STATE OF OREGON
DEPARTMENT OF GEOLOGY & MINERAL INDUSTRIES

PORTLAND, OREGON

THE ORE.-BIN

VOL. 9 NO. 11 PORTLAND, OREGON November 1947

STATE DEPARTMENT OF GEOLOGY & MINERAL INDUSTRIES
Head Office: 702 Woodlark Bldg., Portland 5, Oregon

****

THE MINES OF LAURIUM*

by

E. De Golyer**

Laurium is an ancient silver-lead mining district lying near the promontory of Sunium in southernmost Attica. It centers about twenty-five miles south of Athens. The minerals of the district may have been discovered and worked by the Phoenicians as early as 1000 to 700 B.C. but the mines did not become important until about the middle of the sixth century B.C. It was the silver of Laurium which enabled Athens to win and for a long time to maintain her supremacy in the ancient Greek world.

There are more than 2000 pits which represent ancient workings in the district. Some reached depths of almost four hundred feet but none of them extended below sea level. Ore bodies occur chiefly in Cretaceous limestones along their contacts with schists. There are at least two beds of schist and consequently, several contact zones. Shallower zones are relatively unimportant, the deeper ones supporting the richer ore bodies. The ore is a silver-bearing galena or sulphide of lead with which are associated the sulphides of zinc and of iron. The silver content is estimated to have been from 40 to 120 and rarely less than 60 ounces per ton of ore. From the dumps of the old workings it is estimated that silver to the value of some $800,000,000 was produced during the three centuries of prosperity of this district.

The first Athenian coins may have been struck as early as the time of Solon but we know for certain that in 561 B.C., the four drachma pieces bearing the head of Athena on one side and the Attic owl on the other were struck by Peisistratus, the first of the tyrants, whose archonship had begun a few years earlier. These "Laurian owls," as they were called, became the trade dollars - the standard currency - of the Aegean world.

Most histories of Greece have been written by classical scholars and in the days before economic determinism had emerged as a distinct school of historical thought. One searches the older histories for an adequate consideration of the fundamental importance of the Laurian Mines, therefore, without too much success. From scattered statements, however, it seems certain that it would be difficult to overestimate such importance. Specifically, all of the histories cite the building of the fleet which enabled the Greeks to defeat the Persians at Salamis on September 23, 480 B.C. and thus turn the tide of human history. A deeper and rich ore body had been found at Laurian in 483-2 B.C. and the Athenian treasury had grown rich from its share in the product of this discovery. It was at the urging of Themistocles that the citizenry agreed to forego their customary sharing of this windfall and to devote it to the building of ships. It may have been this happy circumstance that prompted Aeschylus, a few years later, to apothesize Laurium as "a fountain running silver, a treasure of the land."

The yield of silver from the Laurian mines, according to Xenophon, sufficed for several centuries to make the Laurian income an important part of the revenue of Greece. The prosperous condition of Athens in the sixth century B.C. was in large part the consequence, according to Herodotus and Aristotle, of new discoveries at Laurium.

---

*Commencement address, Trinity College, Hartford, Connecticut. Courtesy of Edward L. Troxell, Connecticut State Geologist and Professor of Geology, Trinity College.

**Petroleum geologist.

The importance of the silver of Laurium transcended that of being an easy source of revenue for the city state of Athens. Attica was notably a poor land agriculturally. She exported wine and oil but imported wheat and her unfavorable trade balance was paid with this silver. Her sound coinage, moreover, gave her a dominant position in commerce which she could not otherwise have achieved. "There was never any secret about it," wrote Henry Adams in a letter from Athens to his brother Brooks, "her Laurium silver mine made her and its exhaustion unmade her. All Greek and Phoenician economical development after B.C. 1000 is the history of mining and coinage, as fascinating as a fairy-story. It has the advantage also of being fairly established and undisputed. All subsequent history merely illustrated it."

Just how important was this eight hundred million dollars' worth of silver which came from the mines of Laurium? If one mistrusts the amazing array of adjectives which may be marshalled in its support and sticks to numbers, as engineers are prone to do, the results are not less astounding. The purchasing power of the silver in that day - and coinage was its real value - was much greater than in modern times. An able engineer and scholar writing in the times of the late President Coolidge considered that it was forty times as great in ancient times as for the time in which he wrote. Scholars are always a little behind in their accounting but I have not the temerity to attempt to bring this estimate closer to our time. The purchasing power of the Laurian silver in modern terms then would be thirty-two billion dollars. This was distributed over several centuries but in the hands of a people who did not number more than a quarter million souls. Proportionate wealth for a country as large as our own would run into sums of astronomic magnitude. Even when one considers that the street revenue to the state was probably about five per-cent, proportionately the sum is still exceedingly great.

