

STATE OF WASHINGTON
ARTHUR B. LANGLIE, Governor

Department of Conservation and Development
W. A. GALBRAITH, Director

BIENNIAL REPORT NO. 5

of the

DIVISION OF MINES AND GEOLOGY

For the Period Commencing July 1, 1952
and Ending June 30, 1954

Including a special report:

ONE HUNDRED YEARS OF MINING

By
SHELDON L. GLOVER
Supervisor



STATE PRINTING PLANT
OLYMPIA

DIVISION OF MINES AND GEOLOGY

SHELDON L. GLOVER, Supervisor

BIENNIAL REPORT NO. 5

PART I

ADMINISTRATION

General Statement

The following report applies to the organization and activities of the Division of Mines and Geology, Department of Conservation and Development, for the period July 1, 1952 to June 30, 1954. Biennial Report No. 4, just previous, covered the period October 1, 1950 to September 30, 1952. By legislative action the fiscal year of the state was changed in 1953, necessitating a change in the period of the biennial reports, hence the overlap in the present account of three months in 1952, which has been covered previously.

The technical staff for the whole period of the present report remained the same as in the preceding biennium and consisted of Sheldon L. Glover, supervisor, and W. A. G. Bennett, Marshall T. Hunting, and C. Phillips Purdy, Jr., geologists. Efforts to fill a vacant position on the staff were unsuccessful, owing to a lack of adequately trained and experienced personnel. The clerical staff consisted of Dorothy Rinkenberger, clerk-stenographer (secretary), Gloria DeRossitt, clerk-stenographer, and Marcellea Allen, temporarily employed as a clerk toward the end of the biennium. Temporary assistants employed during the 1953 field season were Frank Howd, Thomas Davenport, and Quintin Aune; and during the 1954 season, Gerald Thorsen and Quintin Aune.

Information Service

In accordance with its established functions, the Division continued to acquire all possible information on the geology of the state and on the location and characteristics of mineral occurrences. Investigations carried on in the field are a vital part of the work. Field studies are followed by laboratory work on samples of ores, minerals, and rocks, and may involve various mineralogic and petrographic techniques. These include preliminary chemical testing, optical studies of thin sections and polished sections, and, on occasion, spectrographic analyses. The ultimate objective is to add to the available knowledge accumulated during the 53 years that the Division of Mines and Geology and its predecessor agencies (differing in name only) have been continuously active.

The resultant data form the basis for published bulletins and reports. They also become a part of extensive files which are drawn upon to answer the inquiries of prospectors, mine operators, and industrialists. Most of the requests for information originate in the state, but an increasing number

are from out of state and indicate the interest that industry and individuals elsewhere are taking in the Pacific Northwest. These distant inquiries, from all parts of the United States, show the widest variation. They range all the way from requests for general information by vacationists and mineral collectors, to specific questions from prospectors and miners as to favorable mineralized areas and the desirability of coming to Washington to engage in mining work. Industrialists, in particular, write for data on Washington sources of needed materials. Such inquiries may indicate new and hitherto unrealized markets for local resources, or they may be a part of surveys being conducted to determine the feasibility of new enterprises in the state. Ordinarily, replying to the individual local or out-of-state request for information takes but little time, but sometimes considerable research is required to give satisfactory, usable answers to questions that are complex and unusual. The aggregate daily correspondence is considerable and is increasing in amount. Certainly, it is a service that is appreciated and which produces valuable returns, directly or indirectly, to the state.

Published Material

A major part of the activities of the Division is directed toward acquiring data on specific areas or mineral commodities. When the necessary field investigations have been completed and the subsequent laboratory work is finished, the results are put in manuscript form and published as expeditiously as possible. The final reports and bulletins, usually with accompanying illustrative charts and maps, are sold by the Department of Conservation and Development and supply the mining industry and the general public with authentic, usable information on many subjects involving geology, mineral resources, mine development, and related matters, all pertaining to the state. Also, the Division compiles a few informal papers and reports which are distributed without charge, in order to supply commonly requested information that is difficult to handle adequately by correspondence.

During the past biennium, the following material has been printed or otherwise put into proper form for sale or free distribution:

1953 Directory of Washington Mining Operations, by C. Phillips Purdy, Jr.
81 pages, photo-offset, free.

1954 Directory of Washington Mining Operations, by C. Phillips Purdy, Jr.
73 pages, photo-offset, free.

Introduction to Washington Geology and Resources, by Dr. Charles D. Campbell of the Geology Department, State College of Washington, Pullman, Washington. 45 pages, printed, free.

This report was made available to the Division through the courtesy of Dr. Campbell and through a special arrangement with Dr. Howard C. Payne, Editor, Research Studies of the State College of Washington, whereby only the minor cost of covers bearing the imprint of the Department of Conservation and Development, Division of Mines and Geology, was borne by the Division.

Mineral Rights in the State of Washington. 3 pages, mimeographed, free.

Placer Gold Mining in Washington. 3 pages, mimeographed, free.

Notes for Uranium Prospectors. 5 pages mimeographed, free. This was first issued in 1949 to supply information to uranium prospectors in the state.

The demand was so great that it was revised and reissued in 1953. Ap-

proximately 200 copies per month are sent out in response to requests from all over the United States as well as from within the state.

