

State of Washington
Arthur B. Langlie, Governor

Department of Conservation and Development
Ed Davis, Director

DIVISION OF MINES AND MINING
Sheldon L. Glover, Supervisor

Report of Investigations No. 3

MINERAL RESOURCES OF THE
WENATCHEE-ELLENSBURG-YAKIMA REGION

By
Sheldon L. Glover

Olympia, Washington
April, 1942

MINERAL RESOURCES OF THE WENATCHEE-ELLENSBURG-YAKIMA REGION

Introduction

This information circular has been issued in response to many inquiries regarding minerals as a supplementary source of wealth in certain areas where horticulture is the dominant industry. Its purpose is not to provide detailed information but rather to call attention to resources of present and potential value. Other reports are available to those who wish more complete data. Many persons living in the principal orchard section of the State are interested in some phase of the mineral industry; others may not realize how valuable that industry is. Some mention of specific minerals and the possibilities that exist in mineral development may suggest the desirability of commercial investigations leading to the further exploitation of these important resources that are so necessary in the present emergency.

The Wenatchee-Ellensburg-Yakima region is considered, for the purposes of this report, to include that part of Washington which is adjacent to the eastern foot of the Cascade Mountains from the international boundary south to Oregon. The northern third of this region includes the Okanogan Valley and nearby country, the southern two-thirds lies mostly west of the Columbia River but in part extends a considerable distance east of that river. It lies within and includes most of seven counties: Benton, Chelan, Douglas, Grant, Kittitas, Okanogan, and Yakima. Although much of this region is served by other important towns and is many miles removed from Wenatchee, Ellensburg, or Yakima, still those are the largest business centers and may be used to designate a more-or-less distinct part of the State.

As the region includes the principal fruit-growing sections of Washington, it is natural that the importance of orchard and farm products tends to obscure the part played by minerals in the economic structure of the area. Nevertheless, the value of the annual production of minerals and aggregates is a decidedly large amount. In 1940, the latest year for which statistics are available, the mineral output of the region was \$9,364,938; this is approximately 30 per cent of the total State production, estimated, in advance of the publication of final figures, to be in the neighborhood of 31 million dollars.

Metallic Production

When the State as a whole is considered, the metallic minerals are outranked in value by the nonmetallic minerals and contribute only from 10 to 25 per cent of the total production. Yet in the Wenatchee-Ellensburg-Yakima area the value of the metals greatly exceeded this proportion in recent years, owing chiefly to the output from one mine, the Holden property, of Chelan County. In 1940 the production from this mine alone is given by the U. S. Bureau of Mines as having a value of \$4,041,264 in copper, gold and silver.

Metallic Production, 1940 ^{a/}

County	Mines Producing		Value	Metals, in order of importance
	Lode	Placer		
Benton	--	4	845	Gold, silver
Chelan	9	7	4,051,236	Copper, gold, silver
Douglas	--	4	1,265	Gold, silver
Grant	--	2	1,617	Gold, silver
Kittitas	2	14	57,035	Gold, silver
Okanogan	27	20	195,239	Gold, copper, silver, lead,
Yakima	--	--	0	-- iron
			4,307,237	

^{a/} From U. S. Bur. Mines Minerals Yearbook, 1940.

Possibilities of Additional Metallic Mineral Development

Chelan, Kittitas, Okanogan, and Yakima Counties are particularly well situated, geologically, for the occurrence of economically valuable metallic minerals. The granitic intrusives of the northern Cascade Mountains and the Okanogan Highlands are the source of some of the State's most important mineral deposits, and ore bodies of many kinds occur in these granites and particularly in the metamorphosed sedimentary rocks that overlie or are adjacent to them. Benton, Douglas, and Grant Counties are less favorably situated, but even here placer operations along the bars of the Columbia and Yakima rivers have intermittently produced small amounts of gold for many years.