I have selected this particular example of the economic, political, and social consequences which followed upon the exhaustion of an important mineral resource because it is so simple and so direct; not, as you may suspect, because I could refer to Aeschylus, Aristotle, Thucydides, Herodotus, etc., and thus impress upon you that the classics are a common heritage, even to Texas. That the example which came to hand was Greece is doubly pleasing. The citizens of Greece Macauley considered to have been "the most remarkable people who have yet existed" and he credits them also with having been "the beginners of nearly everything . . . of which the modern world makes its boast." The achievements in culture and civilization of this people are great beyond question. I was happy also that the civilization under consideration was one which had gone farthest in things of the spirit and yet, one which rested upon very material foundations.

Nor does the example of Athens stand alone, even in the Greek world. The silver of Pangaeus served as sinews of war to Philip of Macedon and to his son, Alexander, in their world conquest and played quite as effective a part as the silver of Laurium in decisive historic events.

Our country is richly endowed with mineral resources - more abundantly so perhaps than any other nation - and upon them we have builded the material civilization with which we face the world. But we are voracious consumers; normally the United States uses half of the world's output of industrial minerals. And so it comes about, as we periodically take stock of our diminishing resources, dividing the most recent estimate of proved reserve by current rate of consumption for each particular mineral, that we are alarmed at the low ratios thus secured. Three to five years for lead, zinc, mercury, tungsten and even less for bauxite - the aluminum ore. Ten years for copper, fifteen or so for petroleum, and say twenty for iron. It is only the coal ratio that is reassuring, running as it does to hundreds if not thousands of years.

We view these ratios too seriously. In the first place they are only for proved reserve. For many years to come, our undiscovered reserve is likely to be greater than our proved reserve. This is particularly true for the metals. Our metal miners as prospectors are still in the highly primitive desert-rat-finds-outcropping-ledge stage and are just beginning to make the scientifically and technically competent large-scale effort to find additional ore bodies which are needed.

Nor can any national mineral reserve be mined to the very end at the undiminished current rate of operations. The assumption that we will do so is the most widespread and common misuse made of our reserves - consumption ratio. If the petroleum ration, to take an example, is thirteen years, we mentally wring our hands over the absolute lack of petroleum products to appear January first of the fourteenth year. Supply diminishes gradually and over a long period. When acute shortages appear they are usually the result of abnormalities in consumption or in transportation. Actually, in the hypothetical case of oil, the thirteen years is being extended and most likely will continue to be extended in substantial degree by the discovery of additional reserves and whether or not there will be a shortage depends upon the rate at which additional reserves are discovered, the rate of imports from other countries and upon the changing rate of consumption. If discoveries should be altogether inadequate or if consumption should increase abnormally, shortage would begin to show long before the end of thirteen years - perhaps as early as three to four years but petroleum would continue to be produced in appreciable quantities fifty, sixty, seventy years from now - perhaps indefinitely into the future. Meanwhile substitutes are developed or come into use and increasing cost weeds out less important and unnecessary uses.

Is the rapid rate at which we are exhausting our mineral reserves as they are measured today cause for alarm? I think not. It is cause for concern, for constant study and review of mineral resources on a worldwide basis, for continued intelligent prospecting both at home and abroad, for scientific and technologic research on utilization as well as production. We should import minerals with the possible exception of coal to the point where further importation would harm our own extractive industries - our first line of defense in time of emergency.

We are fortunate in the tremendous reserves of coal with which the nation is endowed. Coal is power and most of the metals will always be available to us - at a high price perhaps - but available in emergency at a cost in power.

****

DEALINGS IN GOLD FURTHER RESTRICTED

According to the Engineering and Mining Journal, Metal and Mineral Markets issue of October 30, 1947, the Treasury has set up regulations further to restrict export of gold. The regulations go into effect on November 24, 1947. After November 24th gold may not be exported in bar form by private concerns. Licenses to export will be issued only for export of semi-processed gold such as sheets, powder, wire, and dentures. Exception is made where gold will be processed and returned to this country. One of the new Treasury regulations is that gold brought into this country for refining from gold-bearing materials may not be exported for sale by the refineries. Incorporated subsidiaries or branches of United States corporations that mine gold outside of the United States are allowed to ship gold to this country for refining. On the return of the gold to the shipper he may sell it on any terms allowed by the country where the shipper resides. The International Monetary Fund requested the action taken by the Treasury.