Geology of the Bead Lake District, Pend Oreille County, Washington, by Melvin C. Schroeder. 57 pages, 7 plates, 50 cents. This report was published in the present biennium, but the field work was completed and the manuscript prepared in the previous biennium under a cooperative arrangement with the State College of Washington, whereby the Division contributed the field expenses, only, of the geologist in charge.

An Outline of Mining Laws of the State of Washington, compiled and annotated by Morton H. Van Nuys. 142 pages, 50 cents. This is the result of several years' work by a prominent Seattle mining lawyer and fills a marked need for detailed information on state and federal mining laws. Through the courtesy and cooperation of Mr. Van Nuys, the Division paid only the cost of printing.

Reports in Preparation

An investigation of the peat resources of the state is nearing completion. The study is being conducted by Dr. George B. Rigg, Professor Emeritus, Botany Department, University of Washington. All field work is completed, and the manuscript, covering virtually all the principal deposits of the state, is in its final stage of preparation. Publication of this should be possible in the near future. Another report, dealing with the molybdenum occurrences of Washington, by C. Phillips Purdy, Jr., of the Division staff, is nearly completed and ready for printing. A geologic investigation of the structure, stratigraphy, and ore deposits of a large area in the vicinity of Colville, Stevens County, is underway, the work being conducted by staff members W. A. G. Bennett and C. Phillips Purdy, Jr. A comprehensive report on gold and gold mining in the state has been prepared by Marshall T. Huntting of the staff and is nearly ready for printing. Mr. Huntting has also been engaged for several years in the compilation of an inventory of Washington metallic minerals—a detailed, complex undertaking that has proved particularly laborious. The results, when published, will be a companion bulletin to one on nonmetallic minerals that was issued in 1949. These two inventory reports will provide the mining industry with brief but highly useful data on all known mineral occurrences and will supply information that is constantly being requested of the Division.

Mineral Identification Service

The laboratory of the Division is well equipped for the mineralogic and petrographic studies that, as mentioned previously, are a necessary adjunct to the investigations of the state's metallic and industrial minerals. No new equipment was acquired during the biennium, and the purchase of reagents and incidental supplies was kept to a minimum. Nevertheless, more laboratory studies were carried on than usual, partly in connection with mineral projects currently underway and partly in response to requests by citizens of the state for information on samples.

As a continuing service, the public is advised that samples of local ores, minerals, rocks, clays, or any other naturally occurring mineral substances may be submitted for identification and for comment as to usability. No charge is made for this service, as no facilities are required that are not already available and used in the regular investigative work of the Division.

Sample identification does not include assays or chemical analyses; there are many commercial concerns available for any such detailed analytical work. However, the preliminary findings, resulting from the laboratory study of submitted material, commonly satisfy all questions of the sender, and if value is indicated he can proceed with prospecting or development with more confidence. If no value is indicated, the prospector or other person can turn his attention to something having more possibilities of commercial importance. Obviously, the Division gains valuable information from this opportunity to inspect mineral material from all over the state, and occasionally learns, thereby, of hitherto unknown deposits and unreported mineral occurrences. In the current biennium 1,106 samples were submitted for this service. This was 364 more than in the preceding biennium.

The phenomenal and increasing interest of the public in radioactive minerals was indicated by the fact that 90 samples were submitted for specific tests for radioactivity. Of these, only 7 gave a positive reaction and only 2 showed promise of warranting thorough investigation; but even this small number of occurrences, added to the few discovered in the preceding biennium, indicates that prospecting for fissionable materials, particularly in the northern row of counties, may repay the required time and effort.

Oil and Gas Activities

Geologic studies have been continued throughout the biennium by many major companies, independent concerns, and minor operators, all interested and active in acquiring data on the oil and gas possibilities of the state. This has resulted in the drilling of 23 test wells for oil or gas during the past two years, for a total footage of 43,726. Besides these wells, many "core holes" were drilled, solely to obtain subsurface information on stratigraphy. The Division closely follows all this work in order to be conversant with the progress of exploration. Also, it renders all possible assistance to those engaged in legitimate geologic and exploratory work, believing that eventually Washington will become a producer of commercial oil and gas.

In 1951 the Legislature passed an "Oil and Gas Conservation Act." In 1953 the Supervisor of the Division of Mines and Geology was requested by the Oil and Gas Conservation Committee, charged with the administration of the Act, to draw up a set of rules and regulations under the authority of the Act to govern drilling, testing, and other operations that are a part of the exploration for and the production of oil and gas. The regulations of many oil-producing states were studied, and the suggestions of the Interstate Oil Compact Commission were sought. From this accumulated material, modified in part to better suit local conditions, applicable rules and regulations were formulated and presented on January 18, 1954 to the Oil and Gas Conservation Committee for its consideration. At that time, at a public hearing and with a few changes, these rules and regulations were adopted by the Committee, and the Supervisor of the Division of Mines and Geology was appointed as Oil and Gas Supervisor for the State.

Following this, such forms were devised as were necessary for the use of the operators, who are required to obtain drilling permits and make reports under the newly adopted regulations. Wide publicity was given to the action of the Committee and to the requirements with regard to permits, bonds, and general procedures. Excellent cooperation was obtained from the individuals and companies concerned. From January 18, 1954, when the rules and regu-

lations went into effect, to June 30, 1954 a total of 18 permits had been issued by the Oil and Gas Supervisor; 6 of these were for oil and gas test wells, and 12 were for core holes. One of the test wells was reported by the operating company to have developed 50,000 cubic feet of gas per day at 300 pounds pressure—hardly of economic interest by itself, but indicative of commercial possibilities in the area under exploration.

