore minerals—The principal source of platinum is natural alloys with one or more of the other members of the platinum group—iridium, osmium, palladium, rhodium, and ruthenium—and with copper and iron. Other than the native alloys, only three platinum minerals are known—the arsenides, sperrylite, PtAs2, and cooperite, Pt(As,S)2, and the sulfide, braggite, (Pt,Pd,Ni)S.

Geology—Platinum is widely distributed over the world, but in only a few places is it sufficiently concentrated to be recovered commercially. Most primary platinum is intimately associated either with nickel or chromite in deposits formed by magnetic processes in ultrabasic rocks such as peridotite, pyroxenite, and their metamorphosed equivalent, serpentinite. The platinum in placer deposits was derived from rocks of this type.

Occurrences

The map showing the numbered platinum occurrences is plate 18, on page 47 in volume 2.

CHELAN COUNTY

Leavenworth Placer


Mad River Placer (1)

Platinum Occurrences—Chelan County

Nigger Creek Placer (2)

CLALLAM COUNTY
Cedar Creek Placer (4)
(see under gold, placer)
Lovelace Placer
(see Shi Shi Beach Placer under gold, placer)
Ozette Beach Placer (2)
(see under gold, placer)
Shi Shi Beach Placer (1)
(see under gold, placer)
Starbuck Placer
(see Cedar Creek Placer under gold, placer)
Sunset Creek Placer (5)
(see under gold, placer)
Yellow Banks Placer (3)
(see under gold, placer)

CLARK COUNTY
McMunn Placer (1)
(see under gold, placer)

FERRY COUNTY
La Fleur
(see Walla Walla under copper)
Rogers Bar Placer (2)
(see under gold, placer)
Walla Walla (1)
(see under copper)

GRAYS HARBOR COUNTY
Moclips Placer (1)
(see under cerium)

KITTITAS COUNTY
China Camp Placer

OKANOGAN COUNTY
Little Mount Chopaka (1)
Okanogan
(see under chromium)
Oro Fino
(see under gold)
Riverside Placer (3)
Similkameen River Placer (2)
Slate Creek Placer

PACIFIC COUNTY
Beards Hollow Placer (1)

SKAGIT COUNTY
Anacortes (2)
(see under chromium)
Cypress (1)
Loc: Cypress Is. Ore: Platinum. Deposit: Platinum is reported to occur in some of the chromite in amounts from 0.006 to 0.245 oz. per ton. Ref: 123, p. 65.

SKAMANIA COUNTY
Primary Gold (1)
(see under gold)

SNOHOMISH COUNTY
Le Roy (1)
(see under silver)

POTASSIUM
Properties—Potassium metal is silvery white and bright when freshly cut but quickly oxidizes on exposure to air, the oxidation being rapid enough to cause the metal to catch fire spontaneously in air. It is lighter than water, ductile, malleable, and almost as soft as wax at ordinary temperatures but becomes brittle at low temperatures. It is harder than sodium but softer than lead. It is a good conductor of heat and electricity, its electrical conductivity being exceeded by that of only three or four other metals. Potassium is one of the most active metals chemically, and its chemical properties are similar to those of sodium. It is univalent in its compounds, and, except for the silicates, most potassium salts are water soluble. The metal decomposes water with explosive violence and must be kept under a liquid containing no oxygen, such as petroleum. Alloys of potassium and sodium are liquid at room temperatures. Other properties are shown in the table on page 12.

Uses—Potassium metal is rarely found outside of chemical laboratories. Because of its softness and extreme chemical reactivity, the metal is not suitable for the structural or mechanical uses characteristic of ordinary metals, so uses of potassium metal are based on chemical rather than physical properties. It can be used in synthesis of inorganic potassium compounds, but these compounds ordinarily are not made from the metal but from other potassium salts. The metal can also be used in organic synthesis involving condensation, dehalogenation,
Selenium is a semi-metallic element in the sulfur group. Its compounds resemble very closely those of sulfur, and, like that element, it occurs in several different allotropic forms—crystalline, metallic, and amorphous. The crystalline form is red, and the amorphous variety is a dark-red to black powder. The metallic form is lustrous and steel gray and is the most stable form. It has only slight electrical conductivity, but when exposed to bright light its conductivity increases by as much as 100 times. The element has valences of 2, 4, and 6. Most of its compounds are poisonous, and certain plants growing in soil rich in selenium will take up enough of the element from the soil to render the plants poisonous to cattle. Other properties are shown in the table on page 12.

Uses—In 1950 the most important uses for selenium were in the electrical industry, followed by the glass, rubber, ferroalloy, and pigments industries. The important electrical uses are in selenium rectifiers and in photovoltaic cells. Large quantities are used in small percentages to eliminate the green color which iron imparts to glass, and when added in larger percentages it produces pink and ruby glass. Likewise, it is used in pigments for other ceramic products and for rubber. Other uses in rubber are as a substitute for sulfur in certain heavy-duty rubber products and in vulcanizing synthetic rubber. Selenium is added in small percentages to some stainless steels, copper alloys, and invar, where it produces free-machining qualities without impairing non-corrosion properties. As a coating on magnesium alloys it prevents corrosion by sea water. Small quantities of selenium compounds are used in anti-fouling paint for ship bottoms, as an ingredient in lubricating oils, in photography, insecticides, frothers for flotation treatment of ores, as flameproofing for fabric covering on wires, and as a powerful solvent.