Restrictions in London are along the same lines as the United States. The statement is made that the demand for gold for export in semi-manufactured form is large but the authorities have reduced the amount for which export licenses are granted. Gold may not be handled in London for the account of non-residents at a higher price than the official Bank of England (172s, 3d). At the request of the American Government authorities have ruled that gold shipped to London for refining by non-residents may be returned only to the country from which it was shipped.

The article states that under the present circumstances an active gold business is being carried on by the Far East and Middle East on one hand and South America on the other.

****

GAS AND OIL PROSPECTING IN OREGON*

By
F. W. Libbey

Introduction

For more than fifty years tests have been drilled in Oregon seeking petroleum. A great many of these tests were by groups with no technical supervision and wholly lacking in proper geological investigation or control. Some oil promotions were out and out frauds, but the great majority were honest in their plans although woefully ignorant of geological and engineering essentials. It goes without saying that most of the tests were under-financed.

Some methane has been found both in eastern and western Oregon but only in small quantities. Some oil was reportedly discovered in early-day tests but these reports have not been verified by the writer.

Reports on oil and gas

Until recent years studies of oil and gas possibilities in Oregon by public agencies were of a reconnaissance nature only. Chester W. Washburne made reconnaissance studies in both eastern and northwestern Oregon in the early part of the present century. His work resulted in two U.S. Geological Survey bulletins - No. 431-A, with chapters on Gas and Oil Prospects near Vale, Oregon, and Payette, Idaho, and Gas Prospects in Harney Valley, Oregon, (1911); and No. 590 entitled "Reconnaissance of the Geology and Oil Prospects of Northwestern Oregon" (1914). Harrison and Eaton, consulting petroleum geologists, were employed by the Oregon Bureau of Mines and Geology to make a study of western Oregon and a bulletin entitled "Investigation of Oil and Gas Possibilities of Western Oregon" was published in 1920. This report had no geologic map and was mainly a statement of opinion. John P. Buwalda made a reconnaissance study of oil and gas possibilities in eastern Oregon in 1921 under a co-operative arrangement between the U.S. Geological Survey and the Oregon Bureau of Mines and Geology, and a bulletin was published, more for the nontechnical reader than for the geologist. It does, however, contain a large amount of useful information condensed in a small size. In 1945 the Oil and Gas Division of the U.S. Geological Survey, in co-operation with the Oregon Department of Geology and Mineral Industries, published a map entitled "Geology of Northwestern Oregon West of Willamette River and North of Latitude 45° 15'." This map was aimed at oil and gas possibilities and gives several stratigraphic sections. In 1945 the Oregon Department of Geology and Mineral Industries published a preliminary geologic map of the St. Helens quadrangle - a 15-minute quadrangle in an area in northwestern Oregon under study by several large oil companies - followed by a bulletin in 1946 entitled "Geology of the St. Helens Quadrangle, Oregon."

Investigations

In 1943 and 1944 the Texas Company engaged in a rather extensive preliminary investigation in northwestern Oregon and southwestern Washington. Geology was mapped, subsurface structure was studied by means of shallow drilling, and, somewhat later, geophysical studies were made. Work by the Texas Company stimulated other companies to send geologists into Oregon to find out if they had been overlooking something. Geologists of Richfield, Amerada, Phillips, Shell, Standard of California, Union, General Petroleum, Carter Oil Company, and representatives of some of the smaller midcontinent operators did geological work, mainly in northwestern Oregon and western Washington.

In 1943 the Phillips Petroleum Corporation drilled a test 6441 feet deep in the middle of the Coos Bay coal field at a place where gas had reportedly been encountered in a shallow hole previously drilled. This test started in and passed through the coal-bearing Eocene series and entered volcanics at a depth of 2300 feet. It passed through a thick section of volcanics with some shale interbeds and was in volcanics at the bottom.

---

*From Journal of Association of American State Geologists, October 15, 1947.

