

STATE OF WASHINGTON
Clarence D. Martin, Governor

DEPARTMENT OF CONSERVATION AND DEVELOPMENT
J. B. Fink, Director
Olympia

1C4

PRELIMINARY REPORT ON STRATEGIC METALS IN WASHINGTON

by
DIVISION OF MINES AND MINING
Thomas B. Hill, Supervisor
J. W. Melrose, Geologist and Field Engineer
March, 1940

INTRODUCTION

Experience gained in the World War revealed that our domestic supplies of strategic materials were inadequate. These experiences have caused to be made intensive investigations of strategic mineral occurrences.

The common usage of the term "strategic" is to define those metals that are essential in munition and industrial production for national defense. Of course there are many such metals and include principally iron, manganese, copper, lead, zinc, tin, antimony, tungsten and many others of great importance.

The War Department after making a careful study of our resources classifies twenty-two commodities as strategic and defines them as "those materials essential to the national defense for the supply of which in war, dependence must be placed in whole or in large part, on sources outside the continental limits of the United States, and for which strict conservation and distribution control measures will be necessary." Of the twenty-two commodities only nine are metals and comprise aluminum, antimony, chromium, manganese, mica, nickel, mercury, tin, and tungsten.

To solve the problem of a shortage of strategic metals during times of emergency it was proposed to purchase the various materials and create stockpiles for purposes of national defense. Congress has authorized for this purpose \$100,000,000 to be used over a period of four years at the rate of \$25,000,000 a year. An appropriation of \$10,000,000 has so far been made for the acquisition of strategic metals. Forms have already been issued for the purchase of the metals. Any person interested in the sale of strategic materials may obtain the standard form of bid, entitled "Specifications and Proposals For Supplies" from the Procurement Division of the United States Treasury Department, Washington, D. C.

Another appropriation has been made relative to field investigations of strategic metals. This amounts to \$500,000, of which \$350,000 is allocated to the United States Bureau of Mines and \$150,000 to the United States Geological Survey. Of the eight projects in the United States selected by the two governmental agencies in the field investigation program, the manganese of the Olympic Peninsula was chosen as one. To date a certain amount of the appropriation has been spent in this State in connection with the manganese. The United States Geological Survey has been for the past two years mapping the manganese belt and the United States Bureau of Mines is engaged in outlining ore bodies by diamond drilling near Lake Crescent.

Out of the strategic metals listed by the War Department, the metallics aluminum, antimony, chromium, manganese, nickel, mercury,

and tungsten occur in Washington in certain amounts. The following descriptions of localities are those that have been reported. However there are doubtless many other occurrences within the State boundaries that will be brought to attention.

ALUMINUM

With the coming of cheap power to the Northwest through the advent of Bonneville and Grand Coulee dams considerable interest has been created in the possibilities of extracting aluminum on a commercial basis from aluminum clays. At the present time commercial production of aluminum from clays has been confronted with too many difficulties to compete with the metal recovered from the mineral bauxite.

Washington Occurrences: The low grade materials that occur in Washington that have possibilities as future sources of aluminum are principally clays and alunite. The mineral alunite is a hydrous sulphate of potassium and aluminum and theoretically contains 37.0 per cent Al_2O_3 , 11.4 per cent K_2O , 38.6 per cent, SO_3 , and 13.0 per cent H_2O .

The better clays for this purpose are located in the Inland Empire near Spokane and in King, Pierce and Cowlitz Counties. Alunite has been exposed six to ten miles east of Enumclaw and is found in andesitic rocks. It has been formed by the hydrothermal alteration of the andesite. Analyses of this material have shown it to contain commercial quantities of aluminum.

ANTIMONY

Industrial uses for unalloyed metallic antimony are few. Antimony combined with lead is important from a military standpoint because it is used to make bullets both for small arms and shrapnel. Antimonial lead containing 6 to 16 per cent antimony is used for bearing metals and type.

Washington Occurrences: Production of antimony in the State during peace times has been negligible. However, during the World War when the need for antimony created higher prices, one oxide treatment plant operated. The known properties are as follows:

The Antimony Queen Mine, some nine miles by road up Gold Creek from the Methow Valley in Okanogan County, recovered sizable amounts of antimony oxide from the mineral stibnite. The following analysis of the ore is reported:

Sb	36-54%	SiO_2	32.84%	As	None
Fe	4.03	Zn	3.34	$CaCO_2$	2.28%
S	16-67	Cu	None	$MgCO_3$	4.45

A few miles west of Tonasket, Okanogan County, the Lucky Knock Mine has a production record of several tons but at the present time is idle.

In the Covada District, Ferry County, the R. E. Lee and Longstreet Mines contain veins that carry antimony. In the Longstreet Mine the antimony is associated with silver. In the R. E. Lee Mine pure veins of the sulphide of antimony (stibnite) occur.

