

OREGON'S MINERAL PRODUCTION INCREASES SHARPLY

By Ralph S. Mason*

Oregon mineral production for 1963, spurred on by a more than nine percent increase in value over that of 1962, reached another all-time high with an estimated total of \$57,400,000. Oregon led all of the neighboring states in the rate of increase over the previous year; greater production of construction materials, such as sand and gravel and stone, was largely responsible for the record.

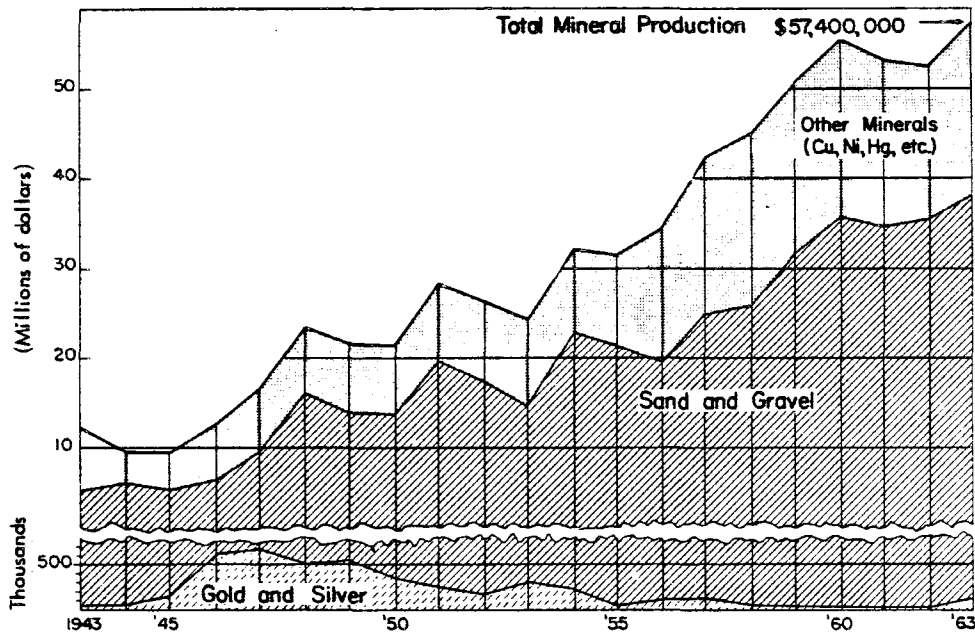
Production of clays, lime, and nickel showed little change. Gold and silver increased markedly, although their value is only a small fraction of what it once was. Interest in offshore oil and gas exploration continued at a high level, with several companies conducting seismic surveys and shallow coring programs. Extension of natural gas pipelines to most of the larger communities in the state was accomplished during the year. A study by the Department of Geology and Mineral Industries was started to assess the impact of this development of existing and potential mineral resources. Work was continued on a long-range geochemical study of mineralization which will eventually include nearly all of the state.

Industrial Minerals

Stone, sand and gravel

Stone and sand and gravel accounted for almost two-thirds of the total dollar value of all minerals produced in Oregon in 1963. The rapidly growing importance of these basic construction raw materials is clearly shown on the accompanying graph (see page 2). With but few exceptions, these materials are produced and consumed a few miles apart. Since heavily populated areas are the largest users of sand and gravel, these same areas must

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Graph showing rapid growth of sand and gravel and stone production as compared to the total mineral production of the state.

necessarily be the source, also, for most of the material used. Growing competition for land for urban expansion and for production of substances suitable to supply building materials for the urbanization has aroused some responsible agencies to action. Studies by local planning commissions, assisted by personnel of this department, are being made of several critical community areas in western Oregon. Identification of potential and existing sources of supply is the first step of the multi-phase project which, when completed, should provide the communities with a plan for a maximum of essential construction materials with a minimum of inconvenience to the inhabitants, at the lowest possible cost.

Portland area gravels were used in prestressed concrete piles, pile caps, and beams for a two-mile section of the Astoria interstate bridge at the mouth of the Columbia River. Empire Prestress, Inc., began moving the units from the Portland plant late in the year. The piles, some of which weigh 35 tons and average 95 feet in length by 4 feet in diameter, are barged to the site after a short haul on specially designed truck and trailer units.

