The Ore Bin

Vol. 34, No. 1
January 1972

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

The Ore Bin
Published Monthly By

STATE OF OREGON
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Subscription rate - $1.00 per calendar year
Available back issues $.25 each

Second class postage paid
at Portland, Oregon

State of Oregon
Department of Geology
and Mineral Industries
1069 State Office Bldg.
Portland Oregon 97201

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OREGON'S MINERAL AND METALLURGICAL INDUSTRY IN 1971

Ralph S. Mason*

If 1971 could be labelled the year of "Emergent Environmentalism", then 1972 will almost certainly have to be tagged as the year of "Enforced Environmentalism." Of particular interest to the extractive mineral industry will be the implementation of HB 3013, the Mined Land Reclamation Act, which becomes effective on July 1, 1972. Other environmental regulations originating at state or Federal levels will also have profound effect on the industry.

Despite the lackadaisical state of the economy, mineral production in Oregon chalked up a modest gain, rising to an estimated $68.4 million. As usual, sand and gravel and stone accounted for most of the production. The value of metals and metallurgical products refined in the state is not included in the canvass by the U.S. Bureau of Mines. If this figure were included, the total would exceed $700 million.

The Big E

The Environment means many things to many people. To the sand-and-gravel producer Environment will mean conformance to the Mined Land Reclamation Act which goes into effect July 1, 1972, and which will require a permit, a mining plan, a reclamation program and the payment of a small fee. Rules and regulations have not been drawn up but will be published in the Ore Bin later this year. To the hard-rock miner Environment means removal of the requirements for digging location cuts on claims and tightened regulations on solid waste disposal and on air and water pollution. To the mill operator the Big E will mean stricter control of chemical and solid wastes and air and water pollution.

Metallurgical plants have already spent large sums in diminishing environmental problems and millions of dollars more are being spent by

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northwest plants. In the state of Washington, where a mined land reclamation act is two years old, production costs have been upped an estimated one to two cents per yard. The enhancement of the Environment in many sectors is badly needed and long overdue. Just what remedies to apply and to what degree they should be enforced will require much study. Environmental Impact Statements attempt to characterize the effects of a proposed activity. It is suggested that a companion Economic Impact Statement also be prepared to evaluate the effects of environmental controls on industry, jobs, natural resources, and related factors. Enhancement of the environment can only be achieved by massive injections of funds derived from a healthy economy. No matter what course environmental controls take, it is certain that the cost of doing business will be increased.

The Metals

The mining and smelting of nickel ore at the Hanna operation at Riddle in Douglas County continued to be the state's most important metal mining activity. Utilization of some of the vast pile of slag accumulated over the years at the smelter has been growing, and now 3,000 tons a month are processed and sold for a variety of end uses. Sandblasting grit is the most important use for the gray-green glassy material, which is also sold for roofing granules, non-skid coatings, and road sanding material.

Several exploration projects for nickeliferous laterite deposits in southwestern Oregon were conducted during the year. The work follows earlier geochemical stream-sediment sampling conducted by the Oregon Department of Geology and Mineral Industries.

The production of mercury declined almost to the vanishing point as the price per flask moved to lower and lower levels. The old Maury mine east of Prineville in Crook County was explored with the aid of an OME loan by C. F. Taylor. Exploration drilling was also conducted just west of the Horse Heaven mine in Jefferson County, where Ray Whiting had previously produced a few flasks. The Horse Heaven mine closed a number of years ago after a long period of production. Cleanup operations at the Elkhead mine, Douglas County, by Alcona Mining Company accounted for the bulk of the state's liquid metal production, with a total of 31 flasks retorted.

Although gold mining in Oregon extends back 120 years, it reached what must be an all-time low during 1971 when no production was reported by the U.S. Bureau of Mines. Actually tiny amounts were produced from a few seasonal placer and small hard-rock mines. Additional quantities were also recovered by part-time skin divers and recreationists, who spent many days in and under the water collecting "colors."

Interest by mining companies looking for gold prospects continued at a slow pace in the state during the year. The old Bald Mountain mine, Cracker Creek district, Baker County, was explored by Nuclear Development Company, which shipped 13 rail carloads of development ore to Tacoma.