Library

An extensive reference library of geologic and mining literature is maintained by the Division for the use of the staff and as a convenience to the public. Books are not loaned but may be consulted by anyone during office hours. Most of the material is acquired without cost on an exchange basis from the U. S. Geological Survey, U. S. Bureau of Mines, and other federal agencies, and also from the geologic surveys and mining bureaus of the other states. Similarly, publications are acquired from Canadian and various foreign sources. The library includes many technical books, texts, and maps dealing with special phases of geology and the mineral industry. The available reference material, therefore, is quite complete and is continually used in the progress of research.

Mineral Exhibits

No museum is maintained, but an excellent working collection of metallic ores, industrial minerals, and representative rocks are on display or are filed and available for reference. All this material is drawn upon in the regular activities of the staff. It is also available for the benefit of prospectors, miners, students, and the general public. The particular value of these collections is in acquainting prospectors with the appearance and characteristics of minerals with which they are unfamiliar and in informing the users of mineral substances as to the physical features of local materials. The collections are constantly being added to and their usefulness enhanced.

Cooperation

The Division cooperates with the U. S. Geological Survey in topographic mapping within the state, \$20,000 in matching funds having been expended during the past biennium in this work. Cooperation is also maintained with the U. S. Bureau of Mines in the collection of statistics of mineral production and, on occasion as the need arises, with various other federal agencies in matters of mutual interest. Similarly, the Division offers all possible assistance to other state agencies in problems involving geology and mineralogy.

Topographic Mapping

Topographic mapping was carried on at an accelerated rate during the biennium, many maps having been published and a greater number brought to a near-publication stage. A part of this work was conducted under the usual cooperative arrangement between the state and federal governments; a much larger proportion, as an independent activity of the federal government alone. Through the courtesy of Mr. C. A. Ecklund, Pacific Region Engineer, Topographic Division, U. S. Geological Survey, Sacramento, California, the following data on the progress of mapping in Washington have been supplied. 480 linear miles of levels were run.

48 new triangulation stations were established and monumented.
 3,300 square miles were controlled by 2nd and 3rd order triangulation.
 9,900 square miles of photography were completed.
 8,100 square miles were compiled by photogrammetric instruments and field surveys.

36 new quadrangles were published.

Quadrangles worked on and financed as cooperative projects between the State of Washington and the Geological Survey are as follows:

<i>Names of quadrangles</i>	<i>Counties in which located</i>
Bald Knob	Okanogan
Centralia	Lewis
*Keller	Ferry
*Penawawa	Garfield and Whitman
Seventeen Mile Mountain.....	Ferry
*Twin Lakes	Ferry

Also, during the biennium, the following quadrangle maps were completed and published using federal funds only. The new official names appear in parentheses:

<i>Names of quadrangles</i>	<i>Counties in which located</i>
Anacortes	Skagit and Whatcom
Blaine NE (Bertrand Creek).....	Whatcom
Boundary NE (Leadpoint).....	Stevens
Boundary NW (Boundary).....	Stevens
Boundary SE (Deep Lake).....	Pend Oreille and Stevens
Boundary SW (Spirit).....	Stevens
Clatskanie	Cowlitz and Wahkiakum
Colville NE (Gillette Mountain)...	Stevens
Colville NW (Echo Valley).....	Stevens
Colville SE (White Mud Lake)...	Stevens
Colville SW (Colville).....	Stevens
Colville No. 4 NW (Aladdin).....	Pend Oreille and Stevens
Deception Pass	Island and Skagit
Disautel	Okanogan
Endicott	Whitman
Gig Harbor	Kitsap and Pierce
Glacier Peak	Chelan and Snohomish
Hamilton	Skagit and Whatcom
Inchelium	Ferry and Stevens
Lake Shannon	Skagit and Whatcom
Marshall (Spokane SW).....	Spokane
Mount Olympus	Clallam and Jefferson
Mt. Spokane	Spokane
Opportunity (Spokane NE).....	Spokane
Samish Lake NE (Lake Whatcom).....	Skagit and Whatcom
Samish Lake SE (Alger).....	Whatcom

* Published during the biennium.

Sharon (Spokane SE).....	Spokane
Spokane (Spokane NW).....	Spokane
Sumas NE (Sumas).....	Whatcom
Sumas NW (Lynden).....	Whatcom
Sumas SE (Lawrence).....	Whatcom
Van Zandt	Whatcom
Wickersham	Skagit and Whatcom



DIVISION OF MINES AND GEOLOGY BIENNIAL REPORT NO. 5

PART II

ONE HUNDRED YEARS OF MINING

By SHELDON L. GLOVER

The current biennium, 1952-54, is of special significance in the history of Washington, as it marks the centennial of the organization of Washington Territory, and it also marks the centennial of mining within the present area of the state. On March 2, 1853, the original Oregon Territory was divided and Washington Territory was formed, although at that time its area included all of Idaho and parts of Montana and Wyoming. In 1863, when Idaho Territory was created, the present boundaries of Washington were established. Statehood followed on November 11, 1889. The centennial of the formation of Washington Territory has been well recognized and duly celebrated, but the nearly coincident centennial of the state's mining industry has received little, if any, recognition. This account, therefore, is presented to record briefly some features of the beginning of mining in Washington and of the development of the mining industry during the hundred years just ended.