The Texas Company drilled three tests from 1945 to 1947, all in the northwestern part of the State. The first, Benson Clatskanie No. 1, was located about 50 miles airline northwest of Portland in Columbia County. It reached a depth of 5924 feet after penetrating Eocene formations including basalts, basaltic breccia, and sediments. The second was called Cooper Mountain No. 1 and was located about 12 miles west of Portland in Washington County. It reached a depth of 9263 feet and penetrated much the same section as the first test except that it started higher in the section and probably bottomed at a lower horizon. No gas or oil was reported in either of these tests. The third hole was called Clark and Wilson No. 6-1 and was drilled in Columbia County about 35 miles airline northwest of Portland. Total depth was 8500 feet and the hole was abandoned June 30, 1947. Cores were predominantly sedimentary with minor amounts of basaltic rocks. The section appears to include both upper and middle Eocene. Formation tests were made and one interval was reported to have had a little gas but not enough to be of value.

The Richfield Oil Company drilled a test in the hills on the west edge of Portland city limits in 1946. It reached a depth of 7885 feet after penetrating first basalt and then Oligocene sediments and finally over 5000 feet mainly of volcanics. No encouraging evidence of oil or gas was uncovered.

Conclusion

In 1946 most of the geologists of the major oil companies who had been in Oregon moved over into Washington where there was and is considerable prospecting activity. The Texas Company Clark and Wilson No. 6-1 was the last test drilled and since then there has been no prospecting activity in Oregon by a major oil company. Geologists are studying possibilities and following closely the drilling activities in western Washington, with very little oil work of any kind being done in Oregon. However, should any favorable developments occur in Washington, undoubtedly further prospecting would be done in Oregon.

****

SOURCES OF ENERGY USED IN UNITED STATES, 1945[1/]*

Sources of energy	Energy[2/]	Percent	Quantity	Value
Bituminous coal and lignite (short tons)	15,091	46.6	576,000,000	$1,777,336,000
Anthracite (short tons)	1,485	4.6	54,933,909	323,944,435
Petroleum (42-gal. bbls.)	10,712	33.2	1,711,103,000	2,093,300,000
Natural gas (M cu. ft.)	3,662	11.3	3,875,172,000	821,099,000
Water power (fuel equivalent)[3/]	1,399	4.3	---	---
Totals	32,349	100.0		$5,015,779,435

1/ Figures from U.S. Bur. Mines Minerals Yearbook.
2/ Expressed in trillions of B.t.u.
3/ Computed at 1.3 lbs. of coal per Kw-hr.

*Adapted from Mining and Metallurgy, September 1947.

****

NEW GEOLOGY BIBLIOGRAPHY

Over a thousand references to publications on Oregon's geology and mineral resources are listed in a bibliography just issued by the State Department of Geology and Mineral Industries. Both an author index and a subject index are included to facilitate the work of the researcher. This volume is a supplement to the bibliography issued in 1935 by the State Planning Board, and brings the listing of Oregon's geological references up to the year 1946. The chief compiler was John Eliot Allen. The bibliography is issued as Bulletin No. 33 and may be obtained at the Department's office at 702 Woodlark Building, Portland, or the field offices at Baker and Grants Pass. Price postpaid $1.00.

****

NEWS OF SOUTHERN OREGON PLACERS

L. O. Krewson is working the Hole-in-the-Ground placer with one giant.. Location is just off Wolf Creek east of the town of Wolf Creek.

* * * * *

W. C. Schleigh has started up the Old Jason placer on Coyote Creek, Josephine County, using one giant.

* * * * *

M. H. Davis has resumed work at the Blue Channel placer on Coyote Creek, using one giant. Normally this is the largest hydraulic operation in the Coyote Creek-Wolf Creek area, but because of the high cost of labor only one giant will be used this season.

* * * * *

Harold McIntosh has been working the McIntosh placer at Robinson Gulch on Coyote Creek with two giants in a limited way as water was available.

* * * * *

O. N. Snavely has resumed work at the Federal Placer on the Little Applegate near Buncom, Jackson County. There are three giants on the property; one is used for cutting, one for sluicing, and the third for stacking.

****

NORTHWEST ALUMINUM AND MAGNESIUM

The West Coast section of the Iron Age, San Francisco, released the following on November 18, 1947, from Seattle:

SEATTLE --- You are reminded of the hectic days of the War Manpower Commission and the ubiquitous labor expediter as you scan the four-column display advertisements of Boeing Aircraft Company in the local newspapers which are headed, "1000 Men Wanted" and go on to tell about the opportunities in the aircraft field.