Some of Oregon's Minerals at a Glance
Preliminary Figures for 1971
(in thousands of dollars)

	1970	1971
Antimony	$ ---	$ 21
Clays	180	180
Diatomite	5	W
Gem stones	750	750
Gold	9	---
Lime	1,777	1,647
Mercury	112	W
Nickel	W	W
Pumice and volcanic cinders	1,252	1,338
Sand and gravel	25,978	26,803
Silver	6	---
Stone	20,948	20,110
Value of items that cannot be disclosed: Cement, fire clay, copper, talc, and values indicated by symbol "W"	17,084	17,605
Totals	$68,101	$68,454

Otherwise most gold activity was by individuals or small partnerships who explored the North Pole Lode, Cracker Creek district, Baker County; the BiMetallic mine, Greenhorn district, Grant County, in northeastern Oregon; and the Humdinger mine and Fall Creek mine in the southwestern part of the state. The Roy prospect adjacent to the Oregon King mine near Ashwood, Jefferson County, was explored with the help of an OME development loan. The Oregon King has produced modest amounts of silver over the years. Although not strictly a mining operation, a considerable quantity of high-grade silver was recovered in the state from old photographic and X-ray film. One of the operators produces pure silver jewelry in addition to the normal silver bars.

Northeastern Oregon and the adjoining area around Cuprum in Idaho saw continuing exploration for copper during the year. Field work ranged from basic geologic mapping to drilling and sampling with most of the work being done by five companies. The Department sparked interest in northeastern Oregon copper a number of years ago when it publicized the results of a limited geochemical sampling program.

In southwestern Oregon copper exploration was conducted at the Rowley mine and at the Lick Creek Copper prospect, both in Jackson County. Duval Corporation employed four men on a stream-sediment sampling program in Douglas, Josephine, and Jackson Counties, with copper as their main objective.

Two tungsten properties, one on Pedro Mountain, Mormon Basin district, and the other on the Little Joe property in the Burnt River district, both in Baker County, were worked in a small way during the year.

Industrial Minerals

Although normal geologic erosional processes annually produce some "new" supplies of sand and gravel, the resource should best be considered to be non-renewable, particularly so in view of the rapidly growing demands for this irreplaceable construction material, and the equally rapid urbanization of areas underlain by potential source beds. Growing numbers of communities are becoming aware that their local supplies of sand and gravel will not last forever and have begun studying how best to preserve their deposits. At the state level several studies have been proposed which would inventory areas underlain by sand and gravel, and identify those areas which (1) are potential sources of aggregate, (2) are aquifers for underground water, and (3) should be left undisturbed as spawning grounds for fish. None of these proposals have received funding. Any effective regional or local long-range planning must necessarily wait until these studies have been completed.

Sand and gravel and crushed stone still are "best buys" in the construction field, with prices rising far less rapidly than most other segments of the economy. As shortages develop in locally deprived areas in the future, this situation will change and prices will rise substantially. Although not

Oregon's Million-Dollar-A-Year Club, 1970*

County	Value	County	Value
Baker	$ 6,153,000	Linn	$1,238,000
Benton	1,030,000	Multnomah	7,402,000
Clackamas	11,433,000	Washington	2,276,000
Klamath	2,945,000		

*In addition to the values shown, there was a total of $21,101,000 which could not be assigned to specific counties. Production from Columbia, Douglas, Gilliam, Harney, Hood River, Jefferson, Malheur, Morrow, and Wheeler Counties was concealed by the U.S. Bureau of Mines 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 $1,891,000 during the year.

practical at present, the time may come when even used concrete will have to be recycled.

Preliminary figures for 1971 show that Oregon produced 30 million tons of sand and gravel and stone with a value of about $47 million, a fractional increase over 1970.

Other industrial minerals produced in the state included limestone quarried at Lime in Baker County by Oregon Portland Cement Company; pumice and volcanic cinders quarried by several operators in central Oregon; diatomite mined near Silver Lake in northern Lake County; silica from a quarry near Gold Hill in Jackson County and another east of Roseburg, Douglas County; dimension stone from various small quarries scattered throughout eastern and central Oregon; and soapstone blocks cut out of a stone quarry near Williams in Josephine County. Clay for red-firing brick and tile was dug in various pits throughout the state. Expansible clay for lightweight aggregate and pozzolan was produced at a quarry in Washington County.

Semi-precious gemstones continued their great popularity with a steadily increasing number of rockhounds. Although the activity is almost exclusively based on individual efforts, the value of quartz family stones annually extracted in the state probably exceeds $750,000. A few commercial gemstone operations are active in the state, but no completely integrated facilities have as yet been developed to cater to both the experienced collector and the casual tourist.

An emery deposit near Sweet Home, Linn County, is being developed by Jerry Gray of the Oregon Emery Company. The deposit was described in the November 1968 issue of the Ore Bin.