Mining was one of the first industries to become established when permanent settlements began to appear in Washington Territory. The region was well mineralized—a fact that was soon recognized by the early settlers, though many years were to elapse before the great diversity of its mineral resources was known. Then, too, the value and importance of many mineral substances became apparent only when population increases brought about local market demands. Just how important mining was to become to the state's economy is best indicated by the dollar value of new wealth contributed by the mines of the state during the past hundred years. From no production at the beginning of the period, this value has shown a nearly continuous yearly increase, except for the occasional times of depression and market stagnation, until it reached an amount of more than 56 million dollars in 1952. The total value of mineral production for the 100-year period has been approximately 1¼ billion dollars.

The progress of prospecting and mining, here, has not lacked the glamour commonly associated with the industry, but actually romance has played

a relatively small part in the mineral development of the state. For some reason, when mining is mentioned one usually thinks of gold and silver and, to a lesser extent, of copper, lead, zinc, and a few other metallic ores. These have had, and do have, an important place in our mining industry, but a far more important place must be given to the nonglamorous industrial minerals—coal, sand and gravel, stone, portland cement, magnesite, and other non-metallic substances.

In considering our first hundred years of mining, it is of interest to review the accounts of early discovery and development. Some of these records are vague and contradictory, and some have been garbled and misquoted by later commentators, but the original accounts are available in libraries and include observations and findings by competent observers who were present during or near the times and events described. Some common-sense interpretations of the various accounts may be desirable, but it is unnecessary to rely on rumor and hearsay to reconstruct a fairly representative picture of those early days.

Earliest Coal Mining

The earliest recorded discovery of mineral in what was later to be Washington Territory occurred in 1833, when Dr. Tolmie, an Englishman in the employ of the Hudson's Bay Co. at Fort Vancouver and later Factor of Fort Nisqually, found and described coal outcroppings on the Toutle River near its junction with the Cowlitz River in what is now Cowlitz County. Other coal in this same vicinity was found in 1848, but there is no record of any mining at those times, and certainly the coal was valueless at that early period, prior to the settlement of the region.

The next record of discovery was again of coal, this time in 1852 on the shore of Bellingham Bay. A Captain William Pattle was then engaged in furnishing the Hudson's Bay Co. with timber, which he was cutting on Lopez Island. He had crossed over to the mainland and was inspecting timber on Bellingham Bay when Indians called his attention to coal outcrops along the shore. He and Messrs. Morrison and Thomas, who were working with him, immediately located adjoining claims of 160 acres under the provisions of the donation law then in force in the Territory. Captain Pattle opened a "wheelbarrow" mine on his claim and took out a small amount of coal, an operation which, although soon abandoned, apparently initiated mining in the Territory. The next year, 1853, a more ambitious undertaking was started on Morrison's claim, where the "Ma-moose mine" was developed; about 150 tons of coal was shipped from this property to San Francisco before operations were suspended for several years. In the meantime, the blowing down of a large tree had exposed a coal bed about 2 miles north of the Pattle claim. This was located in the fall of 1853 by Messrs. Brown and Hewitt, and resulted in the organization of the Bellingham Bay Co., and the eventual development of coal reserves which, under various managements and names and despite fires and other difficulties, have supported large-scale operations to the present time.

Coal was something familiar to those early settlers, and they needed and valued it. Also, the phenomenal growth of population in California and the lack, there, of coal provided an immediate export market and source of much-needed cash. The extensive coal beds of Skagit, King, Pierce, and



BELLINGHAM COAL MINE, WHATCOM COUNTY

Present surface installation

Kittitas Counties were awaiting discovery, and the existence of the southwest Washington fields had been known since 1833. It is no wonder, therefore, that one occurrence after another was found and prospected in the years just subsequent to the Bellingham Bay discoveries. In 1853 coal was discovered on Black River, near the present site of Renton, and a mine was opened there in 1854. A few years later the coal fields of the Issaquah and Newcastle areas, King County, and the coking coal of Carbon River and the Wilkeson area, Pierce County, were found. In about 1871 the Kittitas field was discovered, with shipping commencing in 1886, by which time the industry was well established throughout the present coal-producing areas of the state.

Discovery of Gold

The discovery of gold and the beginnings of metal mining are not so well documented, but certain features are clear. In 1853 Major Isaac I. Stevens had been appointed governor of the newly organized Washington Territory. He was to journey overland from St. Paul to Olympia, and while so doing was charged with the duty of searching out a feasible route for a transcontinental railroad. The highly readable account of his trip is in what are known as "Pacific Railway Reports," vol. 12, pt. 1, 1855, the actual narrative being in a section called "General Report," and dated 1860.

Governor Stevens had assigned to Captain (later, General) George B. McClellan the task of investigating passes over the Cascade Mountains, which work was underway while Stevens was journeying west. The two men met at Fort Colville in October, 1853. At that time McClellan reported that he had ascended the Yakima River on September 3, 1853 and mentioned finding the first traces of gold that he had encountered, saying "though not sufficiently

abundant to pay for working, it caused considerable excitement in the camp." A later historian erroneously ascribes this earliest account of the finding of placer gold in Washington to the Wenatchee River, probably confusing it with subsequent events.

