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DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
Head Office: 1069 State Office Bldg., Portland, Oregon - 97201
Telephone: 226 - 2161, Ext. 488

Field Offices

2033 First Street
Baker 97814

521 N. E. "E" Street
Grants Pass 97526

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OREGON'S MINERAL AND METALLURGICAL INDUSTRY IN 1968

By Ralph S. Mason*

Oregon mineral production, pacing the state's growing economy, reported a healthy 16-percent increase in value of production over 1967 (table 1). The demand for "growth minerals" such as sand, gravel, and stone by public works, industry, and domestic consumers varies from year to year and from place to place within the state. The mineral industry meets this demand promptly and efficiently without recourse to outside assistance. Its remarkable resiliency and vitality stem from the fact that it must compete vigorously in an ever-changing market place. The economic impact of this segment of the state's natural-resource industry is clearly shown in table 2.

Growth Minerals

The demand for sand, gravel, and stone in Oregon in 1968 amounted to 40 million tons. If all of this vast pile of material were transported in 10-ton trucks making a delivery every 30 minutes, it would require 1000 trucks hauling 8 hours every working day of the year. Last year each man, woman, and child in the state used an average of 20 tons of sand, gravel, and stone -- two truckloads per person. A considerable portion of this cargo of aggregate was used in large-scale projects such as highway and dam construction; lesser amounts were used as fill, riprap, and for numerous miscellaneous purposes. The most specialized use for aggregate was in concrete, which was available in a wide variety of mixes -- a far cry from the time-honored 1:2:4 cement-sand-gravel ratio popular a few years ago. The versatility of concrete can be illustrated by the numerous structures that are being built currently. One building, the State of Oregon parking facility in downtown Portland, will use nearly 11,500 cubic yards of concrete when it is completed early in 1969. The unusual thing about this block-square, six-floor building is that all of the concrete was pumped from ready-mix trucks to the forms through a 4-inch-diameter hose. The year 1968 was designated the "Year of the Meteorite" by this Department. It might be equally fitting to call the year 1969 the "Year of the Ready-Mix Truck."

* Mining Engineer, State of Oregon Dept. Geology & Mineral Industries.

Table 1. Some of Oregon's Minerals at a Glance.
Preliminary Figures for 1968
(in thousands of dollars)

	1967	1968
Clays	\$ 295	\$ 338
Gem stones	750	750
Lime	2,059	2,311
Mercury	461	509
Pumice; volcanic cinders	1,195	1,200
Sand and gravel, stone	45,406	55,440
Miscellaneous*	16,394	16,999
Total	\$66,560	\$77,547

*Cement, copper, peat, nickel, perlite, silver, gold, diatomite, talc, and soapstone.

Most certainly, these huge vehicles clearly symbolize community growth and state development. In an era of rapidly increasing costs the aggregate-producing industry of Oregon stood out almost alone in holding the price line. The average price per ton surprisingly declined one cent from that of the previous year. This makes the 21.8 percent increase in total value of the aggregate produced in the state last year even more significant.

The rapidly increasing demand for aggregate in Ore-

gon is creating some problems which must be solved in the very near future. Despite the existence of numerous planning groups in the state, no steps have yet been taken to guarantee that adequate supplies of aggregate will be available in the years ahead. Supplies of aggregate in the state as a whole are plentiful, but their location with respect to markets in many cases is poor. Aggregate is a low-cost commodity which generally must be produced within a short distance of the market. Deposits of aggregate are not harmed by fire, frost, or flood but they must remain fixed in one place until used. It is this last feature that makes planning so vitally necessary. Aggregate deposits are located for the most part close to population centers, and these settlements are, almost without exception, rapidly extending out to the vicinity of the deposits. Many deposits have already been engulfed and thus wasted. Some have been zoned out of existence and others have been checkmated for various reasons. Comprehensive and effective steps must be taken shortly to provide planning for timely extraction of the aggregate, followed by conversion of sites for use in the communities' long-range development. Unless this type of consecutive conservation is programed, many areas will be facing shortages of aggregate which will be costly to obtain from distant sources.

The production of cement increased slightly over that of the previous year and was furnished by one company, Oregon Portland Cement, operating plants at Lime in Baker County and at Lake Oswego in Clackamas. Limestone for the Baker County operation was obtained locally, that for the Lake Oswego plant came from Texada Island, B. C. The manufacture of lime increased more than 10 percent with four companies in operation. Oregon Portland Cement Co. opened a pit in weathered sandstone on Gnat Creek in eastern Clatsop County during the year and began shipments to its Lake

Table 2. The Million-Dollar-a-Year Club, 1967*

<u>County</u>	<u>Value</u>	<u>County</u>	<u>Value</u>
Baker	\$5,985,000	Klamath	\$1,716,000
Clackamas	7,574,000	Lane	7,890,000
Deschutes	1,054,000	Multnomah	6,748,000
Douglas	9,730,000	Polk	1,129,000
Jackson	2,843,000	Umatilla	5,378,000
Washington			\$2,441,000

* In addition to the values shown, there was a total of \$5,706,000 which could not be assigned to specific counties. Production from Columbia and Wallowa Counties was concealed to avoid disclosing individual company confidential data. If the state's total mineral production had been divided equally among the 36 counties, each county would have produced an average of \$1,850,000 during the year.

Oswego plant. The pit is located on State Board of Forestry lands. Royalties accruing to the board amounted to \$4,643 for the year. Approximately three acres were involved in the operation, which will reclaim the worked-out areas as the work progresses. The sandstone is trucked to the Columbia River at Wauna and then barged to Lake Oswego, where it is unloaded with the same equipment used for the limestone shipped from Texada Island, B.C.

Consumption of Oregon-produced pumice, scoria, and volcanic cinders continued at about the same level as last year. Most of the demand for these materials was for road construction. An increased interest in red scoria in a wide range of sizes for roofing material was reported.

Common brick and tile were fired at kilns located in 10 different counties. Production was at about the same level as in the previous year. Red-firing clays have been produced in the state since 1855. Production of expansible shale was confined to one operation in northwestern Washington County, where Empire Building Materials furnished Keasey shale to make a lightweight aggregate. Empire also fine-ground some of its product to make a pozzolan.

Skeletons of microscopic fossil plants (diatoms) from a deposit in Christmas Lake Valley in central Lake County were marketed by Archie M. Matlock for use as an extender in plywood glue. Matlock has been mining and processing diatomite in Lake County for a number of years. The diatomite is sold as a floor-sweeping compound, as an absorbent for oil and various liquids, as a poultry and animal litter, a soil conditioner, and as an additive in concretes. Matlock announced plans to erect a diatomite

processing plant at the quarry. Plans for constructing a perlite "popping" plant at the same location were under consideration. The plant would process crude perlite from a deposit southeast of the town of Paisley.

Minor Industrial Minerals

Central Oregon Bentonite Co. helped Keep Oregon Green during one of the worst droughts in recent years. Bentonite produced from the company's pits in eastern Crook County was used to seal water reservoirs and canals, and as an additive in drilling muds used by well drillers. Minor amounts of bentonite were also used in foundries and as a stock-feed binder.

Jewell's Mother Earth expanded its plant facilities near Enterprise in Wallowa County. The company digs and processes peat humus from a large bog. The product is sold under the company label and is also distributed through other large outlets.

Blocks of talc and soapstone suitable for sculpture were quarried by John Pugh at a quarry located on Powell Creek in Josephine County. Approximately 3 tons were produced during the year.

Bristol Silica Co. continued to quarry and process lump silica from a pit near Gold Hill in Jackson County. The company has been in continuous operation since the 1930's.

A small tonnage of perlite was mined by Del Harmon from a deposit on Dooley Mountain in Baker County.