Rigid specifications and a short supply of suitable local material made it necessary to barge large jetty rock from Government Cove, a few miles upstream from Bonneville Dam, 151 miles down the Columbia River to a

jetty at its mouth. During the year considerable investigation was made by the department in an endeavor to locate quarry sites which could produce quantities of large blocks having sufficient density and resistance to seawater to make them suitable for jetty repair and construction. Intrusive masses in the northern portion of the Coast Range were studied and will be the subject of a forthcoming report.

Lightweight aggregates

Little change was reported in the lightweight aggregate industry. Two plants in Washington County produced expanded shale for concrete aggregate and for use as a pozzolan in cement. Empire Building Materials added a third kiln to its plant at Sunset Tunnel in Washington County and fired it up in mid-December. Empire produced a special screened and uncrushed 5/8 - No. 4 fraction for monolithic concretes. Low absorbency of the kiln-coated pellets makes it possible to produce concretes weighing 105 pounds per cubic foot with crushing strengths ranging from 3,500 to 4,000 pounds per square inch. Lightweight prestressed concrete has become a standard construction material in the area. Numerous construction projects started during the year used a wide variety of prestressed beams, girders, and roof and floor slabs.

In the Bend area of central Oregon, pumice and volcanic cinder producers supplied sized and blended aggregate for monolithic concrete and unit-block manufacturers. Shipments were made to most of the important centers in the West. Large blocks of shaggy scoria from Tetherow Butte near Redmond were sold for rockery and wall construction. Lump pumice from Newberry Crater in southern Deschutes County was hand sorted and cobbled for filtering vinegar in a northwest plant. Other lumps of pumice were shipped to the Chicago area for abrasive purposes and to Oregon and California localities for landscaping stone.

Pacific Diatomite Corp. of Eugene processed and packaged diatomite from a deposit in Lake County. The diatomite is sold mainly as a sweeping compound and is distributed throughout the West. The company also announced plans to erect a perlite popping plant at Eugene to treat ore screened in a plant constructed during the year at the Tucker Hill deposit near Paisley, in Lake County. The expanded perlite will be used as an insulation additive in fibre wallboard. Archie M. Matlock of Eugene, one of the principals in Pacific Diatomite, has been developing uses and markets for Lake County diatomite and perlite for a number of years.

Two firms in the Portland area continued to pyroprocess ores imported from outside the state. Supreme Perlite Co. expanded crude perlite shipped from Nevada and vermiculite obtained largely from Montana. Vermiculite

Northwest, Inc., expanded vermiculite from Montana.

Lime and limestone

Ashgrove Lime & Portland Cement Co. started construction of a large lime plant at the Rivergate area near Portland. The structure will be completed in early 1964 and will use limestone barged from Texada Island, British Columbia. First shipments of stone were being stockpiled at the plant late in the year. Chemical Lime Co. increased production of burnt lime at its plant near Baker. A new quarry on Baboon Creek a few miles west of the company's Marble Creek pit was opened early in 1963 and began supplying stone in October.

Oregon Portland Cement Co. quarried limestone and shale from pits in Baker County for its cement plant at Lime. High-calcium stone for the company's Oswego operation was imported by ocean-going barge from Texada Island and supplemental stone was obtained from the company-owned quarry near Dallas in Polk County. Ideal Cement Co. quarried high-grade limestone from its quarry at Marble Mountain in Josephine County and trucked it to kilns at Gold Hill.

Silica

Bristol Silica Co. quarried and processed silica from its quarry in Jackson County. Small amounts of a high-silica altered tuff were shipped from the Rannells deposit on Quartz Mountain in Douglas County. The silica went to various metallurgical plants for the production of ferrosilicon, silicon carbide, silicon, and refractories.

Building stone

Most of the ornamental and building stones in Oregon are comparatively young, geologically speaking. The industry, however, is beset with the age-old problems of financing, distribution, and marketing. With but one or two exceptions, most of the quarries are small, intermittently operated enterprises using little if any mechanical stone-cutting equipment. At the Rainbow quarry near Pine Grove in Wasco County a spectacularly banded volcanic tuff was sawed out of the solid with rail-mounted travelling circular saws. The strips thus formed were resawed and guillotined into market stock. The Willowdale quarry in northern Jefferson County also produced a colorful tuff from a pit which has been active for many years. In the Bend-Redmond area several ornamental stones were quarried and sold, either in rubble form or as crushed and sized pieces.