Later in Governor Stevens' report, under the heading "Geographical Memoir," he confuses the issue by saying, ". . . the country about Colville and on Clark's Fork [Pend Oreille River] has been pretty thoroughly prospected for gold, and it exists in paying quantities throughout that region." And still farther on in the memoir he states, ". . . gold was found to exist, in the explorations of 1853, throughout the whole region between the Cascades and the main Columbia to the north of the boundary, and paying localities have since been found at several points, particularly on the southern tributary of the Wenatchapam [Wenatchee]. The gold quartz is also found on the Nachess [Naches] River. The gold bearing [rock?], crossing the Columbia and stretching eastward along Clark's Fork and the Koutenay [Kootenai] River, unquestionably extends to the Rocky Mountains." It would appear that these later mentions of gold were the result of information which came to the attention of Governor Stevens between October, 1853 and the time just prior to 1860 when he submitted his report to the War Department, and thus included a period when prospecting was becoming generally active.

Beginning of Placer Mining

Certainly, it seems unquestionable that placer mining in the near vicinity of Fort Colville was underway and probably began there in 1855. It must be remembered, however, that Fort Colville was an outfitting station for a very large region; and placering north of the boundary, in Canada, known to have been profitable, may have accounted for most of the activity ascribed to the Colville area. It is doubtful that the placer-gold production from the bars and tributaries of the Columbia and Pend Oreille Rivers in Washington was ever particularly important.

Whether or not gold mining actually began in the Colville area, an event of greater import was the discovery of placer gold in the Similkameen River in 1859. George A. Bethune, the first State Geologist of Washington, in his report of 1890 credits this with being the earliest find and the first to be profitably developed. The International Boundary Commission was engaged at that time in surveying the line between the United States and Canada, and in 1859 had reached the Similkameen River, having already completed the section north of Fort Colville. One of the soldiers of the party panned some of the gravel of the river bank and found it to be gold bearing. This started a "rush," resulting in hundreds of miners stampeding to the area and causing Okanogan City to mushroom to nearly 3,000 population in the first month of its existence. However, a few months later news came of the gold strikes in the Cariboo, Frazier, and other districts of Canada, and the miners, always ready to believe that faraway fields are greener, deserted the Similkameen for the new diggings to the north.

During the next 10 years or so, prospectors were drifting north from California fields and south from Canadian fields, and were finding gold on streams here and there, both east and west of the Cascades. Some of these strikes in the early sixties were important; others were soon proved to have little value or were quickly worked out.

It was probably in 1860 that placer gold was discovered on Peshastin

Creek in what is now Chelan County, though Bethune gives the date as 1877. This and the Swauk Creek gold, first discovered in 1868 (Bethune says 1874) near the present town of Liberty, Kittitas County, were vigorously worked by individuals and later by mining companies for many years and are still producing some gold. The Peshastin-Swauk district has accounted for what has probably been the principal placer-gold production of the state. In this connection it is interesting to note that here, as in many other placer localities, Chinese were able to operate profitably after the earlier white miners had abandoned the diggings; eventually the Chinese moved out, and again the whites resumed work in the better localities.

The early prospectors ranged far and wide. They needed little financing, they traveled chiefly on foot, and they carried their tools and supplies on their backs when not established in temporary base camps. They missed very little in the way of promising ground, and the remains of test pits, tailing piles, old sluices, and other signs of their activities may be found today on remote and relatively inaccessible creeks throughout the mountains. This is not to say that no future discoveries of placer gold will be found, but the search will be difficult and the places will be where, for one reason or another, the "old timers" were unable to operate advantageously. Even on the better prospected streams unworked ground is occasionally found, and the bars of the larger rivers are, to some extent, replenished during each period of high water. One prospector a few years ago found what he believed to be virgin ground on the Swauk; this was indicated by the apparently undisturbed surface of the bench and by the old trees growing on it. He reached bedrock in a test pit and began panning, but, instead of gold, the recovery consisted of two hobnails and a piece of broken shovel blade, relics of long-forgotten placering.

Placering at the present time is unimportant in Washington. The total gold recovered by this means has doubtless been considerable, although the amount is unknown. The records of recovery prior to 1900 are fragmentary at best and are not broken down to a county basis, or, for that matter, to placer as distinct from lode operations. Nevertheless, it appears reasonable to assume that the recovery made before the turn of the century greatly exceeded the later production. Since 1900, however, the records are fairly complete. The statistics of the U. S. Geological Survey and U. S. Bureau of Mines show a placer-gold production of \$930,597 from 1900 to 1953, inclusive. For comparison, the lode-gold production for this same period was \$41,627,317. Again, the relative insignificance of placer mining in later years is indicated by production figures for the 10-year period from 1900 to 1909, inclusive, when \$350,541 was produced, as compared with figures for the similar period from 1944 to 1953, when only \$12,456 was produced, or 3½ percent of the earlier amount.

Early Lode Mining

The real metal-mining industry of the state probably dates from the discovery in 1871 of lode gold near the base of Mount Chopaka, Okanogan County. Considerable work was done here by Hiram F. Smith, later a member of the state legislature. A short time thereafter additional lode discoveries were made in the area, but as the land was in a reservation set aside for Chief Moses and his Indian tribe, the miners were moved off by soldiers and the work was discontinued until about 1887.