Some twenty different metallic elements have been reported from the mines and prospects of the region. Those of known or possible commercial importance include antimony, chromium, copper, gold, iron, lead, manganese, mercury, molybdenum, nickel, silver, tungsten, and zinc. Others, such as arsenic, cobalt, iridium, platinum, and titanium, are known to occur or have been reported in probably authentic accounts, but their potential value is doubtful. Many of these occurrences are being mined or prospected; many others, however, lack attention, though they warrant detailed investigation, particularly at the present time when supplies of strategic and critical minerals are so greatly needed. The "war" minerals that have definite promise of being available in commercial amount include those from which the following metals are derived: antimony, chromium, copper, iron, lead, mercury, molybdenum, nickel, tungsten, and zinc.

The number of mineral occurrences and the counties in which they are found are given in the following list. This compilation is as accurate as available information allows, though from the very nature of prospecting any such list must be incomplete. It does serve, however, to indicate mineral distribution and suggests the firm basis upon which are founded predictions of augmented mining activity. Information on the minerals from which these metals are produced and descriptions and locations of many properties are given in various reports of the State Divisions of Geology and Mines and Mining. (pp. 12-13)

Metallic Mineral Occurrences

Metal	Benton		Chelan		Douglas		Grant		Kittitas		Okanogan		Yakima	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Antimony	-	-	-	2	-	-	-	-	-	2	6	3	-	-
Arsenic	-	-	-	1	-	-	-	-	-	-	-	4	-	-
Chromium	-	-	-	1	-	-	-	-	2	12	-	10	-	-
Cobalt	-	-	-	1	-	-	-	-	-	1	-	-	-	-
Copper	-	-	3	6	-	-	-	-	3	18	15	44	1	-
Gold (lode)	-	-	30	20	-	-	-	-	18	19	54	111	2	11
Gold (placer)	6	1	11	10	2	2	1	2	27	16	29	9	4	2
Iridium (placer)	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Iron	-	-	-	3	-	-	-	-	-	5	2	2	-	-
Lead	-	-	1	1	-	-	-	-	-	3	5	10	-	-
Manganese	-	-	-	2	-	-	-	-	-	-	1	2	-	-
Mercury	-	-	-	3	-	-	-	-	-	4	-	1	-	1
Molybdenum	-	-	1	2	-	-	-	-	-	1	2	22	-	3
Nickel	-	-	-	8	-	-	-	-	-	6	-	4	-	-
Platinum (placer)	-	-	-	1	-	-	-	-	-	-	-	2	-	-
Silver	-	-	2	12	-	-	-	-	1	3	35	119	-	-
Titanium	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Tungsten	-	-	-	1	-	-	-	-	-	-	1	4	1	2
Zinc	-	-	-	-	-	-	-	-	-	1	-	6	-	1
Total	6	1	48	74	2	2	1	2	51	91	150	355	8	20

- a/ Producing mines, and properties with a record of production.
 b/ Developed properties, prospects, and reported mineral occurrences that appear to be authentic and that may have commercial possibilities. No production recorded.

Nonmetallic Production

Mineral resources are commonly thought of in terms of metals such as gold, silver, copper, lead, and zinc. The nonmetallic minerals, however, are equally important in industry, and in Washington they comprise in various years from 75 to 90 per cent of the total mineral output of the State. This proportion does not hold for the Wenatchee-Ellensburg-Yakima region, where important metal-mining districts are located, yet nonmetallic production here is consistently large, and in 1940 was more than 5 million dollars.

The most important resource, with a value of approximately $2\frac{1}{2}$ million dollars, was prosaic sand and gravel, produced in unusually large quantities because of its use in the concrete aggregate at Grand Coulee dam. Coal from the Roslyn field, Kittitas County, was valued at more than 2 million dollars; and crushed rock, natural gas, epsomite, diatomite, clay, clay products, molding sand, marl, and minor miscellaneous products made up the balance. The production of sand, gravel, and crushed rock varies from year to year with changes in road work and general construction but is always an important amount. Other resources fluctuate in value of output as market conditions change,