Metals

Gold and silver

Production of lode and placer gold reached a five-year high during 1963, with a total of 1,529 fine troy ounces valued at \$54,000. By historical standards the gold production for the state was still at low ebb (see graph, page 2). A strengthening price for silver on the world market not only spurred local mining effort but added to the dollar value per ounce as well. In 1962, a total of 6,047 ounces of silver was recovered from Oregon mines for a value of \$7,000. Average price paid for the year's production was \$1.16. In 1963, a total of 53,729 ounces worth \$69,000 was mined at an average of \$1.28 per ounce.

Principal lode mines active during the year were the Oregon King (silver) in Jefferson County and the Buffalo mine (gold) in Grant County. Two small high-grade gold mines were active in Jackson County. The Warner mine, which has been worked intermittently during the last 40 years, has both free gold and auriferous arsenopyrite. Values along the narrow vein have varied from a few dollars to more than \$4,000 per ton. The Little Arctic mine in the same district has also been worked in a small way for many years. It is noted for spectacular, though extremely thin, plates of leaf gold which occur along seams in the rock.

Twenty-two gold placers, most of them small seasonal operations, helped contribute to the state total.

Of great interest to gold miners, bankers, and economists was the AIME Gold and Money Session held in Portland in April 1963. Papers presented by various authorities at the meeting were subsequently edited by the department and privately published.

Some of Oregon's Minerals at a Glance
Preliminary Figures for 1963
(in thousands of dollars)

	1962	1963
Clays	\$ 305	\$ 306
Gold	29	54
Sand & Gravel	14,556	15,700
Stone	20,977	22,500
Misc.*	14,956	17,253
Estimated total	\$52,458	\$57,399

* Asbestos, cement, copper, gem stones, iron ore, lead, mercury, pumice and volcanic cinder, nickel, uranium ore.

ACTIVE MINES IN OREGON, 1963

<u>Gold Placer</u>		<u>Gold Lode</u>		<u>Building Stone</u>	
<u>Mine</u>	<u>County</u>	<u>Mine</u>	<u>County</u>	<u>Mine</u>	<u>County</u>
Hobson	Baker	Golden Eagle	Curry	Willowdale	Jefferson
Nash	Baker	M. C.	Curry	Rainbow	Wasco
Washington Gulch	Baker	Mule Mountain	Curry	Red Rock	Deschutes
Winterville	Baker	Buffalo	Grant	Cinder Hill	Deschutes
Bandon black sand plant	Coos	Morning	Grant	Hawaiian Travertine	Wasco
Emily Cabin	Curry	Double Jack	Jackson	<u>Limestone and Lime</u>	
Tennessee Gulch	Douglas	Little Arctic	Jackson	Chemical Lime Co.	Baker
Upper Hogum	Douglas	Lucky Bart	Jackson	Ideal Cement Co.	Josephine
De Janvier	Jackson	Warner	Jackson	Oregon Portland Cement Co.	Baker, Polk
Palmer Creek	Jackson	Dark Canyon (Red Rose)	Josephine	<u>Silica</u>	
Aphir	Josephine	Gold Plate	Josephine	Big Quartz	Douglas
Baer	Josephine	Reno	Josephine	Bristol Silica Co.	Jackson
Brown	Josephine	<u>Copper</u>		<u>Sand and Gravel, Crushed Stone</u>	
Goff	Josephine	Standard Oregon King	Grant	Active commercial producers in every county and nearly every community in the state total more than 200. Numerous ad- ditional quarries operated by state, city, county, and federal agencies, and by log- ging companies using aggregate for private use.	
Gold Bar	Josephine		Jefferson		
Joe Joe	Josephine				
Leopold	Josephine	<u>Mercury</u>			
Maloney	Josephine	Canyon Creek	Grant		
Oscar Creek	Josephine				
Princess	Josephine	<u>Nickel</u>			
Speaker	Josephine	Hanna Nickel Co.	Douglas		
Standard Industries, Inc.	Malheur				
Camp Carson	Union				
<u>Uranium</u>					
Lucky Lass	Lake				

Iron ore

In mid-year the Bunker Hill Co. filed applications with the State Land Board and the Clatsop County Court for leases to several thousand acres of iron-bearing sand in the Clatsop Spit area. Although the sands contain only a low percentage of magnetite, an iron oxide, Bunker Hill is hopeful that efficient mining and concentrating techniques can be perfected to make the extraction feasible.