Following the Mount Chopaka finds, increasing attention was centered on the occurrence of lode ores throughout the Territory, with the result that hard-rock mining, as distinct from placering, began to assume the importance it deserved. Differing from the ephemeral placer operations conducted by individuals or small groups, lode mining, to be successful, involves considerable capital, heavy equipment, permanent camps, and competent management. Obviously, it was to mean far more to the industrial development of the state than had most of the earlier placer operations.

Gold-bearing veins in the Peshastin district were first worked at Culver Gulch in 1874, but many other discoveries were soon made in that area and on the Swauk. At first the gold was separated from the quartz gangue by grinding in arrastres. These were crude mills, powered by horizontal or overshot water wheels which were geared to a revolving center post. Heavy blocks of rock, usually four in number, were attached by arms to the post and were dragged around and around in a shallow basin cut in the rock or in a stone-lined pit, the ore being fed to the mill in egg-sized pieces. Many arrastres—the remains of some of which can be seen today—were constructed in the Peshastin-Swauk district, their use being followed by stamp mills in the several instances where continued mining proved profitable.

Following this earliest lode mining, mineral discoveries were made in many of the northern counties, the result of the tireless efforts of countless prospectors—efforts which through 1936 had led to the locating of approximately 125,000 mining claims, and possibly an additional 1,000 up to the present time. The ore deposit of the Old Dominion mine, Stevens County, was discovered in 1883. This mine produced more than \$600,000 in lead-zinc ore prior to 1920. The Bonanza mine, Stevens County, produced nearly 100,000 tons of lead-silver ore between its discovery in 1885 and the present time. The Germania mine, discovered in 1894 in Stevens County, produced about 1,250 tons of high-grade tungsten ore between 1904 and 1941 and is still active.

The many veins of the Ruby-Conconully district, Okanogan County, were discovered in about 1886 and produced some \$200,000 in silver ore before 1907. Since that time the district has seen only intermittent activity, but at the turn of the century it was one of the most active camps in the state, with two or three thousand people in the area. Its old town of Ruby, complete with a brewery and the usual stores and saloons, is now represented only by the brush-covered foundations of former buildings.

The Sunset mine, Snohomish County, was discovered in 1897; from then to about 1932 development or production there was almost continuous. For several years, about the time of World War I, the property was one of the largest copper producers of the state, with an annual output valued between \$100,000 and \$200,000. The Monte Cristo mines of Snohomish County were located in 1889 and 1890, and from then till about 1903 were particularly active, producing some \$7 million from gold ore which was treated at a smelter in Everett. In 1896 the Republic, Ferry County, ores were discovered. This camp has had a long, continuous history of activity and is still one of the state's most important gold producers, approximately \$20 million in gold and \$3 million in silver having been extracted in the past 50 years or so. In 1914 the Electric Point mine of Stevens County was discovered, a property which produced more than a million dollars' worth of lead ore between



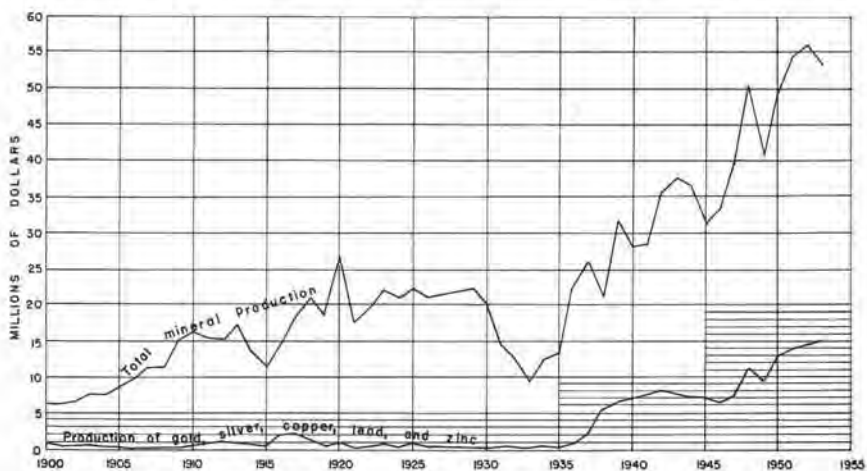
OLD ARRASTRE AT LIBERTY, KITTITAS COUNTY, AS IT APPEARED IN 1924
Powered by overshot water wheel

1916 and 1920. Similarly, many other ore bodies were discovered, prospected, and developed into paying properties during those earlier years of mining activity.

Recent Metal-Mining Activity

In relatively recent years some of the older mines and many more which have been newly developed or discovered have been particularly active, causing the metal output of the state to reach all-time highs. One of the later outstanding developments was the beginning of mining at the Holden property of the Howe Sound Co., Chelan Division, in 1938. This Chelan County operation is one of the largest in the state, producing presently some 1,500 tons per day (it has produced as much as 2,500 tons per day) of copper ore carrying important values also in gold, zinc, and silver. Many millions of dollars have been derived from this property in the past 16 years. Outstanding, too, is the phenomenal development of the Metaline district of Pend Oreille County. The large zinc-lead reserves of this district not only place it in a favored position among the mining areas of the state but give it importance among the producing regions of the nation. The principal mines, here, are those of the Pend Oreille Mines and Metals Co. and the American Zinc, Lead and Smelting Co., but other properties are nearing the production stage. For 1950, the latest year for which detailed statistics have been released by the U. S. Bureau of Mines, the Metaline district was credited with the production of 7,444½ tons of lead, valued at \$2,010,015, and 11,032 tons of zinc, valued at \$3,133,088.