Value of Nonmetallic Production, 1940 ^{a/}

Product	Benton	Chelen	Douglas	Grant	Kittitas	Okenogen	Yekims	Undistributed	Total
Sand, Gravel	\$ 4,158	\$13,539	\$ 6,147	\$ 722	\$ 21,900	\$7,535	\$ 47,612	\$2,495,549 ^{d/}	\$2,597,162
Coal	--	--	--	--	2,198,878 ^{b/}	--	--	--	2,198,878
Basalt	15,100	--	10,633	5,900	--	--	90,883	6,103	128,619
Natural Gas	30,370	--	--	--	--	--	--	--	30,370
Epsomite	--	--	--	--	--	(c)	--	--	--
Diatomite	--	--	--	7,137	25,510	--	--	--	32,647
Clay	--	--	8,268	--	--	--	--	--	8,268
Molding sand	--	(c)	--	--	--	--	--	--	--
Merl	--	--	--	--	--	(e)	--	--	--
Miscellaneous	--	(c)	10,757	--	--	--	--	51,000 ^{e/}	61,757
TOTAL	\$49,628	\$13,539 ⁺	\$35,805	\$13,759	\$2,246,288	\$7,535 ⁺	\$138,495	\$2,552,652	\$5,057,701

^{e/} From statistics of the U. S. Bureau of Mines, in cooperation with the State Division of Geology.

^{b/} From statistics of the Dept. of Labor and Industries, Safety Division

^{c/} Included in "Undistributed Miscellaneous" in order to conceal individual operations.

^{d/} Mostly from Okenogen County.

^{e/} Includes a conservative estimate of the production of certain materials.

may increase or decrease because of variations in availability and utilization, and commonly are dependent on the business strength and progressiveness of the operators.

Possibilities in Nonmetallic Mineral Development

In general, the market for nonmetallic minerals is highly competitive and so differs markedly from that for metallic minerals. The metals have an open market, prices are reasonably fixed, and profits may be estimated from mining and milling costs and volume of output. Most nonmetals, on the other hand, must be marketed in competition with other minerals of established producers, or new uses must be developed and prospective buyers convinced that the product is desirable. Commonly, much research precedes marketing, and expensive processing and treatment may be necessary before the product is salable. This calls for initiative and imagination, but profitable businesses may be built on resources that are seldom given consideration.

Some minerals and aggregates that have been profitably mined in this region or elsewhere are mentioned here in order to call attention to future possibilities as based on past performance. Other materials, such as sand, gravel, and crushed rock, consistently add to the total mineral output of the State but need no more than passing mention, as their occurrence and value are well known. For information on these last as well as for more complete accounts of the occurrence of other materials, reference may be made to detailed publications listed at the end of this report.

Clay

High-grade refractory clay-shales have been mined for many years in Douglas County, just across the Columbia River from Wenatchee. These clays are shipped to Renton where they are used in various mixtures for the manufacture of fire brick and heat-resisting specialties. Similar clays are known to occur in Squillchuck Canyon, south of Wenatchee, and may be expected elsewhere in the sediments of the Swauk formation of the Wenatchee vicinity. Other light-firing refractory clays have formed from the alteration of rhyolite and other igneous rocks; future prospecting may show some of these to have ceramic value. In general, it is only the clays of exceptional quality and which may be cheaply mined that repay shipment to distant manufacturing centers; but it is reasonably certain that such deposits exist in addition to those now known.

Clays suitable for ordinary red-fired ware, such as common brick and tile, occur abundantly and have been used for years in local yards. At the present time brick plants operate at Oroville, Wenatchee, and Granger, and in former years plants were in operation at Chelan, Ellensburg, and other towns of the region.

Some of the better high-alumina clays would doubtless prove available for the manufacture of aluminum in the newly devised process now under consideration. However, these clays occur mostly as beds in the folded Swauk formation, and, though susceptible to cheap mining at their outcrop, would eventually require more expensive underground mining; this would probably place them in an unfavorable position to

compete economically with other State deposits.

Bentonite is an unusual clay composed principally of the mineral montmorillonite. It is mostly used in an unfired condition, hence differs markedly in this respect from the more common ceramic clays. An extensive deposit of large tonnage occurs near the Tieton reservoir in Yakima County. Some parts of the deposit are of particularly high quality; others would require beneficiation. The occurrence is a promising source of material for "drilling mud," filters, and various specialty uses.