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QUICKSILVER MAP PUBLISHED

The Department has issued Miscellaneous Paper 15, "Quicksilver Deposits in Oregon," by Howard C. Brooks. The publication consists of a map showing distribution of all known mines and prospects in the State, with a numerical listing giving locations by county. On the reverse side is a summary of the economics of quicksilver, mineralogy of deposits, prospecting guides, and geology of the main districts where mercury mineralization occurs. Trends in Oregon production over the years are shown graphically, and the annual production from individual mines between 1882 and 1970 is tabulated.

The publication is designed to replace the out-of-print map by Francis Frederick (1945) and to update the information in the out-of-print Bulletin 55, "Quicksilver Deposits in Oregon," by Brooks (1963).

Miscellaneous Paper 15, on a sheet 22 by 36 inches, comes folded in an envelope. It can be purchased from the Department's offices in Portland, Baker, and Grants Pass. The price is $1.00.

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OIL AND GAS EXPLORATION IN 1971

Vernon C. Newton, Jr.*

Oregon, along with Washington and Idaho, is still without commercial discoveries of oil and gas. A total of 181 wildcats has been drilled in the state since the early 1900's, but only 26 of the onshore holes and 8 offshore holes have penetrated deeper than 4000 feet. Texaco's wildcat "Federal No. 1," drilled in central Oregon this past fall, drew considerable attention from the rest of the oil industry, but the hole was abandoned at the 8000-foot level.

Onshore activity

Texaco began drilling the "Federal No. 1" approximately in the center of its 250,000 acre lease block in Crook County in August. The drilling contractor was released in December, so it is presumed that Texaco does not plan any more exploration on its 400-square mile lease block in the near future. It is probable that additional drilling was discouraged by environmentalists asking for delay in issuance of drilling permits by the U.S. Bureau of Land Management.

The Oregon Environmental Council asked in October that the Texaco drilling be halted until an impact statement could be filed, which it claimed was required under the 1970 National Environmental Policy Act. The Regional Director of the U.S. Bureau of Land Management and his staff, after making an environmental analysis of the drilling, determined that an impact statement was not required because the operation did not involve a "major Federal action" significantly affecting the quality of the human environment (U.S. Bureau of Land Management News Release, November 13, 1971).

The U.S. Department of the Interior has announced that after April 1, 1972, a public notice will be required for each application to drill on Federal lands. If substantial objections are raised during that period, a review will be made and an impact statement prepared.

Geologic mapping indicates that the area explored by Texaco has marine sediments at depth. Northeast-striking marine sandstone and conglomerate beds of the Bernard Ranch Formation of Late Cretaceous (Cenomanian) age crop out 12 miles east of the Texaco well site. Older Mesozoic and Paleozoic marine rocks lie at the east of the Cretaceous exposures, and Tertiary volcanics overlie them to the west (Dickinson and Vigrass, 1965).

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Cretaceous marine and nonmarine sedimentary units have been mapped 40 miles north of the Texaco location near the town of Mitchell. These rocks are dated as Albian-Cenomanian by Oles and Enlows (in press), so they are in part older than the Bernard Ranch Formation. Mapping by Swanson (1968) shows the location of the Texaco "Federal No. 1" well to be on an anticlinal structure, with the Eocene Clarno Formation exposed at the crest and Miocene basalt covering the flanks.

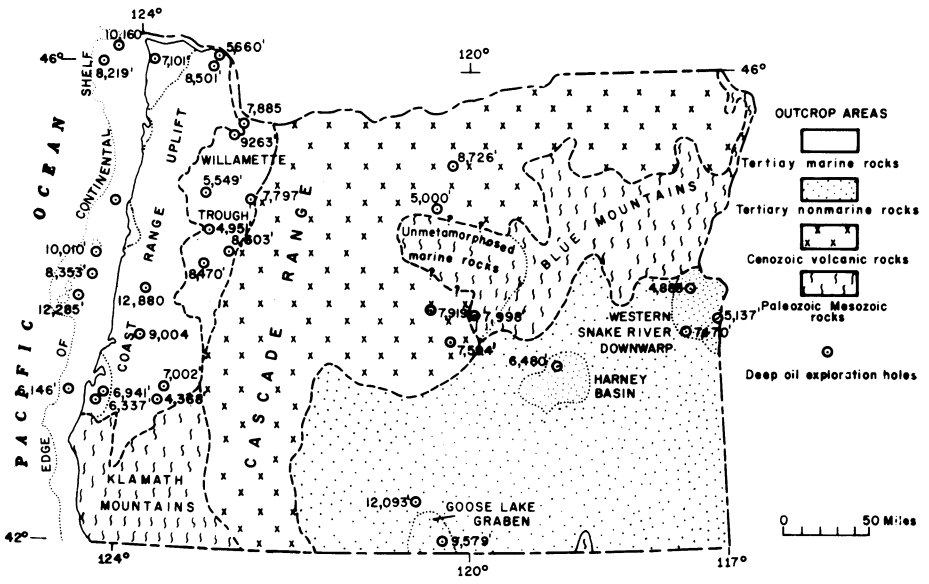
Standard Oil Company of California made a surprise move early in 1971 by leasing several hundred square miles of land in eastern Oregon and western Idaho which is covered by young volcanics and the subsurface geology uncharted. Standard also picked up some acreage at the southeast corner of the Texaco land block. Amoco Production Company (formerly Pan American Petroleum Corp.) applied in September for leases on Federal lands adjoining the northwest portion of Texaco's leases and for another several hundred square miles of leases in the western Snake River Basin where many gas shows have been found in past drilling. Processing of the leases by the U.S. Department of Interior has been delayed because of environmental considerations.