Recreation Materials

Oregon's large and varied treasure house of semi-precious gems provided the state with the basis for its most popular recreational activity. "Rockhounding" now accounts for more family hours of time than any other natural-resource based recreation. Rockhounding appeals to all ages and is an all-season, day and night pursuit. Finding raw gem material in the field is only half the fun, since cutting, polishing, tumbling, shaping, and jewelry making comprise an equally important place in the rockhound's activities. Rockhounds are understandably reticent about revealing certain favorite locations, but they are communal by nature and the state is spotted with agate and mineral clubs which sponsor a wide range of associated activities such as the study of geology, lapidary, gemmology, mineralogy, and crystallography. Numerous club-sponsored exhibitions are held each year which attract record-breaking crowds. Several counties have organized annual rockhound get-togethers which draw enthusiasts from all over the United States. The Prineville Pow-Wow hosted 18,000 visitors during the week-long session, and the Chamber of Commerce estimates that rockhounds spent 80,000 visitor days in the county last year, leaving \$1 million to perk up the local economy.

It is extremely difficult to assess the dollar value of the semi-precious gems produced in the state. Compared to the rest of the state's mineral industry, the number of operators is very large and many sales are consummated on an informal basis. The U.S. Bureau of Mines estimates that \$750,000 worth of stones are produced annually, but no detailed canvass has ever been made.

Closely related to rockhounding, but aimed at an even wider audience, was the interesting geology-based program that got under way in Grant County during the year. Under the auspices of the Grant County Chamber of Commerce and the Grant County Planning Commission, initial steps were taken to provide roadside geological information for tourists. With the cooperation of the U.S. Geological Survey, the State of Oregon Department of Geology and Mineral Industries, the State Highway Department, and the Division of Parks and Recreation, a series of geological points of interest was selected and informational material prepared. In addition to roadside plaques that will identify and explain the geologic features, a brochure will be printed for distribution to give a running account of the geology visible from the highways and roads.

The Metals

The production of ferronickel by Hanna Mining Co. at its mine and smelter in Douglas County continued at very nearly the same rate as that of last year. Hanna quarried 1.1 million tons of ore containing 1.4 percent nickel. The operation is the only producer of primary nickel in the United States and the mainstay of the state's metal-producing industry.

Mercury production remained at almost exactly the same rate as last year's, with 940 flasks weighing 76 pounds each reported. The average annual price per flask climbed more than \$50 above that of 1947 to \$542, the second highest level ever attained. Oregon mercury production came principally from three mines, the Black Butte in Lane County, the Bretz in Malheur, and the Glass Buttes in Lake County. The Bretz and Glass Buttes shut down late in the year. Minor amounts of the metal were furnished at the Elkhead mine in Douglas County, the Canyon Creek mine in Grant, the Whiting prospect in the Horseheaven mine area in Jefferson, the Mercury Queen prospect in Crook, and the Polaris prospect in Lake.

With a reported production of only 15 ounces of gold during 1967, the gold miner practically disappeared from the scene. Very probably additional gold was produced in the state by small, part-time operators who failed to report their production. This is a sad come-down for a state that has invigorated the local economy with 5,797,000 fine troy ounces of gold since it was first discovered in 1852. At today's prices (\$40 per ounce) that much gold would be worth \$231,880,000.

Iron-ore slurry originating in Peru will be processed into steel in a new plant to be operated by Oregon Steel Mills in North Portland. The

PRINCIPAL PRODUCERS OF NONMETALLIC MINERALS IN OREGON, 1968

Commodity and company	Type of activity	County	Address	Commodity and company	Type of activity	County	Address
Cement: Oregon Portland Cement Co.	Plant	Baker and Clackamas	Portland	Peat: Jewell's Mother Earth	Mine	Wallowa	Enterprise
Clay: Central Oregon Bentonite Co.	Pit	Crook	Prineville	Perlite: Del T. Harmon	Mine	Baker	Stanfield
Columbia Brick Wks.	Pit & plant	Multnomah	Portland	Pumice: L.V. Anderson	Mine & plant	Lane	Oakridge
Empire Lite-Rock, Inc.	Pit & plant	Washington	Portland	Central Oregon Pumice Co.	Mine & plant	Deschutes	Bend
McMinnville Brick Co.	Pit & plant	Yamhill	McMinnville	Graystone Corp.	Mine & plant	Deschutes	Bend
Monroe Clay Products Co.	Pit & plant	Benton	Monroe	Kaiser Cement & Gypsum Corp.	Mine & plant	Gilliam	Permanente, Calif.
Needy Brick & Tile Co.	Pit & plant	Clackamas & Marion	Hubbard	Oregon Portland Cement Co.	Mine	Baker	Portland
Oregon Portland Cement Co.	Plant	Baker	Portland	D. W. Parks	Mine	Klamath	Klamath Falls
Willamina Clay Products Co., Inc.	Pit & plant	Yamhill	Tigard	Silica: Bristol Silica Co.	Mine & plant	Jackson	Gold Hill
Diatomite: Keating Diatomaceous Earth Co.	Mine	Baker	Baker	Building stone: Ray Bohlman	Quarry	Jefferson	Madras
A.M. Matlock	Mine & plant	Lake	Eugene	Anthony Brandenthaler	Quarry	Baker	Baker
Lime: Ash Grove Lime & Portland Cement Co.	Plant	Multnomah	Portland	Talc and soapstone: John H. Pugh	Mine	Josephine	Grants Pass
Chemical Lime Co.	Plant	Baker	Baker				
Pacific Carbide & Alloys Co.	Plant	Multnomah	Portland				

PRINCIPAL PRODUCERS OF METALLIC MINERALS IN OREGON, 1968

Commodity and company	Type of activity	County	Address
Aluminum:			
Harvey Aluminum Co.	Plant	Wasco	The Dalles
Reynolds Metals Co.	Plant	Multnomah	Troutdale
Ferroalloys:			
Hanna Nickel Smelting Co.	Plant	Douglas	Riddle
Union Carbide Corp. Mining & Metals Division	Plant	Multnomah	Portland
Gold:			
M & B Logging Co.	Mine (lode)	Jackson	Canyonville
Russell Mitchell	Mine (lode)	Jackson	Medford
Osee Oden	Mine (lode)	Josephine	Wolf Creek
George Slade	Mine (lode)	Josephine	Applegate
Mercury:			
Alcona Mining, Inc.	Mine	Douglas	Springfield
Black Butte Mining Company	Mine	Lane	Cottage Grove
Canyon Creek Mercury Mine	Mine	Grant	Canyon City
Jackson Mt. Mining	Mine	Lake	Winnemucca Nev. (Hampton, Or.)
Nickel:			
Hanna Mining Co.	Mine	Douglas	Riddle
Silicon:			
National Metallurgical Corp.	Plant	Lane	Springfield

plant is scheduled to go into production in 1969. Cascade Steel Rolling Mills began construction of a rolling mill which will turn out bars and angles. The plant site is at McMinnville in Yamhill County.

Smelting of primary aluminum at the state's two aluminum plants increased 4 percent over the 1967 mark. The Harvey Aluminum plant at The Dalles imported alumina from a company-owned facility located at St. Croix in the Virgin Islands. Reynolds Metals Co. announced that a 40,000-ton-

per-year potline would be added to its Troutdale complex located a few miles east of Portland on the Columbia River. Employment at the two plants totaled almost 1300 workers. Ground was broken last summer for the state's third aluminum-reduction plant. Northwest Aluminum Co. announced plans to erect a \$140 million aluminum complex in the Warrenton-Astoria area of Clatsop County. Annual capacity would be 130,000 tons of primary aluminum. The plant would also recover 310,000 tons of alumina annually from bauxite imported from Australia. When fully operative, the complex will employ 1000 men on a year-around basis.