Coal

One of the most important coal fields of the State is in the Cle Elum-Roslyn area of Kittitas County. The production there was 771,536 tons in 1940 and is commonly more than a million tons. Coal also occurs in Kittitas County outside this area of greatest development, and in Yakima and Chelan counties, but is not worked commercially because of such factors as inadequate prospecting, low quality, thinness of beds, or difficult accessibility. As market and transportation conditions improve it is certain that prospecting will indicate other properties and probably even other coal fields to be economically valuable.

As an example of the possibilities of other areas, coal is present rather commonly in the Swauk formation. Most of the known occurrences are too small or of too low grade to be commercial. However, coal of good quality and in apparently workable thickness was encountered in drilling a test well for oil near Wenatchee, so it is reasonable to expect similar material will be found where mining would be feasible. Another field that has promise is near the summit of the Cascades to the west of Yakima. Coal of anthracite rank occurs here in minable beds and has been prospected and developed to some extent. Financing, mining problems, and transportation difficulties appear to have been the principal deterrents to production in this area.

Diatomite

Diatoms are microscopic plant forms, living in fresh and salt water, that secrete a test, or shell, of hydrous silica. They may grow in such abundance that the tests accumulate in deposits many feet thick as the diatoms die, although 40 or 50 million individuals are required to produce a cubic inch in such deposits. The accumulated material is called diatomite, or diatomaceous earth, and is a porous, light-weight, powdery substance that, when pure, is nearly white in color and resembles chalk.

Diatomite has many varied uses. Most of these are due to its peculiar physical properties; others are due to its high content of silica that is easily soluble in alkalis and relatively insoluble in most acids or in neutral solutions. The dead-air spaces provided by the hollow cells of the diatoms make the diatomite an excellent thermoinsulation material for industrial and architectural use. It is particularly valuable, also, as a filtering medium and as an absorbent, filler, and mild abrasive. Other uses may be expected as

industry becomes aware of its adaptations.

Diatomite in large and unusually pure beds occurs in many parts of the State, particularly in (1) Grant County, 10 miles or so south of Quincy, (2) in Kittitas County, between Ellensburg and Yakima, and (3) in Adams County, in the Hatton vicinity. Grant and Kittitas County deposits have been mined for many years, and a small but rather steady production of diatomite has been made by various companies. Some diatomite is mined and shipped without treatment; the principal production at the present time, however, is by companies at Quincy, Kittitas, and Yakima, which dry and pulverize the raw material, air classify the powder, and ship the sized product.

Diatomite occurs at many places in the United States but seldom in the purity that characterizes the Eastern Washington beds. This very purity is partly a detriment, for the Washington material lacks the induration (in part due to impurities) that permits certain California diatomite to be sawed into blocks which have a moderate compressive strength. The addition of bonding materials to diatomite has so far not proved feasible, but research may yet develop a method of forming blocks from the Washington variety without decreasing too greatly its desirable physical properties. For all uses requiring powdered diatomite the Washington material appears to be equal or superior to that of other States. This should assure it the local market without competition, and give it a favorable position against other sources with out-of-State users.

Dolomite

Dolomite resembles limestone but is a double carbonate of magnesium and calcium and so has certain uses to which limestone (calcium carbonate) is not adapted. It occurs in extensive beds of large tonnage in the Riverside area of Okanogan County, and is available for any market demand that may arise. One quarry is now in operation, the stone being shipped for use in paper mills. One of the newly developed processes for the extraction of metallic magnesium utilizes dolomite, and the availability of all other needed raw materials and abundant electric power makes this mineral a resource of potential importance to this region.

Epsomite

Two lakes in the vicinity of Oroville, in northern Okanogan County, contain magnesium sulphate as brine and as the crystalline salt, epsomite. This material was refined and sold during the last war, and a few years ago production was resumed from one of the lakes (Poison Lake). The solution is pumped into a tank truck, hauled to Tonasket, and there refined by a comparatively simple process to pharmaceutical-standard epsom salts. About 7 tons per day is produced and sold in eastern markets.

Graphite

Various industries use graphite in considerable amount, but under normal conditions the market is chiefly supplied by the artificial

product and by importations from foreign sources. Natural graphite occurs in many parts of the United States and can be produced extensively if the market warrants; it is reasonable to expect a marked expansion in domestic production under the present unusual conditions of demand and ocean transportation.