Among the other more important metal mines of the state are: Gold King (Lovitt Mining Co., Inc.), Chelan County, producing gold and silver; Knob Hill (Knob Hill Mines, Inc.), Ferry County, producing gold and silver; Deep Creek (Goldfield Consolidated Mines Co.), Stevens County, producing zinc and lead; and the Van Stone (American Smelting and Refining Co.), Stevens County, producing zinc and lead; this, incidentally, is the most recent large property to go into production, treating 1,000 tons of ore per day.



Value of Washington's Mineral Production, 1900-1953

It is not feasible in this summary account to list all the many proved or promising properties. Most of them are operated for the more usual ores of gold, silver, copper, lead, and zinc. However, to indicate the variety of available metals, other resources deserve mention: These include ores of antimony, chromium, iron, manganese, mercury, and tungsten. Their mining is on a relatively small scale and may, for some, be intermittent, but each has contributed to the value and importance of the metal-mining industry.

Industrial-Mineral Development

There is little of the spectacular about the usual nonmetallic minerals and aggregates, but without them the state's industrial development would be crippled indeed. However, one mineral, magnesite, has had an unusual and intriguing history. Formerly, the extensive deposits in Stevens County were thought to be marble, and some was even quarried and used as architectural stone. It was not until 1916 that this magnesium carbonate mineral was properly identified and the early mistake rectified. Soon an outstanding industry was founded on its use, the mineral being "dead burned" at Chewelah and supplied to steel mills of the East as a basic refractory. The output has been such that for many years the state has ranked as the foremost producer of magnesite in the country, the value adding many millions of dollars to the total mineral production of the state.

Adequate supplies of limestone, clay, and shale have assured the production of portland cement in the areas where construction is at a maximum. Six large cement plants care for all market requirements, the dollar value of their output leading that of any other mineral substance. Sand, gravel, and common stone, all used in construction work, are in abundant supply



NORTHWEST MAGNESITE CO., STEVENS COUNTY

Plant for calcining magnesite, produced from extensive quarries situated a few miles to the southwest

in most areas where the need is greatest, and contribute many millions to the value of the state's mineral output.

Coal reached its peak production in 1918, when 4 million tons were mined, valued at more than \$14 million. The recent annual production has dropped to less than a million tons, owing to competition with oil and because of other factors, but increased prices give a value to the current annual output of nearly \$6 million. The many billions of tons of coal reserves may some day be more important to the state's economy than any other individual mineral substance, but this can only be realized when coal is used for its chemical products rather than as a raw fuel.

Epsomite, olivine, peat, pumice, quartz, talc and soapstone, and a few other industrial minerals are in current production, all contributing their share to the total value of mining to the state. Ratios change from one period to another, but in recent years the various nonmetallic minerals and aggregates have accounted for about 75 per cent of total production. In 1952 the production of metallic minerals had a value of approximately \$14¾ million; the industrial minerals had a value of about \$41¼ million. Incidentally, in 1950 Washington was 29th in rank with 0.41 per cent of the total mineral output of the United States. For comparison, Idaho was 27th in rank with 0.67 per cent, and Oregon was 38th in rank with 0.18 per cent.

Total Mineral Production 1944-1953

Year	Metallic minerals	Nonmetallic minerals	Total
1944	\$7,195,136	\$29,287,864	\$36,483,000
1945	7,140,242	24,160,758	31,301,000
1946	6,886,748	26,189,252	33,076,000
1947	7,313,398	30,737,602	38,051,000
1948	11,171,715	37,756,285	48,928,000
1949	9,613,307	31,249,693	40,863,000
1950	12,652,000	36,403,000	49,055,000
1951	14,064,000	40,490,000	54,554,000
1952	14,782,000	41,318,000	56,100,000
1953	13,086,000	38,655,000	53,741,000
Totals	\$105,904,546	\$336,247,454	\$442,152,000

Further Statistics of Recent and Current Production

Directories of mining operations are compiled and published each year by the Division of Mines and Geology. These include the names of all operators; their addresses; the location of the mine, pit, or quarry; and the mineral substance that is being produced. An individual concern is considered to be active if there is current production, or if development work now underway indicates that production may be expected shortly, or if the property has been in production within the past year or so and may be expected to resume shipments in the near future.

The current (1954) directory canvass shows that 335 mining properties are active, as compared to 346 in 1953, an operational decrease of 11. The metallic minerals account for 66 operations distributed in 14 counties; 34 of these operations are in a stage of development where production is expected; 32 are actively producing. Stevens County leads with 24 operations, followed by Ferry and Pend Oreille Counties with 6 each, Chelan, Clallam, and Okanogan Counties with 5 each, and 8 other counties with from 1 to 3 operations each. As to the principal metallic minerals involved, copper and