Mercury

Production of mercury declined almost to the vanishing point. A few flasks were retorted at a property on Canyon Creek in Grant County. A comprehensive report on the mercury resources of the state was published by the department in mid-year. The Office of Minerals Exploration entered into an exploration program with Pacific Minerals & Chemical Co. to develop the Mother Lode, Cobar, and Lookout Mountain groups of mercury claims in Crook County. Actual work on the project will commence in June, 1964.

Aluminum

Reynolds Metals Co. purchased more than 500 acres of bauxite-bearing land in the Salem Hills area of Marion County from Harvey Aluminum Co. Harvey formerly had optioned and explored nearly 3,000 acres in the district lying immediately south of Salem. Reynolds is leasing back to the owners the land, which is composed largely of small tracts, and is holding the property as a hedge against a national emergency when foreign ores would not be available. The Aluminum Co. of America holds considerable acreages of bauxite-rich land in Washington and Columbia Counties for the same purpose. The deposits in northwest Oregon were discovered by the department. Interest in the aluminum ores by several of the aluminum companies followed shortly after results of the department's initial exploration work was published in August, 1944.

Copper

Geophysical investigations of some of the copper sulfide deposits in southwestern Oregon were conducted by a private organization during the year. Several deposits in the Takilma-Waldo area of Josephine County were surveyed and at year's end a diamond drilling program was started at some of the more promising areas. Copper was first discovered in the district

in 1860, although little development occurred until 1903. A smelter to treat the ore from the Queen of Bronze mine was erected in 1904.

Exotic metals

The city of Albany continued to expand its exotic metals activities during the year. Oregon Metallurgical Corp., Wah Chang Corp., Northwest Industries, and the U.S. Bureau of Mines Electrometallurgical station were deeply engaged in the processing of crude ores, beneficiating concentrates, reducing, melting, rolling, casting, pelletizing, powdering, and fabricating more than half a dozen of the space-age metals. Martin Metals Co. opened a \$750,000 research laboratory in the Beaverton area to develop new metal alloys for high-temperature applications. Steadily stiffening specifications by governmental and private consumers saw installation of additional research and testing facilities designed to identify impurities farther and farther to the right of the decimal point.

Electroprocess Industries

Hanna Nickel Smelting Co. continued to mine and smelt nickeliferous laterite from its hilltop deposit near Riddle. The year-around operation employs nearly 450 men in the production of ferronickel pigs. National Metallurgical Corp. announced plans at year's end to revamp and enlarge the original portion of its Springfield plant. Cost of the reconstruction will be nearly \$500,000. National produces silicon metal in electric furnaces from a mixture of silica and wood chips. In the Portland area, Electrometallurgical Corp. and Pacific Carbide & Alloys furnaced lime and carbon to make calcium carbide. The Troutdale plant of Reynolds Metals Co. announced plans in April to the effect that approximately \$500,000 would be spent in plant modernization. The Harvey Aluminum Co. plant at The Dalles was in continuous operation throughout the year.

Federal mining leases and permits

A total of 5,400 acres in federal coal leases was held by two lessees in 1963. Mandrones Coal Mining Co. of Molalla worked a seam near Wilhoit in Clackamas County. Pacific Power & Light Co. held approximately 4,800 acres in the Eden Ridge district of southern Coos County, where it has been conducting extensive exploration of several coal seams in connection with a proposed coal-fired base-load steam plant for supplying electrical energy to the Coos Bay area.

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OIL AND GAS EXPLORATION IN OREGON

By V. C. Newton, Jr.*

Offshore Studies

Interest mounted in 1963 over prospects of finding oil on the continental shelf adjacent to Oregon. Recent studies indicating thickening of Tertiary marine sediments westward from shore have led geologists to believe that there has been extensive basin development on the shelf lands (Byrne, 1962, 1963). Eight oil companies (see table below) participated in offshore exploration in 1963, and five other companies are expected to commence studies next summer.

Offshore Exploration Permits, 1963

<u>Company</u>	<u>Permit</u>	<u>Type Survey</u>	<u>Est. Period of Operation (months)</u>
Shell Oil Co.	SL-2	Sparker - gas exploder Conventional seismic Bottom sampling and coring	7
^{1/} Union Oil Co.	SL-3	Bottom sampling and coring	3
^{2/} Standard Oil Co. of Calif.	SL-4	Conventional seismic	2½
Richfield Oil Corp.	SL-6	Sparker Bottom sampling and coring	2

^{1/} Union and Standard jointly conducted sampling and coring operations.