Ferroalloy production in the state included ferromanganese and silicomanganese produced by Union Carbide at its North Portland plant and ferro-silicon produced by Hanna for its own use at the Riddle ferronickel plant.

Refined silicon metal was reduced by National Metallurgical at its Springfield plant. National is a subsidiary of Kawecki Berylco Industries, Inc. Silicon is used principally as an alloy in aluminum.

Modern Metals

The city of Albany reinforced its position as a center for the space-age metals columbium, zirconium, and titanium during 1968. Four firms, Wah Chang Albany, Oregon Metallurgical, REM Metals, and TiLINE were joined late in the year by a newcomer, Zirconium Technology Corp. Zirtech will manufacture seamless zirconium tubing and finished products from other specialty metals. Plant construction will get under way early in 1969 with production by midyear.

TiLINE installed the world's largest titanium-casting furnace during the summer. The unit stands 44 feet high and can accommodate 1000-pound castings up to 100 inches in diameter. Oregon Metallurgical Corp. increased its plant capability by installing a new ingot-melting facility which can produce a 30-inch-diameter ingot. OREMET specializes in titanium ingot and casting production. REM Metals Corp. operated its newly built precision casting and machining plant throughout the year. REM produces exotic metal shapes for the aircraft industry.

Wah Chang Albany Corp., in response to increased demands for zirconium in the commercial nuclear power industries, doubled its zirconium-sponge reduction capacity. This increase was accomplished by conversion to a new furnace design which allows more rapid cycles and virtually eliminates release of contaminants to the atmosphere. Zirconium-oxide production remained at 1967 levels. New air-pollution control devices were added to the crude and pure chlorination facilities and a new 100-foot-diameter clarifier was placed in operation for improved water-pollution control. The melting capacity was increased by the addition of a vacuum arc remelt furnace and improved electrode-welding facilities. A 2000-ton forging press was installed in the fabrication plant. The new 20,000-square-foot technical center, housing the analytical laboratories, plant engineering,

assurance, library, and research and development functions, was occupied during the summer. Employment increased from 950 to 1075 during the year.

Mineral Exploration

During 1968 more exploration for minerals was conducted in the state than ever before. At least 21 exploration programs were fielded, most of them by major mining companies. The Nuclear Fuels Division of Gulf Oil Corp., which leased large acreages of state-owned land in southeastern Oregon in 1967, conducted an active campaign during the year. The company drilled more than 100 test holes, some of them deeper than 1000 feet, to verify indications reported by geophysical exploration. A report filed with the Division of State Lands by Gulf late in the year revealed that it plans to retain its interest in approximately three-fourths of the 82,327.56 acres leased originally from the state. Leased lands were relinquished in Crook, Grant, and Wheeler Counties and retained in Harney, Lake, and Malheur Counties.

The most comprehensive exploration program for low-grade copper ore ever carried out in the state was in full swing during 1968. Two companies, Cyprus Mines, Inc., and Bear Creek Mining Co., which is a subsidiary of Kennecott Copper Co., drilled prospects in eastern Baker County. Interest by the companies in the area stems from a geochemical study made by the Department of Geology and Mineral Industries several years ago.

The continuing high price for mercury has induced several companies to look at various cinnabar prospects. The Canyon Creek mine in Grant County and the Glass Buttes mine in Lake County were both examined by major companies. Interest in the quicksilver district east of Prineville in Crook County was also shown by several firms, but no serious programs were inaugurated.

Omega Mining Co., Ltd., of Vancouver, B.C., continued its intensive exploration of the base-metal mines in the Bourne area of eastern Baker County. Omega, now entering its third year on year-around activity, has reopened old workings at the Golconda, E&E, Tabor Fraction, and North Pole mines. The company holds nearly 1500 acres over a continuous 3-mile distance along the strike of one of the most important mineralized zones in eastern Oregon. Omega has so far rehabilitated 1540 feet of drifts and 200 feet of raises, driven 1900 feet of new drifts and 165 feet of new raises, and core-drilled 4250 feet from 7 surface and 15 underground stations. Late in the year Omega announced plans to construct a 1000-ton-per-day mill. If the program develops as planned, Omega will become Oregon's second largest mine operator with 300 men employed. The Hanna Mining Co. nickel mine and smelter in Douglas County is the largest mining operation in the state and has been a major economic factor in the area ever since 1954.

In response to a steadily increasing demand by the mining industry for information on Oregon gold and silver deposits, the State of Oregon Department of Geology and Mineral Industries published its two-pound-five-ounce, 337-page bulletin No. 61, "Gold and Silver in Oregon." The report contains information on 400 lode and 50 placer mines. Numerous mine maps and several regional maps showing the gold placers are included. Originally prepared for the professional geologist and mine operator, the bulletin has enjoyed wide acceptance by the general public, which is using the volume as a guide book to mineral deposits and old mines.

Cornucopia Placer Co. continued with its work of stripping overburden from a deeply buried placer on Pine Creek. Pine Creek is situated in the same general area as the famous Cornucopia mine in the foothills of the Wallowa Mountains of northeastern Baker County. The creek was worked in a small way by drift placers in the 1930's. Full-scale production is scheduled for early 1969.

In sharp contrast to the large amount of private exploration in the state, there was only one project (the Argonaut mine in Baker County) cooperatively financed by the Office of Minerals Exploration. OME contracts are for exploration and development of properties containing certain minerals. The monies advanced by OME are repaid out of profits from production resulting from the program.

Atlantic Richfield flew over much of southeastern Oregon last summer making a geophysical reconnaissance for radioactivity. Atlantic acquired the old Lakeview uranium mill from Commercial Discount Corp. of Chicago. At year's end no plans for using the plant had been disclosed. Western Nuclear exercised its two-year-old option to purchase the White King uranium mine near Lakeview. The White King was discovered in 1955, with first ore production starting in 1957. The Lakeview uranium plant was constructed in 1958 and processed White King ore until late in 1960, when the mine shut down.

During 1968 a cooperative project to assess the mineral potential of about 6000 square miles of Klamath and Lake Counties was carried out by the Department with financial assistance from the Great Northern Railroad Co. and Pacific Power & Light Co. A geological map and bulletin discussing the metallic and industrial mineral occurrences and potential is scheduled for publication in 1969. A total of 350 geochemical stream-sediment samples was collected by the Department and analyzed for copper, zinc, molybdenum, mercury, and uranium. The sampling area was in the Fremont Mountains west of Lakeview.

The Heavy Metals Program of the U.S. Geological Survey, which was initiated in 1966 to stimulate the production of a small group of critical metals, principally gold and platinum, was continued during 1968. Following publication of a Survey report on the gold distribution in surface sediments on the continental shelf off southern Oregon, further exploration of some of the areas containing above-normal concentrations of gold was

started late in the summer with work scheduled to be continued in 1969. The current program is designed to determine the thickness and tenor of the previously delineated areas, all of which lie at depths of 40 fathoms or less. This Department cooperated with the Survey by supplying 3000 stream-sediment samples collected from adjacent onshore locations. The Survey also has a joint research contract with the Department of Oceanography at Oregon State University and with the Geology Department of the University of Oregon.

Selected List of Department Publications on Minerals

The following publications on Oregon minerals have been selected from those issued by the Department. In addition, the Department has numerous unpublished reports on mines and prospects in its files. The publications that have gone out of print may be examined at the Department's offices or at repository libraries in the state and at many universities across the country.