Graphite occurs in various localities in Washington, including Chelan, Kittitas, Okanogan, and Yakima counties, but with few exceptions it is the amorphous variety, for which there is little demand. However, an occurrence of high-quality crystalline (flake) graphite east of Omak has been extensively prospected during the last few years, and a mill for the concentration of the mineral has been constructed at Omak. The local material should find ready acceptance by Northwest users, and if a uniform grade of superior quality can be maintained, it should be acceptable to the eastern market despite peculiar prejudices that affect the graphite industry.

Limestone

Limestone is burned for lime and is used as mined, or after grinding and sizing, in many industrial processes. It is essential in the manufacture of portland cement, paper, sugar, and in many metallurgical and chemical processes. A steady, continuing demand for limestone exists, and favorably situated deposits of proper quality are mined on a large scale at many places in Washington.

One of the largest limestone areas of the State is near Riverside, Okanogan County. Other deposits, smaller but of good quality, occur at several places farther south, as near Pateros, on the shores of Lake Chelan, near Orondo, near Entiat, and in the mountains to the west of this general area. A quarry is in operation on one of these deposits, and a small amount of work has been done on others. In general, however, they are undeveloped though entirely available for any local demand.

Marl

A deposit of nearly white marl, a powdery form of calcium carbonate, occurs in Wagon Road Coulee, near Riverside, Okanogan County, and has been mined in a small way for several years. This material could be produced on a much larger scale and, after treatment, might be suitable for purposes not now considered. Other deposits of the more ordinary gray or buff-colored marl are known in the extensive limestone area of that same vicinity and are quite suitable for use as soil "conditioners" and in certain industrial processes.

Natural Gas

Natural gas was struck in 1913 in a well drilled for water in Benton County. Other wells were drilled later, and in 1929 the Rattlesnake Hills gas field was put into commercial production, supplying seven towns in the Yakima Valley. Production was continuous for 12 years and reached its peak in 1935; thereafter it declined

rapidly until the field was practically abandoned in 1941. During this active period, nearly $1\frac{1}{2}$ billion cubic feet of gas, valued at \$875,000 was sold. This field may again be in production at some future time, but meanwhile continued exploration-drilling in that general vicinity and in the folded Swauk (Eocene) formation near Wenatchee has produced sufficient gas showings to indicate that other commercial supplies may be expected.

Pumicite

Pumicite, or volcanic ash, is a fine-grained sand or dust composed of fragmented volcanic glass that originates as ejecta from volcanic eruptions. The individual particles are always small and are commonly microscopic in size, but they have accumulated in sufficient quantity in many places in the State to form rather pure beds many feet in thickness. These deposits are buff or light gray in color and may be unconsolidated and powdery, or so compacted as to resemble a soft fine sandstone.

When pumicite is free from impurities, such as hard quartz grains, it is used as an abrasive in certain cutting scouring, cleaning, and polishing compounds. It is the active scouring agent in Old Dutch Cleanser and in mechanics' hand soaps. To prepare pumicite for such use is generally very simple; the raw material may or may not require pulverizing but it usually is screened or air-separated into uniformly sized particles. Very fine grained pumicite may be used in concrete aggregates to replace up to 50 per cent of portland cement without loss of strength in the finished concrete. Other uses, such as in special plasters, take some of the material, and experimentation will doubtless develop a greater field of usefulness.

Most of the Washington occurrences are in Benton, Grant, Walla Walla, and Yakima Counties, though large deposits are known in other counties. A quarry was formerly operated on a deposit near Sunnyside, and efforts were made a few years ago, with considerable success, to market pumicite from near Wallula. Probably a market could be developed in the Pacific Northwest, if one does not already exist, for a dependably uniform product, and it is also possible that grades may be available here that would allow the producer to enter the rapidly increasing eastern market.

Sand and Gravel

Sand and gravel for general construction needs are available in many places and are produced in important amounts in most of the counties of the region. These materials are too well known to require particular mention here. Certain varieties of sands, however, warrant special consideration:

A good grade of molding sand (for foundry use) has been mined for many years from a deposit at Ellensburg. This bed is nearly exhausted, but the formation in which it occurs is widespread and doubtless contains other suitable beds.