The Cleveland Mine about eighteen miles west of Springdale in Stevens County, contains a considerable amount of the antimonial lead mineral boulangerite. Also in Stevens County workings of the Wells Fargo Mine have exposed the mineral stibnite.

In the Miller River district in King County some attempt has been made to treat antimony ore. At the Cleopatra Mine antimonial silver is reported to occur and stibnite is found at the Great Republic Mine.

CHROMIUM

For both industrial and military uses chromium is important. The three major industrial uses are metallurgical, refractory, and chemical. In the metallurgical industry it is used for making special varieties of steel. As a refractory it is used principally in the steel industry although small quantities are used in certain parts of furnaces for smelting copper and nickel. For chemical uses the ores contain on the average 44 per cent chromic oxide, and are made into chromium chemicals. It has been estimated that the distribution of chromium into its three major uses is as follows: metallurgical ore, 50 per cent; refractory ore, 40 per cent; and chemical ore, 10 per cent.

Chromite is the principal ore of chromium and usually occurs in olivine or serpentine rocks. The deposits are normally composed of the pure or nearly pure mineral and are quite often found in lenticular or tabular shaped bodies.

Washington Occurrences: The Sisters Mountain region probably contains more chromite than any other portion of the State. Prospecting by private interests and State and Federal agencies has revealed a sizable mass of olivine rock (dunite) in which occur numerous deposits of an excellent grade of chromite.

On Cypress Island considerable development work has revealed bodies of chromite ore in serpentine. The ore from these deposits was utilized during the World War.

Chromite occurs near Mt. Stuart in Chelan County, and Mt. Hawkins in Kittitas County. At one time shipments of high grade ore were made from the Mt. Hawkins locality. Recent activity in Kittitas County is reported.

Near Nighthawk, Okanogan County, chromite is found in dunite on Little Chopaka and Big Chopaka Mountains. Some development work has been done on both mountains. The chromite on Little Chopaka is only a short distance from the railroad.

MANGANESE

Manganese is used principally in the steel industry. The acceptability for this use and the price offered for the ore, depends upon the susceptibility to conversion to the two standard alloys, ferromanganese (78-82 per cent manganese) and spiegeleisen (16-20 per cent manganese). Oxide ores are desirable for making ferromanganese and should contain from 45 to 50 per cent manganese and less than 6 per cent iron and 8 per cent silica. A variety of iron and manganese bearing material is used for spiegeleisen. The manufacture of dry batteries consumes about 30,000 long tons of a special type of manganese ore annually.

Recent progress in technology has made possible the exploitation of our manganese resources that heretofore have been considered either too low grade or too difficult to recover the valuable constituents. The United States Bureau of Mines has completed investigations relative to recovery of manganese and have announced the development of a method for making electrolytic manganese. If the process proves successful on a commercial basis production in Washington will be important.

Washington Occurrences: For many years manganese deposits have been known to exist on the Olympic Peninsula and in the past some production from the higher grade deposits has been made. The deposits are of an unusual type and consist chiefly of the mineral bementite. This mineral is a manganese silicate and contains a high percentage of manganese but in the past has been considered to be too high in silica to be useful. Consequently the material has not been exploited; however, the recent metallurgical advances by the State Electrometallurgical Laboratories, under the direction of Dean A. E. Drucker, Pullman, in co-operation with the United States Bureau of Mines have overcome the problem of removing the excess silica. The manganese deposits are lens-like or tabular in shape. Recent work by the W.P.A. mineral survey has uncovered many new exposures by trenching and the Bureau of Mines has just completed diamond drilling a deposit near Lake Crescent, Clallam County. Large reserves of the ore are reported in a horseshoe-shaped belt from Ozette easterly to Hood Canal and back to the west coast on the south side of the Olympic Mountains.

The Olympic Peninsula manganese deposits bid fair to be an important source of the Nation's supply. The principal developments have been made at the following locations: Crescent Mine, Ed B. Group, Bear Creek area, State Lease Group, June Group, Sunrise Group, Pine Ridge Lode, Aurora Ridge area, Storm Creek area and Little River area in Clallam County; Tubal Cain Mine and Dosewallips River area in Jefferson County; Triple Trip Mine, Apex Mine, Black and White Mine and Steel Creek area in Mason County, and Quinault area, Stevens Creek area, Skunk Creek area and Cook Creek area in Grays Harbor County.

Stevens Creek area, Skunk Creek area and Cook Creek area in Grays Harbor County.

On Fidalgo Island bementite and the black oxide of manganese occur a few miles south of Anacortes. Bementite has been reported from near Samish Bay on the mainland.

The Three Buttes Mine on Pogue Flat near Omak, Okanogan County has produced manganese oxide intermittently for many years.

A sizable occurrence of the black oxide of manganese has recently been reported in Northeastern Okanogan County near Wauconda.