^{2/} Standard was operator for a 5-company group: Humble, Pan American, Texaco, and Phillips.

A federal lease sale of outer continental shelf lands in northern California in May 1963 interested Oregon officials, because bidding on these lands would reflect what might be expected on submerged lands in Oregon. Oil companies leased a total of 310,000 acres of the 670,000 acres of California shelf lands nominated. Cash paid for the leases amounted to nearly \$13 million. The majority of leases were in water more than 200 feet deep, and leases offshore at the Klamath River outlet near Eureka were in water 300 to 1,200 feet deep.

Bidding on shelf lands in Washington netted little more than minimum

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ONSHORE DRILLING PERMITS ISSUED IN 1963

<u>Permit No.</u>	<u>Company</u>	<u>Well Name</u>	<u>Location</u>	<u>Total Depth</u>	<u>Operations Commenced</u>	<u>Abandon Date</u>
51	E. M. Warren & Assoc.	Coos County 1-7	SE $\frac{1}{4}$ sec. 7, T. 27 S., R. 13 W. Coos County	6,337'	5-13-63	6- 5-63
52 PB	Marvin Lewis (Reserve Oil & Gas Co.)	Roy-L&G-Bruer 1	NE $\frac{1}{4}$ sec. 31, T. 6 S., R. 4 W. Polk County	5,549'	6- 6-63	Idle
53	Gulf Oil Corp.	T. J. Porter 1	NE $\frac{1}{4}$ sec. 27, T. 13 S., R. 4 W. Linn County	8,471'	11- 9-63	1-10-64

rental in 1963. Superior Oil Co. leased most of Washington's submerged lands in 1962 for minimum rental.

Oil companies were asked by the U.S. Department of Interior to indicate which areas of the federal submerged lands (lying beyond the state 3-mile limits of Oregon and Washington) they thought should be open to leasing. Selections were to be submitted by the end of October 1963. The Pacific Outer Continental Shelf Office of the Bureau of Land Management in Los Angeles is expected to announce by mid-February the areas to be offered for leasing.

Tentative plans of the Department of Interior call for a sale of federal submerged lands in October 1964. This date was chosen so that companies short on seismic data could utilize another summer season to collect data before making bids. With this timing it appears that no drilling can be done prior to May 1965.

The Oregon State Land Board is in the process of platting a lease map covering state-owned tide and submerged lands and is studying the procedure for giving public notice and accepting bids. It is anticipated that a great deal of interest will be shown in state lands when the Bureau of Land Management announces the areas to be offered for lease.

Exploration Onshore

The department issued two drilling permits and one plugback permit in 1963 as compared to six permits in 1962. Total wildcat footage for the year was 13,837 feet. E. M. Warren, San Antonio, Texas, drilled a 6,300-foot test in Coos County, approximately 3 miles south of where Phillips Petroleum Co. drilled in 1944. The Phillips well encountered lower Eocene volcanic rocks at 2,325 feet.

Gulf Oil Corp. started a test in October 3½ miles northwest of Halsey in the central Willamette Valley. The well was abandoned on January 10, 1964 after reaching a depth of 8,471 feet (depth on December 31, 1963 was 7,500 feet). Information obtained from this well will help determine the extent of marine deposition during Eocene-Oligocene time in the southern half of the Willamette Basin. The Gulf well is located 16 miles southwest of a well drilled by Reserve Oil & Gas Co. in 1962. Reserve suspended work on its well pending further study and has not as yet officially abandoned it.