- Brooks, Howard C., 1963, Quicksilver in Oregon; Bulletin 55 (out of print).
Brooks, Howard C., and Ramp, Len, 1968, Gold and Silver in Oregon; Bulletin 61 (\$5.00).
Corcoran, R. E., and Libbey, F. W., 1956, Ferruginous Bauxite Deposits in the Salem Hills, Marion County, Oregon; Bulletin 46 (\$1.25).
Koch, George S., 1959, Lode Mines of the Central Part of the Granite Mining District, Grant County, Oregon; Bulletin 49 (\$1.00).
Libbey, F. W., Lowry, W. D., and Mason, R. S., 1945, Ferruginous Bauxite Deposits in Northwestern Oregon; Bulletin 29 (out of print).
Libbey, F. W., and Corcoran, R. E., 1962, The Oregon King Mine (silver), Jefferson County, Oregon; Short Paper 23 (\$1.00).
Libbey, F. W., 1967, The Almeda Mine, Josephine County, Oregon (copper); Short Paper 24 (\$2.00).
Ramp, Len, 1961, Chromite in Southwestern Oregon; Bulletin 52 (\$3.50).

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OAS TO MEET AT UNIVERSITY OF PORTLAND

The Oregon Academy of Science will hold its annual meeting February 22 at the University of Portland. Presentation of papers will begin at 9:30 a.m. and continue through the morning. In the afternoon there will be a symposium on "Man and his natural environment." M. Alan Kays is chairman of the geology section.

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OIL AND GAS EXPLORATION IN OREGON

By V. C. Newton, Jr.*

During 1968 field investigations were conducted by one major oil company in western Oregon while five other large firms had exploration staff members assigned, at least on a part-time basis, to geologic studies of the Pacific Northwest. Mobil, Standard, and Texaco hold an estimated 85,000 acres of leases in the western half of the state. Approximately 5000 acres are leased to Central Oils, Inc. southeast of the town of Madras in central Oregon, and several hundred acres of oil leases are scattered throughout eastern Oregon, many of them held for speculative purposes. Union Oil Co. emerged as the only offshore leaseholder in Oregon when rentals came due December 1, 1968 (table 1). No other firms renewed outer-continental shelf leases in Oregon and Washington for the year 1969. Standard Oil Co. relinquished its interest in offshore leases held jointly with Union in the Pacific Northwest, so that Union now is the sole owner of the leases. Standard, Texaco, Mobil, and Atlantic-Richfield held federal leases off the Oregon coast last year. Leases on the offshore tracts expire December 1, 1969 and can be extended only if production is obtained.

No work was done under the drilling permit (No. 59) held by William Craig, Tacoma, Wash. on his Marion County wildcat, in spite of plans to drill below the 1560-foot depth reached in 1967 (table 2). The test was designed to explore shallow Eocene sands and was located near a hole drilled by Portland Gas & Coke Co. in 1935, which encountered several gas shows. R. F. Harrison began work to deepen an old hole drilled by Central Oils, Inc. of Seattle, Wash. on the Morrow Bros. ranch 10 miles southeast of Madras. No new hole was drilled in 1968. Harrison had drilled out the abandonment plugs and conditioned the hole for deepening by the end of the year.

Geology and Drilling

There is geologic evidence that Oregon has been invaded by the sea many times during the past 400 million years. Sediment deposited on the

* Petroleum Engineer, State of Oregon Dept. Geology & Mineral Industries.

Table 1. Federal OCS Leases - 1968

Company	OCS No.	Tract No.	Area	Present Status
Shell	PO -73	19	Tillamook, Ore.	Relinquished 12/1/68
Shell	PO -75	22	Tillamook, Ore.	Relinquished 12/1/68
Texaco-Mobil	PO-113	105	Florence, Ore.	Relinquished 12/1/68
Texaco-Mobil	PO-116	113	Florence, Ore.	Relinquished 12/1/68
Texaco-Mobil	PO-122	126	Florence, Ore.	Relinquished 12/1/68
Texaco-Mobil	PO-078	28	Florence, Ore.	Relinquished 12/1/68
Union	PO -85	39	Florence, Ore.	Renewed 11/25/68
Union	PO -86	40	Florence, Ore.	Renewed 11/25/68
Union	PO-144	10	Hoh Head, Wash.	Renewed 11/25/68
Union	PO-145	11	Hoh Head, Wash.	Renewed 11/25/68
Union	PO-146	12	Hoh Head, Wash.	Renewed 11/25/68

Table 2. Active Drilling Permits - 1968

Permit No.	Company	Well Name	Location	Depth	Status
59	William Craig	Gilmour 1	Sec. 24, T. 9 S., R. 4 W. Marion County	1560'	Work suspended, abandonment pends.
60-D	R.F. Harrison	Morrow 1	Sec. 18, T. 12 S., R. 15 E. Jefferson County	3300'	Drilled out plugs and conditioned hole. Lost tools in hole - recovered.

ancient ocean floors accumulated as rock strata which today measure more than 100,000 feet in thickness (Youngquist, 1961; Dickinson and Vigrass, 1963). Since petroleum hydrocarbons are found predominantly in marine rocks throughout the world, it appears as though large areas in Oregon consisting of this type of rock are likely to contain oil and gas deposits. Favorable geologic conditions have encouraged oil companies and wildcatters to drill 170 test holes in the state over the past several decades, but none of the tests found hydrocarbons in commercial amounts.

Marine sedimentary rocks in Oregon range in age from Devonian to late Tertiary. Exposures of Paleozoic and Mesozoic marine rocks occur in the Klamath Mountains and in the Blue Mountains (see accompanying map). These older rocks are not exposed anywhere in western Oregon outside of the Klamath Mountains and the bordering areas, and none of the deep holes drilled thus far has reached them. Presumably Paleozoic and Mesozoic rocks do underlie much of western Oregon, and they are believed to extend beneath the Cascades and to be contiguous with rocks exposed in the Blue Mountains (Weaver, 1945; Wells and Peck, 1961; Dott, 1965). The area of unmetamorphosed Paleozoic-Mesozoic marine rocks in central Oregon is estimated to be 8000 square miles (Corcoran, 1956). Tertiary marine rocks ranging in age from early Eocene through middle Oligocene are exposed over a large area of western Oregon, whereas late Oligocene rocks are less extensive. Miocene marine beds are found in the Lower Columbia River valley of northwestern Oregon and in some of the small coastal embayments, indicating that the sea had nearly withdrawn from the continent by that time. Most of the later Tertiary marine rocks lie west of the present shore line.

The western Tertiary basin, including the continental shelf out to the 600-foot water depth, encompasses an area of nearly 14,000 square miles. More than 40,000 feet of sediments and interbedded volcanic rocks were deposited in the Tertiary seaway (Youngquist, 1961). Thirty deep tests have been drilled in the western basin (see accompanying map and table 3).

All of the sedimentary basins in Oregon have been tested by deep drilling. This drilling density compares with a 30-mile grid covering the basin areas, so that exploration thus far can be seen to be of stratigraphic importance only. Not enough drilling has been done in any area to define subsurface structure. The offshore area was the last to be drilled because of deep-water environment of the Pacific shelf.