Boeing already has approximately 16,000 men and women on its local payroll and is hoping to get another 1000 before the end of the year to produce the 133 B-50's (Army bombers); 56 Stratocruisers; and 10 Stratofreighters for the Army; for which contracts have been announced. It is known that these contracts do not constitute the entire backlog of the company but details on other aircraft have not been officially released.

Boeing is definitely big business in this area. Seattle boasts of 212,000 persons engaged in manufacturing out of its total population of approximately 570,000. Eight percent of these are already employed at Boeing making it by far the largest single employer in the Pacific Northwest.

This high rate of production is more than interesting to Aluminum Company of America, Reynolds Metals Company, and The Permanente Metals Corporation as the present contracts will utilize approximately 1,160 tons of extrusions and 2,500 tons of sheets.

* * * * * * *

Morley & Associates which has for some time been in the picture as a bidder for the magnesium plant near Mead, Washington, is continuing its development of magnesium shipping reel for steel cable and electrical conduits to replace the conventional wood reels.

James C. Morley, president, reports that one five-foot diameter reel has had the equivalent of two years of service and has made a very creditable showing. Present plans call for the production of 36 additional reels which will be put into service by cooperating cable manufacturers to determine their ability to withstand wear and tear.

The reels are so designed as to permit their being taken apart and shipped back to the cable manufacturers in nested form with considerable savings in freight, according to Mr. Morley. He points out that with standard wood reels only about 14 can be placed in a freight car and that with the collapsible reel at least 100 can be shipped in one car.

The five-foot diameter reel now out on test weighs 220 lb as compared to 650 lb for a wood reel and 380 lb for a steel reel of the same size. Mr. Morley states that magnesium is the ideal material for this purpose and that it is far superior to aluminum. If the reels were made of this material they would have to be cast in such a manner as to approximate the weight of a steel reel; would have lower shock resistance; and that the price would ultimately be higher than that for magnesium reels. He said that his organization contemplates producing these reels at a cost of about 50¢ per lb.

There are approximately 84 manufacturers of wire rope and electrical conduit in the country who utilize this type of shipping reel and Mr. Morley states that 32 of these represent approximately 80 pct of all the business. Because of the wear and tear on shipping reels these companies have an inventory loss of approximately $32 million per year. It is his contention that with the longer-lived magnesium reel this loss will be greatly reduced and even eliminated if his plan for a rental or lease pool is developed.

Extensive market studies have been made by Mr. Morley and his associates during the past two years and he has secured the support of cable manufacturers, objectively inclined state development men, and financiers. A local foundry is to be established here this month for production of the additional 36 test reels which will utilize unique improvements in permanent mold casting of magnesium according to Mr. Morley. He claims that his organization will be in a position to produce such castings of industrial grade for about 60¢ per lb. Work is now in progress on these molds and if everything proceeds according to plan the magnesium castings will be the world's largest produced in permanent molds according to Mr. Morley.

Morley & Associates had bid on the magnesium plant near Mead offered for sale by WAA under Section 19 but when announced as successful bidders failed to consumate the deal. The explanation for this reneging as given by Mr. Morley was that it was still necessary to prove beyond all doubt to potential financial backers that the magnesium reel was practical and economically advantageous.

Mr. Morley, who has had experience in magnesium production and sales with The Permanente Metals Corporation, states that he is convinced that this metal can be produced at Mead for approximately 18¢ per lb at 100 pct operation and for approximately 20¢ per lb at 50 pct operation. He is aware of the fact that Dow Chemical Company is producing magnesium at a cost of about 11¢ per lb. When the Mead plant closed it was producing magnesium at 19.40¢ per lb.

****

OREGON GOLD, SILVER, COPPER, LEAD, AND ZINC

According to the preprint from U.S. Bureau of Mines Minerals Yearbook for 1946, production of gold in Oregon in 1946 was four times the 1945 output, owing largely to dredging operations, but the total recovered was only 16 percent of the all-time record set in 1940. Silver production was down to 66 percent of the 1945 output, and copper and lead production remained extremely low. No zinc production was reported.