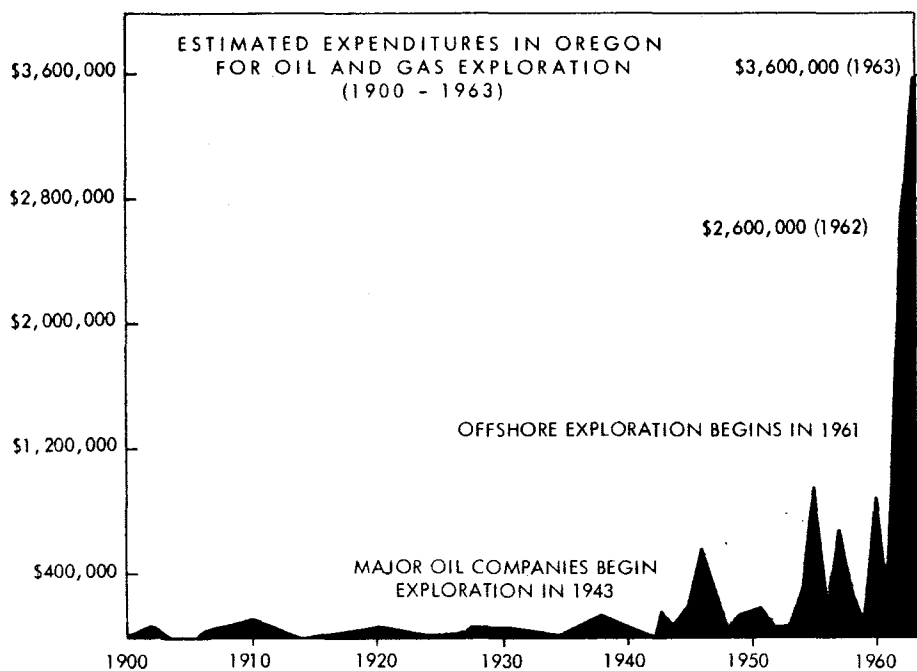
At least three oil companies made geological studies along the coast onshore in Oregon this past year. One firm engaged in an auger-drilling program in order to obtain paleontological information.

At the close of 1963, Gulf, Superior, Humble, Texaco, Standard, Richfield, and Reserve were holding leases in western Oregon. Gulf held the greatest amount of acreage of the seven companies. E. M. Warren & Associates retained a portion of their leases in Coos County, and Wesley G. Bruer & Associates retained lease holdings in Marion County. Leasing in Oregon east of the Cascade Mountains has been inactive since 1962 except for occasional filings on federal lands.

The accompanying graph shows estimated expenditures for petroleum exploration in Oregon over the past 63 years. Significant increases can be noted on the graph for 1943, when major companies began exploration in the state, and later in 1961, when studies commenced on shelf lands. Estimates were based on footage drilled, land costs, administrative expense, supervisors' salaries, and contingencies. During 1963, approximately \$2.5 million was spent offshore and \$1.1 million onshore.