Petroleum and Economy

It is often asked what effect an oil discovery would have on the state. When one considers that Oregon residents and visitors to the state use more than 43 million barrels of petroleum products (Independent Petroleum Assn. of America, 1976) and 65 billion cubic feet of natural gas each year, it

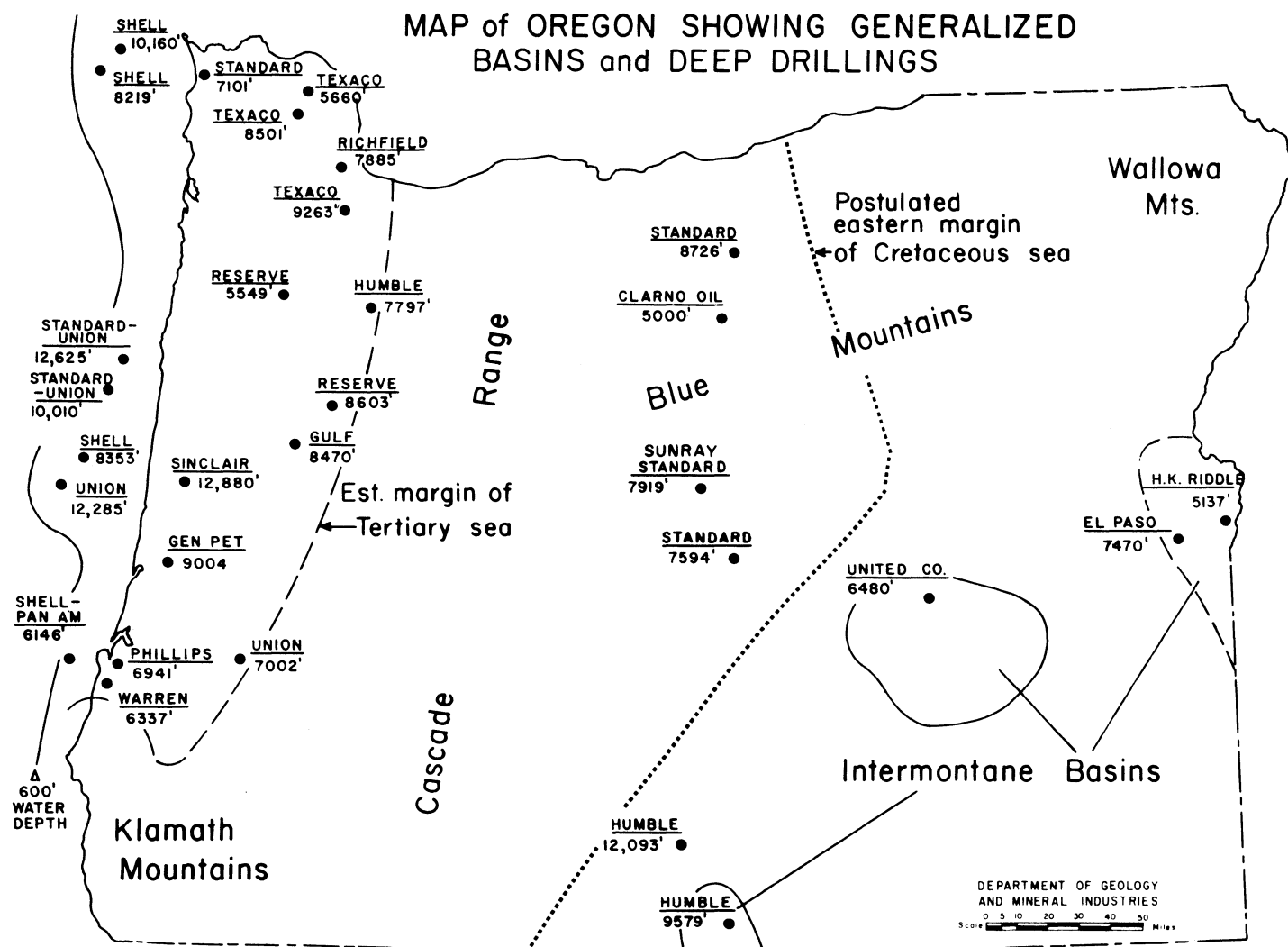


Table 3. Deep Wells with Hydrocarbon Shows.

Company	Well Name	Year Drilled	Total Depth	Description of Show
Gulf Oil	Porter 1	1963	8470'	High pressure salt water at 4650', registered 74 units on gas logging instrument. (Tertiary)
Pan American et al.	Coos Bay 1	1967	6146'	Hydrocarbon shows tested, found to be noncommercial. (Tertiary)
Reserve Oil & Gas	Bruer 1	1960	5549'	Test at 1550' recovered 358' gassy, muddy salt water, registered 60 units on gas logging instrument. (Tertiary)
Reserve Oil & Gas	Esmond 1	1962	8603'	Gas in sandstone at 2900', registered 85 units, gas in tuff at 6400'-7100' registered 400+ units. Test at 7100' flowed 2100 Bbl/day very gassy salt water. Gas at 8050' in volcanics registered 300 units on logging instrument. (Tertiary)
Sunray-Standard	Bear Creek 1	1958	7919'	Gas in siltstone 3950'-4250', registered 30 units on logging instrument. (Cretaceous)
Texaco, Inc.	Cooper Mt. 1	1946	9263'	Test 7862'-9263' flowed 29 Bbl/hr. gassy salt water from sandstone and interbedded volcanics. (Tertiary)
Warren	Coos 1-7	1963	6337'	Gas shows 3500'-4100', registered 300+ units on logging instrument. Wire-line test 4320' recovered oil. Hydrocarbon fluorescence on cuttings 4860'-5200'. (Tertiary)

becomes evident that a local market of significant size is available. The market has an estimated well-head value of \$150 million. The value of finished products is several times greater.

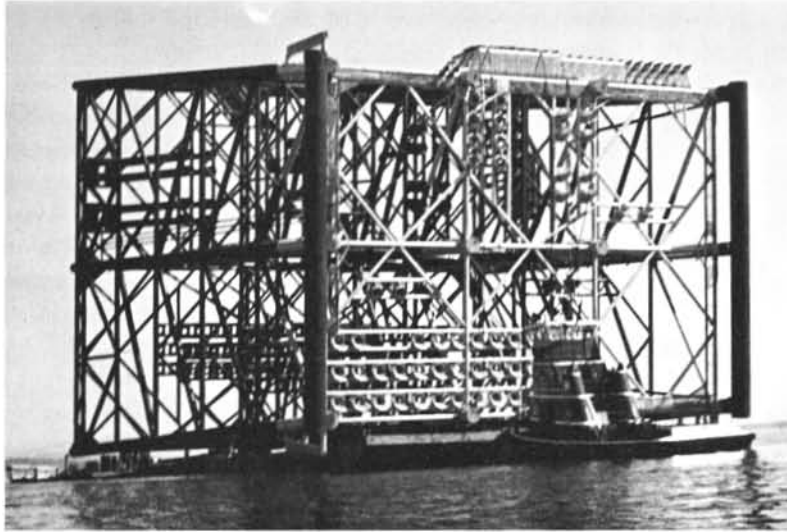
Recent oil discoveries in the Cook Inlet of Alaska and offshore from Santa Barbara in California have been felt as far away as Portland, Oregon. American Pipe & Construction Co. in Portland has started construction on its sixth drilling platform for offshore development (see photograph). Each structure represents a contract for several million dollars. Albina Engine & Machine Works, Inc. of Portland has received ship repair contracts on vessels used in Alaskan exploration in past years and in 1968 constructed a two-story platform to house separating units for Texaco's Cook Inlet production. Atlantic-Richfield Co. has laid plans to construct a \$100 million refinery in northwestern Washington to process crude from the recent Alaskan North Slope discovery. When completed, the facility will be the largest in the Pacific Northwest. Mobil, Texaco, and Shell have large refineries in the area to treat Canadian oil. The advent of an oil discovery of size within the state would add greatly to the economy of Oregon.

The bringing of natural gas to Oregon and Washington in 1957 has resulted in good jobs for hundreds of workers. Pipe-line construction boomed for 10 years until the present interstate systems were completed. El Paso (Northwest system to be operated by Colorado Interstate Corp.) and Pacific Gas Transmission Co. operate the two transmission systems which cross the state. Northwest Natural Gas, California-Pacific Utilities, and Cascade Natural Gas operate distributing systems within the state. The availability of low-rate natural gas and hydro-electric power in the industrial areas of Oregon has stimulated economic growth and helped to provide a high living standard for residents.