Soft sandstones of relatively high silica content occur in

the Swauk formation and are being mined for special uses at one place near Wenatchee. This rock may be readily disintegrated and treated to remove impurities; the resultant silica sand would be available for various industrial applications not now considered and might be suitable for the manufacture of some kinds of glassware.

A large deposit of unconsolidated sand, relatively high in silica occurs near Corfu, in Grant County. It could be very easily mined and is adjacent to a railroad. With some treatment it should find industrial application.

Silica (Quartz)

Massive quartz makes up large veins and pegmatitic segregations in various places and is available for industrial uses. In Chelan County, an exposure of very pure quartz near Merritt and other large bodies on Burch Mountain are being considered for the manufacture of ferrosilicon. Near Wenatchee, an extensive dike-like mass that is predominantly silica has been mined for smelter use from a quarry in Squillchuck Canyon. A very high silica content and an unusually low content of impurities, particularly phosphorous, are essential for the newer metallurgical requirements, and ease of access and mining are determining factors in choosing between individual occurrences.

Sodium Compounds

Sodium sulphate occurs as brine and as the crystalline mineral mirabilite in several Okanogan County lakes in the southwest part of the Colville Indian Reservation, about 60 miles northeast of Wenatchee. Another deposit of sodium sulphate and one of sodium carbonate are near Warden in Grant County, some 60 miles east of Ellensburg, and another deposit of the carbonate is near Wilson Creek, about the same distance east of Wenatchee. A refining plant, located at Monse, is expected to bring the Okanogan County occurrences into production, although previous efforts to produce salts from the various Washington deposits have not been too successful. There is no apparent reason why such difficulties as there are in mining, treatment, and marketing cannot be overcome, making these sodium compounds available for the use of manufacturers of paper, glass, and various chemicals.

Stone

Basalt is abundant, particularly in the southern part of the region, and is quarried in many places for road metal. The aggregate amount produced annually is large and makes an important addition to the value of the mineral output. Other rock types are common and some could be used for dimension stone for architectural use. This applies especially to the granites of the northern part of the area, but the same demand for such material at the present time is relatively small.

Other Nonmetallic Materials

A number of other nonmetallic minerals or aggregates occur or have been reported in the region. Some of these have a doubtful value; others may warrant prospecting or development, particularly as industrial conditions change or improve. Those that deserve particular consideration include the following:

1. Asbestos. -- Chrysotile or "serpentine asbestos", the principal asbestos of commerce, is not known to occur, though it has been reported in the Wenatchee district, and geologic conditions in that and certain other areas are favorable for its occurrence. Another form of asbestos, however, is known to be present and is doubtless the one referred to in several old reports. This form is generally spoken of as "amphibole asbestos" and may include the fibrous variety of the minerals tremolite, actinolite, and anthophyllite. The fibers may be white and very long, but they lack the flexibility of serpentine asbestos, hence are not usable for spinning and for the manufacture of many high-grade products. Amphibole asbestos is usable, however, in special cements and for steam-pipe covering, and some varieties are especially valuable, particularly at the present time, for acid filters. That it is becoming increasingly in demand is indicated by numerous inquiries from eastern manufacturers as to Washington sources of supply.

Occurrences have been reported on Williams, Goose, and Icicle Creeks, Chelan County, and near Alta Lake, Okanogan County. More recent reports are of an occurrence 14 miles south of Leavenworth and another on Burch Mountain, just north of Wenatchee. An apparently large deposit of short-fiber anthophyllite has been prospected in the canyon of Swakane Creek, near Wenatchee, and a short-fiber amphibole asbestos was formerly mined from the Alta Lake deposit (near Pateros). This last was shipped to Wenatchee, and used with diatomite in the manufacture of fire-proof and cold-water paints.