SELECTED MINERAL PRODUCTION^①—1946 THROUGH 1953

PRODUCT	1946		1947		1948		1949	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Clay (except for cement).....short tons	235,361	\$227,594	192,422	\$216,452	.....	\$262,260	219,738	\$267,300
Coal.....short tons	990,000	5,465,000	1,117,926	6,691,202	1,219,903	7,892,123	999,046	6,028,636
Copper.....short tons	4,527	1,466,748	2,240	940,800	.....	5,665	2,458,610	5,275
Gold.....troy ounces	51,168	1,790,880	31,965	1,223,775	70,075	2,452,625	71,994	2,519,790
Lead.....short tons	2,987	651,166	5,359	1,543,392	7,147	2,558,626	6,417	2,027,772
Manganese ore.....short tons	1,424	②	.....	.....	.....	.....	.....	.....
Peat.....short tons	②	③	2,425	10,125	②	⑤	②	⑤
Pumice.....short tons	14,585	56,008	26,497	74,173	26,675	47,787	8,610	18,221
Sand and gravel.....short tons	7,557,707	4,008,392	8,380,571	5,700,960	9,267,225	6,657,129	9,215,914	6,391,412
Silver.....troy ounces	204,453	213,678	293,736	265,831	375,831	340,146	357,853	329,875
Stone.....short tons	3,140,900	3,232,805	3,865,110	4,550,275	5,229,500	6,382,462	3,688,890	4,105,516
Tungsten ore (60% conc.).....short tons	1	②	.....	.....	.....	.....	.....	.....
Zinc.....short tons	11,329	2,764,276	13,800	3,339,000	12,638	3,361,708	10,740	2,663,520
Miscellaneous ^③.....	.....	12,599,453	.....	13,494,415	.....	16,514,367	.....	14,438,177
Totals.....	.....	\$33,076,000	.....	\$38,051,000	.....	\$48,028,000	.....	\$40,863,000

PRODUCT	1950		1951		1952		1953	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Clay (except for cement).....short tons	217,000	\$252,000	205,000	\$286,000	225,000	\$287,000	198,000	\$251,000
Coal.....short tons	874,000	5,829,000	867,000	6,031,000	844,000	5,986,000	④684,000	④4,928,000
Copper.....short tons	5,057	2,104,000	4,089	1,979,000	4,357	2,109,000	3,740	2,147,000
Gold.....troy ounces	92,117	3,224,000	67,405	2,359,000	54,776	1,917,000	62,560	2,190,000
Lead.....short tons	10,334	2,700,000	8,092	2,769,000	11,744	3,782,000	11,064	2,899,000
Manganese ore.....short tons	.....	.....	.....	.....	435	②	②	②
Peat.....short tons	.....	.....	45,304	99,000	42,580	111,000	②	②
Pumice.....short tons	11,913	23,000	5,105	11,000	3,604	8,000	②	②
Sand and gravel.....short tons	10,606,000	7,435,000	10,547,000	7,569,000	13,322,000	9,422,000	⑤	④8,988,000
Silver.....troy ounces	364,000	329,000	335,000	303,000	316,000	280,000	321,000	290,000
Stone.....short tons	4,931,000	5,735,000	5,030,000	5,664,000	4,591,000	5,491,000	⑤	④5,723,000
Tungsten ore (60% conc.).....short tons	.....	.....	9	33,000	4	14,000	5	19,000
Zinc.....short tons	14,807	4,205,000	18,189	6,021,000	20,192	6,674,000	32,786	7,541,000
Miscellaneous ^③.....	.....	17,129,000	.....	20,803,000	.....	20,013,000	.....	18,765,000
Totals.....	.....	\$49,055,000	.....	\$54,554,000	.....	\$56,100,000	.....	\$53,741,000

① Compiled by State Division of Mines and Geology from statistics obtained in cooperation with U. S. Bureau of Mines and published in Minerals Yearbook.

② Included in "Miscellaneous."

③ Includes items indicated by ② above; also, in various years, the following: carbon dioxide (natural), diatomite, epsomite, gem stones, iron ore, lime, magnesite, olivine, quartz, strontium, and other minerals.

④ Preliminary statistics, subject to revision.

⑤ Quantity not yet available.

zinc-lead head the list with 16 operations each. Gold-silver is next with 10 operations, then lead-silver and tungsten with 6 each, manganese with 5, and finally lead, silver, mercury, placer gold, and iron with from 1 to 3 operations each.

There are 269 operations involving industrial minerals, of which 139 are sand and gravel and 129 are other nonmetallics. In operations on other than sand and gravel, 20 counties have active properties. King County leads with 36 operations, followed by Stevens County with 15, Skagit County with 12, Spokane County with 9, Snohomish County with 6, and 16 other counties with from 1 to 5 operations each. The considerable variety of industrial minerals produced is shown in the table on page 19 (see, particularly, "Miscellaneous").

The future of mining in Washington is secure, and the industry will continue to be a major factor in the state's economy. The actual dollar value of production is of decided importance in itself, but this is only a small part of mining's total contribution. Mining should be credited also with the value to the state of the payrolls and capital investments of the supply houses, powder manufacturers, equipment and machinery dealers, and others who are dependent on the mines for their markets. Of increasing importance, too, is the credit due mining for the operation of the growing number of processing, fabricating, and manufacturing industries whose activities depend on the products of the mines, pits, and quarries. Fortunately, the reserves of both metallic and industrial minerals are sufficient to maintain the industry on a profitable and useful basis for a long time to come, and their diversity is such as to minimize the effect of depressed market conditions which might adversely effect an economy based on only a few mineral products. It appears reasonable to predict, therefore, that the importance of mining to the state in the next hundred years will at least equal and probably exceed the value and importance reached in the past hundred years.