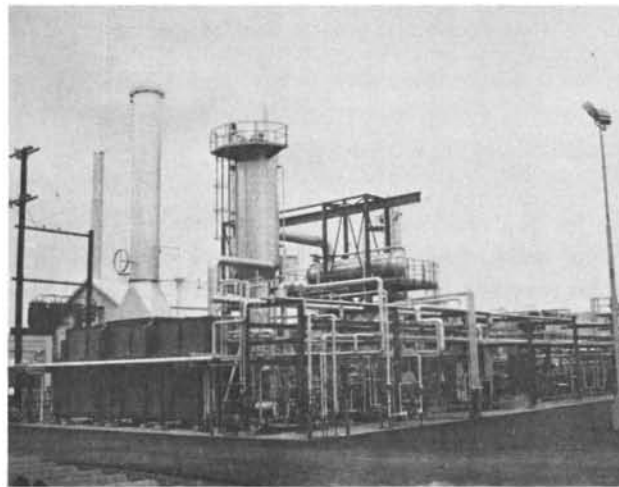
Will Oil Be Found?

The odds for discovering petroleum in Oregon are just as good as in any other wildcat area. Results of drilling have not been entirely discouraging, as can be seen in table 3. Reservoir strata do exist but thus far have yielded only salt water in tests. Such strata have not been found offshore as yet, but drilling is too sparse to reach any definite conclusion about the shelf geology. Gauging from the depth of the holes drilled, sedimentary rocks are at least 13,000 feet thick on the shelf, probably much thicker. There are still many good locations onshore to test in Tertiary rocks of western Oregon. The Paleozoic-Mesozoic basin of central Oregon, which challenges the sophisticated geoscientist because of its complex geology and cover of younger volcanics, is virtually unexplored.

There is no question that the \$600 million offshore lease sale near Santa Barbara in California and the continuing development of the Cook Inlet fields in Alaska make it difficult to attract exploration money to



Offshore production platform starts its journey to Santa Barbara, Cal., down the Columbia River. The large structure was built in 1968 by American Pipe & Construction Co. of Portland.



Completely automated refinery completed by Union Oil Co. in 1968 at its northwest Portland storage complex. Plant capacity is rated at 7500 BBL/D of asphalt.

Oregon and Washington. The latest drain on West Coast capital is for development of the huge North Slope, Alaska discovery made by Atlantic-Richfield and Humble jointly in 1968. The remote location of the field, the extreme operating conditions, and the competition for leases will tax industry heavily. The North Slope may become the largest oil field on the continent.

Julius Babisak, exploration manager for Atlantic-Richfield Co., said at the July 1968 meeting of the International Oil Scouts Association in San Antonio, Texas, "The critical data need is stratigraphic." He outlined a \$100 million program for group drilling projects in the United States, of which \$10 million was projected to be spent on Oregon-Washington drilling. An urgent need for crude reserves by domestic companies to supply the United States market with 3.6 billion barrels of oil a year (U.S. Bureau of Mines, Nov. 1968) will stimulate more such thinking among explorationists. Oregon should see several more deep tests in the future.

Bibliography

- Buddenhagen, H. J., 1967, Structure and orogenic history of the southwestern part of the John Day Uplift, Oregon: *The ORE BIN*, v. 29, no. 7, p. 129-138.
- Corcoran, R. E., 1956, What is the status of exploration activity in Oregon: *World Oil* magazine, October 1956.
- Dickinson, W. R., and Vigrass, L. W., 1965, Geology of the Suplee-Izee area, Crook, Grant, and Harney Counties, Oregon: *State of Oregon Dept. Geology and Mineral Industries Bull.* 58.
- Dott, R. H., Jr., 1965, Mesozoic-Cenozoic tectonic history of the southwestern Oregon coast in relation to Cordilleran orogenesis: *Jour. Geophys. Res.*, v. 70, p. 4687-4707.
- Eardley, A. J., 1951, *Structural Geology of North America*: Harper & Bros., New York, 624p.
- Gay, T. E., 1966, Economic mineral deposits of the Cascade Range, Modoc Plateau, and Great Basin region of northeastern California: *Cal. Div. Mines and Geology Bull.* 190, p. 97-104.
- Huntting, M. T., et al., 1961, *Geologic map of Washington*: Wash. Div. Mines and Geology.
- Independent Petroleum Association of America, 1967, *The oil producing industry in your state*: Indep. Petr. Assn. of Amer., Tulsa, Okla.
- Peck, D. L., 1964, Geologic reconnaissance of the Antelope-Ashwood area, north-central Oregon: *U.S. Geol. Survey Bull.* 1161-D.
- Petersen, G. L., 1967, Lower Cretaceous discontinuity in northern California and Oregon: *American Assn. Petroleum Geologists Bull.*, v. 51, no. 6, p. 864-872.
- U.S. Bureau of Mines, 1968, *Annual petroleum statement, 1967*: U.S.

- Bur. Mines, Nov. 22, 1968.
- Weaver, C. E., 1945, *Geology of Oregon and Washington and its relation to occurrence of oil and gas*: American Assn. Petroleum Geologists Bull., v. 29, no. 10, p. 1377-1415.
- Wells, F. G., and Peck, D. L., 1961, *Geologic map of Oregon west of the 121st meridian*: State of Oregon Dept. Geology and Mineral Industries in cooperation with U.S. Geol. Survey.
- Wilkinson, W. D., and Oles, K., 1968, *Stratigraphy and paleoenvironments of Cretaceous rocks, Mitchell quadrangle, Oregon*: American Assn. Petroleum Geologists Bull., v. 52, no. 1, p. 129-161.
- Youngquist, Walter, 1961, *Annotated lexicon of names applied to Tertiary stratigraphic units in Oregon and Washington west of the Cascade Mountains, with bibliography*: Ann Arbor, Mich., Edwards Bros., Inc.

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THE DEPARTMENT ASSISTS OIL EXPLORATION

Many research organizations and most of the major oil companies have consulted the Department's sample library during the past few years. Extensive use of the sample library by industry continued this past year, while during the same period the Department used samples in a paleontological study of northwestern Oregon.

Cores and cuttings now on hand in the library represent 220,000 feet of stratigraphic section drilled. Availability of deep-well samples allows the geologist to inspect visually material which is otherwise hidden from their view by thousands of feet of overlying rock.

The Department has also assisted oil explorationists over the past decade by its variety of geological publications. Three such articles are now in the process of completion and will be published in 1969. The geology of the southwest portion of the John Day Uplift in central Oregon, by H. J. Buddenhagen, describes unmetamorphosed marine rocks ranging in age from Devonian to Cretaceous. Detailed mapping of these old marine beds and their structural features in the uplift region provides important clues to the geologic history of several thousand square miles of central Oregon now covered by young volcanic rocks. These sedimentary rocks may hold promise of producing oil.

The geology of the Ironside Mountain quadrangle (30' Quad.) by W. D. Lowry covers a complexly folded region of the Blue Mountains which has undergone a wide range of metamorphism. The possibility of finding petroleum in commercial quantities in the area is remote; however, a knowledge of the geology in this part of the Blue Mountain uplift may lead to important conclusions regarding the oil and gas possibilities in the region to the south and southeast, where several thousand feet of Tertiary volcanic rocks and lacustrine beds cover pre-Tertiary formations. A knowledge of

the rocks exposed in uplifted regions enables geologists to evaluate drilling locations in adjacent basins where contemporaneous rocks lie at great depth below the surface.

Subsurface geology of the Willamette and lower Columbia River Valleys is described in a study by V. C. Newton and will be published as an Oil and Gas Series bulletin. The report interprets regional stratigraphy in northwestern Oregon by use of deep well data and surface mapping. Tables of well data and descriptions of stratigraphic sections are contained in the report.