Further Exploration Encouraged

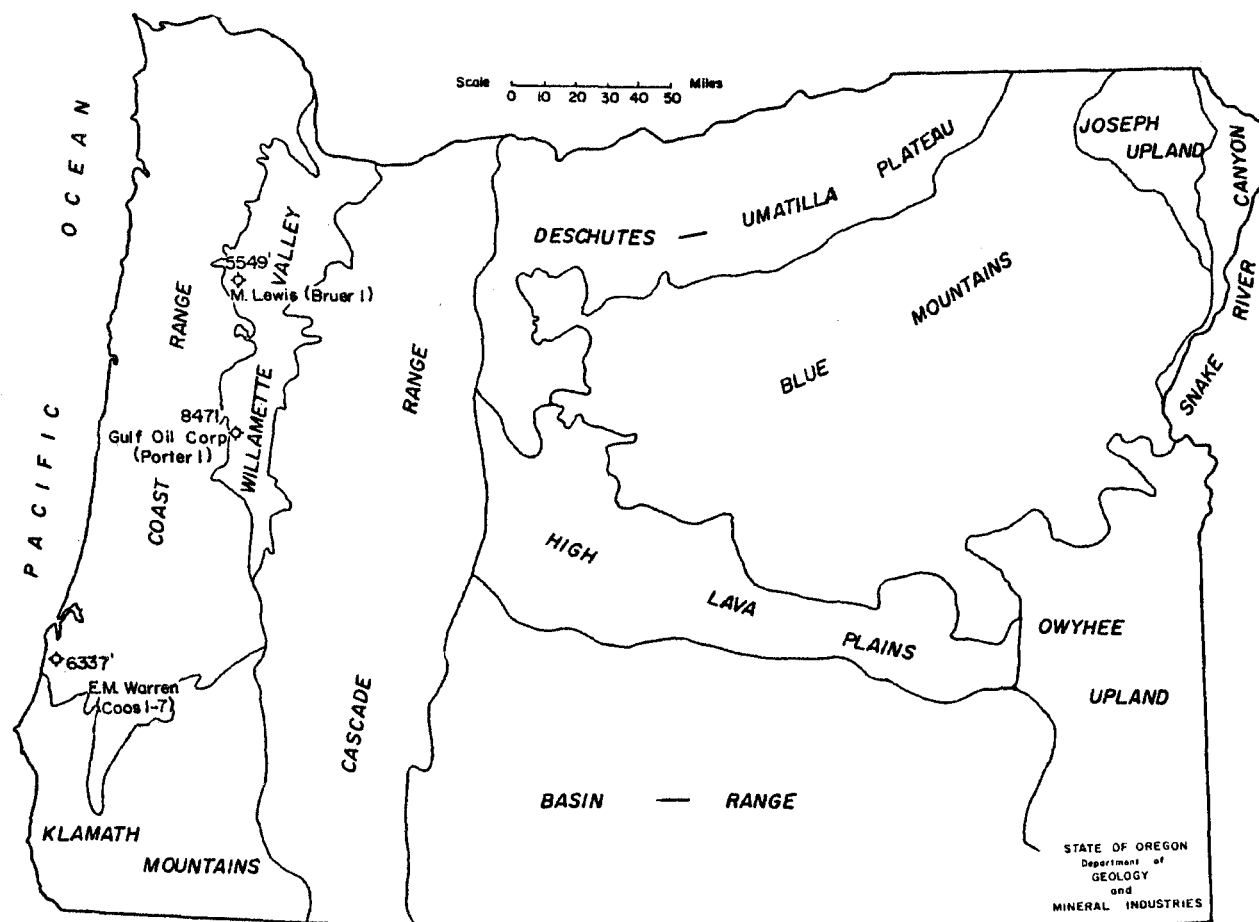
A history of prolific production from the Tertiary marine rocks of California led oil companies to explore sedimentary rocks of the same age in Oregon, Alaska, and Washington. Tertiary marine rocks, together with continental sediments, comprise the major portion of the Coast Range and Willamette Valley geomorphic divisions (see accompanying map, page 13).



Rocks in these two regions are principally tuffaceous sedimentary and volcanic strata, which are thought to reduce the petroleum potential. However, recent discovery of significant production in Eocene continental sediments at the Swanson River Field in the Cook Inlet area of Alaska has renewed hope of finding oil in western Oregon. Production at the Swanson River Field is from the "Hemlock Sand" near the base of a Tertiary sedimentary and volcanic section similar to that found in western Oregon and Washington.

In a large area of central Oregon, unmetamorphosed pre-Tertiary marine rocks which could provide the right environment for oil deposits presumably underlie a thin layer of younger volcanic rocks. Upper Mesozoic marine sediments crop out at many locations along the southwestern portion of the Blue Mountain geomorphic division (see accompanying map). Crude oil filling cavities in fossils and geodes have been found at several localities in this region. Only three or four deep test holes have been drilled thus far to investigate the prospects of the pre-Tertiary rocks.

The Deschutes-Umatilla Plateau, Joseph Upland, High Lava Plains, and the Owyhee Upland (see map) are all a part of the Columbia Intermontane Province. Rocks of this region are predominantly Cenozoic volcanic rocks which are covered at places with thin layers of lake and stream sediments. A few large, deep intermontane basins exist within the province. One such basin is found in the Owyhee Upland, where downwarping of lavas



Map showing the geomorphic divisions of Oregon and location of oil drillings during 1963.

in the Ontario-Payette area of eastern Oregon and western Idaho forms a deep depression into which at least 10,000 feet of continental sediments were deposited during late Tertiary time (Newton and Corcoran, 1963). Numerous showings of gas have been encountered in wells drilled in this basin over the past 50 years, but as yet no commercial deposits have been found. Nearness of the El Paso Natural Gas Co. Northwest pipeline system makes the area attractive for additional exploration. Formation tests of porous zones in the basin thus far have all yielded fresh to brackish, gassy water; dry gas blows have been obtained in less permeable horizons.