MERCURY

The Nation's production of mercury has been greater than any other strategic mineral. The normal annual consumption of mercury in the United States recently has ranged from 25,000 to 30,000, 76 lb. flasks. It is the key metal in our munitions industry through its use in all kinds of explosives. Mercury is used in the manufacture of fulminate, for detonating high explosives and fixed ammunition, for gold recovery by amalgamation, in drugs, dental amalgam, anti-fouling paint for ship bottoms, barometers, etc.

Washington Occurrences: The principal production of mercury in Washington has been near Morton, Lewis County, where it is recovered from the mineral cinnabar (mercuric sulphide). The deposits near Morton are on a whole low grade but in some places where conditions of deposition have been favorable high grade cinnabar concentrations are found. Because of the heavy underbrush and forest cover and thick overburden prospecting for outcrops is difficult. That more deposits exist in the vicinity is indicated by the presence of placer cinnabar in stream channels.

The following properties near Morton have been active; Interstate Mining Co. (Roy Mine), Barnum and McDonald, Apex, Parmenter, Spencer, Fisher, and Lytle Lynch.

A promising prospect in the vicinity of the Tieton reservoir, Yakima County, has recently been reported. Other mercury occurrences that have been reported are as follows: Chelan County, Velma Group and Shoshone Mercury Mines Company in the Blewett District and the Leavenworth prospect; Cowlitz County, Red Star Mining Company; Kittitas County, Washington Quick-silver Company north of Roslyn; Snohomish County, Eclipse Lode near Silverton and the Forest Hope and Myrtle C. Mines near Darrington.

NICKEL

In peace times approximately 45 per cent of the world consumption is

used in alloy steel and the balance as monel metal (an alloy of copper and nickel), miscellaneous non-ferrous alloys, and directly as the metal itself. During the World War 75 per cent of the world consumption was used in the manufacture of alloy steel. The deposits at Sudbury, Canada furnish nearly all of the World's nickel.

Washington Occurrences: No nickel has been produced in Washington but its occurrence is known in several places. At the present time the Pacific Nickel Company is developing a nickel property a few miles southeast of Mt. Vernon, Skagit County. This company is actively engaged in doing surface work and diamond drilling.

Nickeliferous pyrite occurs at the Congress Mine east of Keller, Ferry County. Several levels expose a considerable width of quartz carrying the pyrite. North of the Congress a similar vein has been crosscut in the Shamrock Mine.

Nickel silicate is reported to be found at the Stepstone Mine, Nespelam district, Okanogan County. Other localities from which nickel has been reported are: near Mt. Stuart and the Blewett district, Chelan County and north of Mt. Baker, Whatcom County.

TUNGSTEN

The metal tungsten has many uses. By far the larger part is used in making high speed tool steel. Other uses are in the manufacture of electric light and radio tube filament and cemented tungsten carbides, in the preparation of various chemicals, and in the tanning of white leather.

Washington Occurrences: The production of tungsten in Washington dates back prior to the World War when German interests shipped tungsten from the Germania Mine in Stevens County. Following the World War tungsten was produced intermittently from various properties.

The principal producer is still the Germania Mine now operated by the General Electric Company. Although this company has not actively mined underground during the past year it has produced nearly 400 tons of concentrate since beginning operations in 1936. Prior to 1936 and for several years Tungsten Producers Inc. shipped several hundred tons of concentrates from the Germania Mine.

Tungsten Products Inc. is at present developing a tungsten property on Blue Grouse Mountain north of Deer Park. The ore minerals hubnerite ($MnWO_4$) and wolframite ($(Fe,Mn)WO_4$) occur at this property.

Also north of Deer Park the Loon Lake Tungsten Mines Inc. has recently reopened a former producing tungsten mine and the Blue Grouse Tungsten Inc. is operating the old Tungsten King Mine. Columbia Tungsten is operating a property on the Huckleberry Range west of Addy in Stevens County. Small

but continuous shipments of wolframite concentrates are being made from the properties of Messrs. Kieth and Norton on the Spokane Indian Reservation a short distance from the Germania.

Another former producer at which activity has recently been reported is the John Hatfield Mine near Wolfnite Mountain near the Canadian border in Okanogan County. Wolframite is the principal ore mineral.

The Bumping Lake district, Yakima County, is a potential tungsten producing area. Scheelite (CaWO_4) occurs rather abundantly in several veins at the Copper Mining Company and wolframite is present at the Keystone Mine.

Other properties from which tungsten is reported are as follows: The Red Top Mine, near Northport, Stevens County (scheelite); Pacific Mutual Silver Lead Mine (Old Addison Mine) near Keller, Ferry County (wolframite); Stockwell Mine, Southeastern Ferry County (wolframite); Gold Hill Consolidated Mining Company, near Chinook Pass, Yakima County; Spokane Tin Mine at Silver Hill, Spokane County (wolframite); Pitney Butte Mine, Lincoln County, and the Silver Leaf Mine, Covada district, Ferry County.