The Department has many publications available which are of interest to the oil explorationist. A selected list of Department maps, miscellaneous papers, bulletins, and Ore Bin articles follows.

Maps:

Wells, F. G., and Peck, D. L., 1961, Geologic map of Oregon west of the 121st meridian: U.S. Geol. Survey in coop. with State of Oregon Dept. Geology and Mineral Industries Map I-325.

Berg, J. W., Jr., and Thiruvathukal, J. V., 1967, Free air gravity anomaly map of Oregon: Geol. Map Series 4-a.

_____, 1967, Complete Bouguer gravity anomaly map of Oregon: Geol. Map Series 4-b.

Dehlinger, P., and others, 1967, Free air gravity anomaly map west of Oregon: Geol. Map Series 4-c.

Corcoran, R. E., and others, 1962, Geologic map of the Mitchell Butte quadrangle, Oregon: Geol. Map Series 2.

Miscellaneous Papers:

No. 4 Rules and regulations for the conservation of oil and natural gas.

No. 6 Summary of oil and gas exploration in Oregon.

No. 8 List of available well records on file.

No. 9* Reprints of articles on Oregon oil exploration.

No. 12 Geologic map index of Oregon.

Bulletins:

No. 5* Geological report of the Clarno basin, 1938: D. K. Mackay.

No. 15* Geology of Salem Hills and North Santiam River basin, 1939: T. P. Thayer.

No. 27* Geology of coal resources of Coos Bay quadrangle, 1944: J. E. Allen and E. M. Baldwin.

No. 31* Geology of the St. Helens quadrangle, 1946: W. D. Wilkinson, W. D. Lowry, and E. M. Baldwin.

* Out of print, but available for reference in the Department library.

- No. 35 Geology of the Dallas and Valsetz quadrangles, rev. 1963: E.M. Baldwin.
- No. 36 Vol. I. Tertiary foraminifera of western Oregon, 1947: J. A. Cushman, R. E. Stewart, and K. C. Stewart.
Vol. II. Tertiary foraminifera of western Oregon and Washington; mollusca and microfauna of Wildcat section, Humboldt County, Cal., 1949: R. E. Stewart and K. C. Stewart.
- No. 37 Geology of the Albany quadrangle, 1953: I. S. Allison.
- No. 58 Geology of the Suplee-Izee area, central Oregon: W. R. Dickinson and L. W. Vigrass.

The ORE BIN:

- Baldwin, E. M., Thrust faulting in the Roseburg area: v. 26, no. 10, October 1964.
- Baldwin, E. M., Some revisions of the geology of the Coos Bay area, Oregon: v. 28, no. 11, November 1966.
- Brooks, H. C., and Vallier, T. L., Geology of part of the Snake River Canyon from Farewell Bend to Granite Creek: v. 29, no. 12, December 1967.
- Brooks, H. C., Distinctive conglomerate layer near Lime, Baker County, Oregon: v. 29, no. 6, June 1967.
- Buddenhagen, H. J., Structure and orogenic history of the southwestern part of the John Day Uplift, Oregon: v. 29, no. 7, July 1967.
- Burt, W. V., and Borden, S., Ocean current observations from offshore drilling platform: v. 28, no. 3, March 1966.
- Byrne, J. C., Geomorphology of the continental terrace off the central coast of Oregon: v. 24, no. 5, May 1962.
- _____, Geomorphology of the Oregon continental terrace south of Coos Bay: v. 25, no. 9, September 1963.
- _____, Geomorphology of the continental terrace off the northern coast of Oregon: v. 25, no. 12, December 1963.
- Dott, R. H., Geology of the Cape Blanco area, southwestern Oregon: v. 24, no. 8, August 1962.
- _____, Late Jurassic unconformity exposed in southwestern Oregon: v. 28, no. 5, May 1966.
- Ehlen, Judi, Geology of state parks near Cape Arago, Coos County, Oregon: v. 29, no. 4, April 1967.
- Emilia, D. A., Berg, J. W., Jr., and Bales, W. E., Oceanic extension of coastal volcanics, northwestern Oregon: v. 30, no. 2, February 1968.
- Fowler, G. A., Notes on late Tertiary foraminifera from off the central Oregon coast: v. 28, no. 3, March 1966.
- Hopkins, W. S., Jr., Palynology and its paleoecological application in the Coos Bay area, Oregon: v. 29, no. 9, September 1967.

- Howard, J. K., and Dott, R. H., Geology of Cape Sebastian State Park and its regional relationships: v. 23, no. 8, August 1961.
- Maloney, N. J., and Byrne, J. V., Sedimentary rocks from the continental shelf and slope off the central coast of Oregon: v. 26, no. 5, May 1964.
- Morrison, R. F., Angular unconformity marks Triassic-Jurassic boundary in Snake River area of northeastern Oregon: v. 23, no. 11, November 1961.
- Newton, V. C., Jr., Summary of oil and gas exploration off the coast of Oregon and Washington, 1961-1966: v. 29, no. 2, February 1967.
- Newton, V. C., Jr., and Newhouse, C. J., Oil leasing on the outer continental shelf adjacent to Oregon and Washington: v. 26, no. 11, November 1964.
- Peterson, N. V., and Mason, R. S., Limestone occurrences in western Oregon: v. 20, no. 4, April 1958.
- Schlicker, H. G., The occurrence of Spencer sandstone in the Yamhill quadrangle, Oregon: v. 24, no. 11, November 1962.
- Schlicker, H. G., and Dole, H. M., Reconnaissance geology of the Marcola, Leaburg, and Lowell quadrangles, Oregon: v. 19, no. 7, July 1957.
- Snively, P. D., Jr., Rau, W. W., and Wagner, H. C., Miocene stratigraphy of the Yaquina Bay area, Newport, Oregon: v. 26, no. 8, August 1964.
- Snively, P. D., Jr., Wagner, H. C., and MacLeod, N. S., Preliminary data on compositional variations of Tertiary volcanic rocks in the central part of the Oregon Coast Range: v. 27, no. 6, June 1965.
- Stewart, R. E., Stratigraphic implications of some Cenozoic foraminifera from western Oregon [Pleistocene, Pliocene, Miocene]: v. 18, no. 1, January 1956.
- _____, Stratigraphic implications of some Cenozoic foraminifera from western Oregon [Oligocene, Eocene (upper)]: v. 18, no. 7, July 1956.
- _____, Stratigraphic implications of some Cenozoic foraminifera from western Oregon [Eocene]: v. 19, no. 2, February 1957.
- Vallier, T. L., Geology of a portion of the Snake River Canyon between Granite Creek and Pittsburg Landing, Oregon-Idaho: v. 30, no. 12, December 1968.
- Wagner, N. S., Limestone occurrences in eastern Oregon: v. 20, no. 5, May 1958.
- _____, Important rock units of northeastern Oregon: v. 20, no. 7, July 1958.

NOTE: Many of these issues of The ORE BIN are out of print, but are available for reference in the Department library.

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W. D. WILKINSON

Dr. William D. Wilkinson, former head of the Department of Geology at Oregon State University, died Friday, January 3. Dr. Wilkinson had been on the University faculty since 1932 and head of the geology department from 1960 until last summer. He belonged to a number of national scientific organizations and was the first president of the Oregon chapter of the American Institute of Professional Geologists. For many years Dr. Wilkinson and his students conducted geologic field work in central Oregon and other parts of the state. The popular "Field Guidebook to Geologic Trips Along Oregon Highways," which went out of print soon after its publication by the Department of Geology and Mineral Industries in 1959, was prepared under his direction. Dr. Wilkinson's most recent work, a joint effort with Dr. K. F. Oles, was on the Cretaceous rocks of the Mitchell quadrangle in central Oregon and was published in the January 1968 issue of the American Association of Petroleum Geologists Bulletin.