Production—United States production of selenium comes from the electrolytic copper refineries in Maryland and New Jersey, and averaged about 500,000 pounds per year for the period from 1940 to 1950. Recovery of the element from refinery slimes is difficult, so only enough is recovered to satisfy the demand is recovered. Production could be increased readily if the demand should warrant it. No elemental selenium has been produced in Washington, but sodium selenite is recovered as a byproduct at the copper smelter of the American Smelting & Refining Co. at Tacoma.

Prices—The price of selenium remained near $2 per pound from 1920 to 1950. Black powdered selenium, 99.5 percent purity, sold in New York at $1.75 per pound in 1946, then rose in 1950 to $2, and later in the year to $3.50 per pound. By the end of 1953 the price had risen to $4.25 per pound, and in June 1955 it was up to $6.00.

Ore minerals and geology—Selenium is widely distributed, but is never mined for itself alone. It occurs in association with volcanic sulfur and the sulfides, especially pyrite and chalcopyrite. In the form of the selenides of copper, silver, mercury, lead, bismuth, and thallium it is held in a minor constituent in many important copper-silver-zinc ores. The principal selenides are the copper selenide, umangite, Cu$_2$Se, and the silver selenide, naumannite, Ag$_2$Se.
The map showing the numbered selenium occurrences is plate 18, on page 47 in volume 2.

FERRY COUNTY

Blaine Republic
(see Republic under gold)

Flag Hill (2)
(see under gold)

SILICON

Properties—Although silicon is ordinarily classified as a nonmetallic element, it does possess some metallic properties, and the pure element is commonly called “silicon metal.” Massive silicon is crystalline, lustrous, gray black, and metallic appearing. It is brittle and is harder than glass. It is classified as a semi-conductor; that is, it has only slight conductivity for electricity. Silicon has poor mechanical properties, thus it presents a challenge to metallurgists to adapt it to structural uses in order to utilize such desirable characteristics as light weight (lighter than aluminum), corrosion resistance, high melting point, and ease of production. Silicon is almost inert chemically at low temperatures but is active when heated. It closely resembles carbon in its chemical properties and always displays a valence of 4. Other properties are shown in the table on page 12.

Uses—The use of silicon, mostly in the form of ferrosilicon, in making steel is of utmost importance, silicon being used in about 90 percent of the steel made in this country. Normally, just enough silicon is added to each melt to act as a deoxidizer and degasifier, but sometimes enough is added to make silicon-steel alloys, the latter use accounting for about 10 percent of the silicon consumed in this country. Silicon also is used as a scavenger and as an alloy constituent with copper and aluminum alloys. Silicon is used as a heat- and corrosion-resistant coating on other metals, and the pure material is used in transistors, rectifiers, and other electrical equipment. Silicon compounds have many important industrial uses, but few, if any, of these compounds are made from metallic silicon.

Production—in Washington ferrosilicon is produced in electric furnaces at three plants, those of the Keokuk Electro-Metals Co. at Rock Island, the Ohio Ferro-Alloys Co. at Tacoma, and the Pacific Northwest Alloys, Inc. at Mead. Of these, the first two have produced metallic silicon also.

Prices—Silicon of 97 percent purity sold at 20 cents per pound in 1951; in August 1952 the price dropped to 18½ cents, and was still at that figure 3 years later. One pound of extremely pure silicon for electrical use was imported in 1950, and the quoted value was $517 per pound. Material of similar purity was quoted at $430 per pound in 1952.

Ore minerals and geology—After oxygen, silicon is the most abundant element and makes up nearly 28 percent of the earth’s crust. With the exception of the carbonates, all the common rocks of the earth’s crust are siliceous. Although the element is very abundant, it never occurs free but always in combination in a great variety of minerals, mostly silicates, such as feldspars, amphiboles, pyroxenes, micas, and clays. However, the oxide, quartz, is the most abundant of all the silicon minerals, and it is the only mineral which serves as an ore of silicon. In spite of the abundance and widespread distribution of quartz, there are few deposits of the mineral suitable as ore of silicon or ferrosilicon. Ore specifications are hard to meet in that they call for extremely high silica content, low iron, phosphorus, and calcium, and for unusual physical properties.

SILVER

Properties—Silver is a pure-white metal having a brilliant, perfect metallic luster. It is a little harder than gold, and is exceeded only by gold in ductility and malleability. Polished silver reflects visible light as well as, or better than, other metals, is a good reflector of infrared radiation, but is inferior to aluminum and many other metals as a reflector of ultraviolet light. Silver is the best of the metals as a conductor of heat and electricity. The molten metal in air dissolves 22 times its own volume of oxygen, which, when the melt cools, escapes with a sputtering sound and a flash of light. Silver is not ordinarily oxidized by air, and resists attack by many chemicals, but it tarnishes readily when contacted by sulfur compounds. The element is univalent. Other properties are shown in the table on page 12.

Uses—Silver has been used since earliest times for coins and ornamental articles, and the largest use is still for monetary purposes. Much of it is simply hoarded,