2. Feldspar. -- Occurrences between Chelan and Wenatchee may have future value if the mineral can be mined economically.
3. Fuller's Earth. -- Some clays of the Yakima region, particularly those associated with diatomite, have been reported to have the desirable properties of fuller's earth.
4. Grinding Pebbles. -- Rounded, waterworn quartzite pebbles and cobbles occur abundantly in the general vicinity of Yakima and might be marketed for use in pebble mills. There is a growing demand for suitable pebbles, and the gathering of these may develop into a profitable part-time employment for residents of this area.
5. Mica. -- Merchantable muscovite mica is reported from two places in Chelan County. It is doubtful if a grade occurs which could be profitably mined, but the value of this mineral,

particularly at the present time, warrants the investigation of any possible source. Biotite mica (dark colored) has little value at any time, but an occurrence of schist in which biotite forms an unusually large proportion of the rock is known near Leavenworth and could be used as a source of flake mica for certain purposes.

6. Talc and Soapstone. -- A low-grade soapstone occurs in Okanogan County near Omak, and a better grade is known in small amount in Chelan County near Wenatchee Lake; other occurrences are reported from near the White River (northwest of Wenatchee Lake), from near Blewett, and from the Cashmere vicinity. This general region is favorable, geologically, for the occurrence of talc and soapstone, and careful prospecting might disclose economically valuable deposits comparable to those that are being worked successfully in Skagit County.

Selected References

The following reports, selected as containing detailed or additional information on the Wenatchee-Ellensburg-Yakima region, may be secured for the price indicated from the Department of Conservation and Development, Olympia, Washington. Those marked with an asterisk (*) are no longer available for distribution but may be consulted in the larger libraries.

State Division of Geology

Annual Reports

- * 1901. Volume 1, Part 2. The metalliferous resources of Washington, except iron, by Henry Landes, W. S. Thyng, Milnor Roberts. 1902.
- * 1901. Volume I, Part 4. The iron ores of Washington, by Solon Shedd. 1902.

Bulletins

- No. 2. The road materials of Washington, by Henry Landes. 1911. 50¢
- 4. Cement materials and industry in Washington, by Solon Shedd. 1913. 75¢ (Describes limestone deposits.)
- 5. Geology and ore deposits of the Myers Creek and Oroville-Nighthawk districts, by Joseph B. Umpleby. 1911. 50¢
- 6. Geology and ore deposits of the Blewett mining district, by Charles E. Weaver. 1911. 50¢
- 9. The coal fields of Kittitas County, by E. J. Saunders. 1914. 50¢
- *11. The mineral resources of Washington, with statistics for 1912, by Henry Landes. 1914.
- 19. The coal fields of southeastern Washington, by Harold E. Culver. 1919. 75¢ (Includes information on the anthracite

- coal of western Yakima County.)
21. The mineral resources of Washington, with statistics for 1919, by Ernest N. Patty and Sheldon L. Glover. 1921. 50¢
 22. The road building sands and gravel of Washington, by Morris M. Leighton. 1919. 50¢
 23. The metal mines of Washington, by Ernest N. Patty. 1921. \$1.00
 24. Clays and shales of Washington, by Sheldon L. Glover. 1941. \$1.00
 - *27. Iron ores, fuels, and fluxes of Washington, by Solon Shedd, Olaf P. Jenkins, and Herschel H. Cooper. 1922.
 - *30. The mineral resources of Washington, with statistics for 1922, by Solon Shedd. 1924.
 32. Geology of Washington, by Harold E. Culver.
Part 1. General features of Washington geology (with preliminary geologic map in colors.) 1936. \$1.00.
 33. Nonmetallic mineral resources of Washington, with statistics for 1933, by Sheldon L. Glover. 1936. 75¢
 35. Bibliography and index of geology and mineral resources of Washington, by W. A. G. Bennett. 1939. 75¢
 - Tungsten occurrences of Washington. (In preparation)
 - Chromite occurrences of Washington. (In preparation)

Reports of Investigations

- *1. Abstract of the report by Solon Shedd on the geology and resources of the Pasco-Prosser quadrangles, by Harold E. Culver. 1926.
4. Preliminary report on petroleum and natural gas in Washington, by Sheldon L. Glover. 1936. 25¢

State Division of Mines and Mining

An outline of mining laws of the State of Washington, by M. H. Van Nuys. 1940. Free.

Preliminary report on strategic metals in Washington, by T. B. Hill and J. W. Melrose. 1940. Free.

Washington iron ores, a summary report, by Sheldon L. Glover, 1942. Free.