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INDEX TO PUBLISHED GEOLOGIC MAPS UPDATED

The index to published geologic maps in Oregon, which was last assembled in 1958, has now been brought up to date. For easier access to the information, the index maps have been arranged in the following categories: geologic maps that have appeared in The ORE BIN; ground-water and engineering geology maps; geologic quadrangle maps; geophysical surveys; miscellaneous geologic maps published prior to 1960; miscellaneous geologic maps published 1960 through 1967. Also included in this report are topographic index maps and one showing geomorphic provinces of Oregon. Miscellaneous Paper 12, "Index to Published Geologic Maps in Oregon," is available free upon request.

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MADRAS AND DUFUR QUADRANGLES MAPPED

Reconnaissance geologic maps of the Madras and Dufur 30' quadrangles, by A. C. Waters, have been published in multicolor at a scale of 1:125,000 by the U.S. Geological Survey. The two adjacent maps are bounded by lat. 44°30' and 45°30' and long. 121° and 121°30'. The Madras map, I-555, and the Dufur map, I-556, can be purchased for 75 cents each from the U.S. Geological Survey, Denver Center, Denver, Colorado 80225.

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AVAILABLE PUBLICATIONS

(Please include remittance with order. Postage free. All sales are final and no material is returnable. Upon request, a complete list of the Department's publications, including those no longer in print, will be mailed.)

BULLETINS

- | | | |
|-----|--|---------|
| 2. | Progress report on Coos Bay coal field, 1938: Libbey | \$ 0.15 |
| 8. | Feasibility of steel plant in lower Columbia River area, rev. 1940: Miller | 0.40 |
| 26. | Soil: Its origin, destruction, preservation, 1944: Twenhofel | 0.45 |
| 33. | Bibliography (1st supplement) of geology and mineral resources of Oregon, 1947: Allen | 1.00 |
| 35. | Geology of Dallas and Valsetz quadrangles, Oregon, rev. 1963: Baldwin | 3.00 |
| 36. | (1st vol.) Five papers on Western Oregon Tertiary foraminifera, 1947:
Cushman, Stewart, and Stewart | 1.00 |
| | (2nd vol.) Two papers on Western Oregon and Washington Tertiary foraminifera, 1949: Cushman, Stewart, and Stewart; and one paper on mollusca and microfauna, Wildcat coast section, Humboldt County, Calif., 1949: Stewart and Stewart | 1.25 |
| 37. | Geology of the Albany quadrangle, Oregon, 1953: Allison | 0.75 |
| 46. | Ferruginous bauxite deposits, Salem Hills, Marion County, Oregon, 1956: Corcoran and Libbey | 1.25 |
| 49. | Lode mines, Granite mining dist., Grant County, Ore., 1959: Koch | 1.00 |
| 52. | Chromite in southwestern Oregon, 1961: Ramp | 3.50 |
| 53. | Bibliography (3rd supplement) of the geology and mineral resources of Oregon, 1962: Steere and Owen | 1.50 |
| 56. | Fourteenth biennial report of the State Geologist, 1963-64 | Free |
| 57. | Lunar Geological Field Conference guide book, 1965: Peterson and Groh, editors | 3.50 |
| 58. | Geology of the Suplee-Izee area, Oregon, 1965: Dickinson and Vigrass | 5.00 |
| 60. | Engineering geology of the Tualatin Valley region, Oregon, 1967: Schlicker and Deacon | 5.00 |
| 61. | Gold and silver in Oregon, 1968: Brooks and Ramp | 5.00 |
| 62. | Andesite Conference Guidebook, 1968: Dale, editor | 3.50 |
| 63. | Sixteenth Biennial Report of the State Geologist, 1966-1968 | Free |

GEOLOGIC MAPS

- | | |
|---|--|
| Preliminary geologic map of Sumpter quadrangle, 1941: Pardee and others | 0.40 |
| Geologic map of the St. Helens quadrangle, 1945: Wilkinson, Lowry & Baldwin | 0.35 |
| Geologic map of Kerby quadrangle, Oregon, 1948: Wells, Hatz, and Cater | 0.80 |
| Geologic map of Albany quadrangle, Oregon, 1953: Allison (also in Bull. 37) | 0.50 |
| Geologic map of Galice quadrangle, Oregon, 1953: Wells and Walker | 1.00 |
| Geologic map of Lebanon quadrangle, Oregon, 1956: Allison and Felts | 0.75 |
| Geologic map of Bend quadrangle, and reconnaissance geologic map of central portion, High Cascade Mountains, Oregon, 1957: Williams | 1.00 |
| GMS-1 - Geologic map of the Sparta quadrangle, Oregon, 1962: Prostka | 1.50 |
| GMS-2 - Geologic map, Mitchell Butte quad., Oregon, 1962: Corcoran et al. | 1.50 |
| GMS-3 - Preliminary geologic map, Durkee quad., Oregon, 1967: Prostka | 1.50 |
| Geologic map of Oregon west of 121st meridian: (over the counter) | 2.00 |
| | folded in envelope, \$2.15; rolled in map tube, \$2.50 |
| Gravity maps of Oregon, onshore and offshore, 1967: [Sold only in set]: flat | 2.00 |
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Available Publications, Continued:

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2.	Industrial aluminum, a brief survey, 1940; Leslie L. Matz	\$ 0.10
18.	Radioactive minerals the prospectors should know (2nd rev.), 1955; . . .	
	White and Schafer	0.30
19.	Brick and tile industry in Oregon, 1949; Allen and Mason	0.20
20.	Glazes from Oregon volcanic glass, 1950; Charles W.F. Jacobs	0.20
21.	Lightweight aggregate industry in Oregon, 1951; R. S. Mason	0.25
23.	Oregon King Mine, Jefferson County, 1962; F.W. Libbey and R.E. Corcoran	1.00
24.	The Almeda Mine, Josephine County, Oregon, 1967; F.W. Libbey	2.00

MISCELLANEOUS PAPERS

2.	Key to Oregon mineral deposits map, 1951; R. S. Mason	0.15
3.	Facts about fossils (reprints), 1953	0.35
4.	Rules and regulations for conservation of oil and natural gas (rev. 1962)	1.00
5.	Oregon's gold placers (reprints), 1954	0.25
6.	Oil and gas exploration in Oregon, rev. 1965; Stewart and Newton	1.50
7.	Bibliography of theses on Oregon geology, 1959; H.G. Schlicker	0.50
7.	(Supplement) Bibliography of theses, 1959 to Dec. 31, 1965; M. Roberts	0.50
8.	Available well records of oil & gas exploration in Oregon, rev. '63; Newton	0.50
10.	Articles on Recent volcanism in Oregon, 1965; (reprints, The ORE BIN)	1.00
11.	A collection of articles on meteorites, 1968; (reprints, The ORE BIN)	1.00
12.	Index to published geologic mapping in Oregon, 1968; R. E. Corcoran	Free

MISCELLANEOUS PUBLICATIONS

Oregon mineral deposits map (22 x 34 inches), rev. 1958	0.30
Oregon quicksilver localities map (22 x 34 inches), 1946	0.30
Landforms of Oregon: a physiographic sketch (17 x 22 inches), 1941	0.25
Index to topographic mapping in Oregon, 1961	Free
Geologic time chart for Oregon, 1961	Free

OIL and GAS INVESTIGATIONS SERIES

1.	Petroleum geology of the western Snake River basin, Oregon-Idaho, 1963; V. C. Newton, Jr., and R. E. Corcoran	2.50
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