The total value of the gold, silver, copper, and lead (in terms of recovered metals) produced in Oregon was $624,231 in 1946 compared with $164,456 in 1945 and $4,148,271 in the peak year 1940. It was divided among the metals as follows: Gold, 98.7 percent; silver, 0.9 percent; copper and lead combined, 0.4 percent. Baker County continued to be the leading metal producer and contributed 55 percent of the State total value; Grant County yielded 34 percent, Jackson, Josephine, and Lane Counties each 3 percent, and the other seven producing counties 2 percent.

The major portion of the increased value of production came from placer gold operations, largely worked by connected-bucket dredges. There was an increasing number of dragline dredges in operation in 1946 - the first year that any have been in operation since 1942, when gold mines were closed as the result of War Production Board Limitation Order L-208. Both placer and lode mines continued to face increasing costs and the problem of obtaining labor and supplies. Because of these factors and because of the smelter strike during the first half of 1946, the relatively minor contribution to output made by lode mines did not appear until late in the year.

Placer mines contributed 94 percent and lode mines 6 percent of the gold produced in Oregon in 1946. In 1945 the ratio was placer mines 89 percent and lode mines 11 percent.

* * * * * * *

Production of gold in Oregon in 1946 increased 294 percent compared with 1945, 94 percent coming from placer mines. Of the total placer gold, connected-bucket dredges recovered 84 percent, dragline dredges 12 percent, hydraulicking 2 percent, and combined small-scale hand methods, drift mines, suction dredging, and nonfloating washing plants (with mechanical excavators) 2 percent. All the lode gold was derived from dry and siliceous ores. Although 60 properties produced in 1946 (19 in 1945), the greatest proportion of the gold came from relatively few mines; the following 5 properties, listed in order of output, supplied 83 percent of the State total: Sumpter Valley Dredging Co., Western Gold Dredging Co., Porter & Co., and Sunshine Mining Co. (Burnt River Division) - all connected-bucket dredges - and Associated Dredging Co. (dragline dredge).

****

NEW DEPARTMENT GEOLOGIST

Miss Margaret Steere has joined the staff of the Department and is at present organizing and cataloging the Department museum specimens. Miss Steere majored in geology at the University of Michigan and received both bachelor's and master's degrees.

P. H. W. L. A. R. D. M. L. S.

****

PORTLAND ENGINEER AT MINERAL CONFERENCE

Richard J. Anderson, Managing Engineer of the Raw Materials Survey, Portland, Oregon, presented a paper on "Recent Developments in Mineral Raw Materials in the Pacific Northwest" before the Nonmetallic Minerals Conference, Pacific Chemical Exposition, held in San Francisco on October 23.

****

PUBLICATIONS

	Price postpaid
GEOLOGIC MAPS	
1. Geologic map of the Wallowa Lake quad, 1938: W.D.Smith & Others (also in Bull.12)	$ 0.45
2. Geologic map of the Medford quad., 1939: F.G.Wells & Others	0.40
3. Geologic map and geology of the Round Mountain quad., 1940: W.D.Wilkinson & Others	0.25
4. Geologic map of the Butte Falls quad., 1941: W.D.Wilkinson & Others	0.45
5. Geologic map and geology of the Grants Pass quad., 1940: F.G.Wells & Others	0.30
6. Preliminary geologic map of the Sumpter quad., 1941: J.T.Pardee & Others	0.40
7. Geologic map of the Portland area, 1942: Ray C. Treasher	0.25
8. Geologic map of the Coos Bay quad., 1944: J.E.Allen & E.M.Baldwin (sold with Bull. 27)	----
9. Geologic map of the St. Helens quad., 1945: W.D.Wilkinson, W.D.Lowry, & E.M.Baldwin (sold with Bull. 31)	----
MISCELLANEOUS PUBLICATIONS	
THE ORE.-BIN: issued monthly by the staff as medium for news about the Department, mines, and minerals. Subscription price per year	0.25
Oregon mineral localities map (22 x 34 inches) 1946	0.10
Oregon quicksilver localities map (22 x 34 inches) 1946	0.25
Landforms of Oregon: a physiographic sketch, (17 x 22 inches) 1941	0.10
Index to topographic mapping in Oregon, 1946	Free
Index to geologic mapping in Oregon, 1946	Free

****

The ORE.-BIN
State of Oregon
DEPARTMENT OF GEOLOGY & MINERAL INDUSTRIES
702 Woodlark Bldg., Portland 5, Oregon
POSTMASTER: Return Postage Guaranteed