Basin and Range topography extends over a large portion of the state (see map) and is an extension of the main province covering most of Nevada. Two deep test drillings were made by the Humble Oil & Refining Co. in the Goose Lake and Summer Lake graben basins of south-central Oregon. Objectives of the drilling were Mesozoic and Paleozoic rocks presumed to be underlying younger continental volcanic and sedimentary rocks. The drilling showed there was possibly in excess of 20,000 feet of Tertiary sedimentary rocks and intercalated lava flows filling these basins (written communication, Quintin A. Aune, California Division of Mines, 1963). Although Humble apparently lost interest in the area after drilling the two test holes, it is still possible these extremely deep intermontane basins may produce commercial quantities of gas.

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PORTLAND HOST TO AMC IN SEPTEMBER

Arrangements for the 1964 metal mining and industrial minerals convention of the American Mining Congress, which will be held at Portland, Ore., September 13-16, are rapidly taking shape under the direction of General Chairman Earl S. Mollard, western states representative, Hanna Mining Co., Myrtle Creek, Ore., who is chairman of AMC's western division.

Wesley P. Goss, president, Magma Copper Co., Superior, Ariz., has accepted the important post of national chairman of the program committee. Under Goss' guidance, industry leaders representing all mining areas of the nation will hold an April meeting to formulate a program embracing major subjects of widespread appeal to the industry.

Convention sessions covering new developments and progress in exploration, open-pit and underground mining, minerals beneficiation, safety and management--together with sessions on mineral policies, labor relations, taxes, public lands, and gold and monetary policies--are expected to attract a large attendance of top industry executives and technical and management personnel from all phases of production. In addition, high-level government officials from the Executive Department and members of both Houses of Congress will be on hand to discuss topics of significant concern to the mining industry.

Entertainment events at the mining convention will include the traditional reception on Sunday, September 13; a welcoming luncheon on Monday, September 14; a "miners' cruise" that evening; and an annual banquet on Wednesday evening, September 16. For the many ladies who will attend the convention, special events are being arranged.

Hotel reservations will be handled through the American Mining Congress housing bureau operated by the Portland Convention Bureau, 1020 Southwest Front Avenue, Portland, Oregon 97214. First assignments of accommodations will be made in late May or early June, but it is suggested that requests for reservations specifying arrival and departure dates be sent in promptly to the housing bureau. (AMC News Bulletin, Jan. 17, 1964.)

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NOTICE

Effective with this issue, new and renewal subscriptions to The ORE BIN will be \$1.00 per year. Available back issues will be 10 cents each.

OREGON ACADEMY OF SCIENCE TO MEET IN MARCH

The Oregon College of Education at Monmouth will be the host for the 22nd annual meeting of the Oregon Academy of Science on Saturday, March 7, 1964. The public is cordially invited to attend.

The Geology and Geography Section will hold morning and afternoon sessions. The chairman, Norman V. Peterson, is a geologist on the staff of the Grants Pass office of the State Department of Geology and Mineral Industries. Plans for the meeting are not entirely completed, but an interesting and varied program is anticipated. Those who expect to present papers are urged to submit titles and abstracts to Dr. F. A. Gilfillan, who is Secretary of the Oregon Academy of Science, Oregon State University, Corvallis, Oregon.

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BUNKER HILL TO EXPLORE CLATSOP SPIT

The State Land Board and the Clatsop County Court have prepared leases covering fairly substantial acreages of land in the Clatsop Spit area of Clatsop County for signature by the Bunker Hill Co. of Kellogg, Idaho. Bunker Hill is expected to sign the instruments promptly and to begin exploration work immediately. Application for a lease was made by the company in August (see August 1963 ORE BIN, page 128). Before a lease form was prepared, the Land Board consulted with seven state natural resource agencies and canvassed six other states for royalty and rental structures.

The lease is for a primary period of 25 years. During the first 5 years Bunker Hill will pay an annual rental of 25 cents per acre. The rental increases to one dollar per acre at the end of the 5-year period. Royalties of 20 cents per each long dry ton of iron ore or concentrates produced must also be paid during the first 10-year lease period. The royalties increase 5 cents per ton during the next 5-year period of the lease, and another 5 cents per ton increase occurs at the beginning of the 16th year.

The lease requires Bunker to commence exploration operations within 180 days of the signing of the lease, and the company must spend not less than \$7,500 during the first lease year. This amount increases to \$25,000 in the aggregate for the second year. Construction on a reduction plant must begin within 7 years from signing and be completed by the tenth lease year. Although differing slightly in certain respects, the Clatsop County lease is patterned closely after the state lease.

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