News of the relinquishment of leases in Columbia, Washington, Coos, and Lane Counties by Mobil Oil Company was discouraging. Mobil had done no drilling on the leases but conducted field studies for several years in western Oregon.

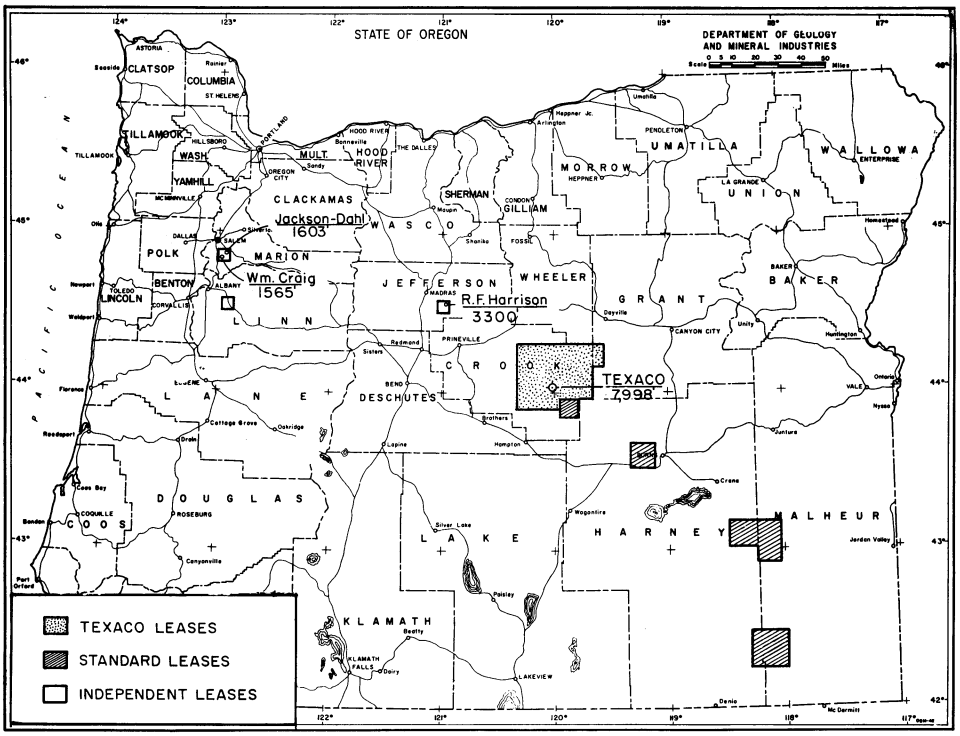
Wildcatters accounted for an estimated 20,000 acres of oil and gas leases in Oregon in 1971.

Active Drilling Permits - 1971

Operator	Permit No.	Unique well No.	Location	Depth	Status
R. F. Harrison	60-D	031-00002	SW¼ sec. 18, T12S., R15E. Jefferson Co.	3300'TD	No new hole drilled Plugged and abandoned 8-9-71
Wm. Craig-Producers Oil & Gas	61	047-20001	NW¼ sec. 24, T9S., R4W. Marion County	1565'TD	Plugged and abandoned 3-19-71
Jackson-Dahl	62	047-20002	NE¼ sec. 24, T9S., R4W. Marion County	1603'TD	Plugged and abandoned 6-29-71
Texaco, Inc.	63	013-20001	SW¼ sec. 31, T17S., R23E. Crook County	7998'TD	Plugged and abandoned 11-22-71



Major rock types and deep exploratory wells (after Wagner and Newton, 1969).



Oil exploration in 1971 showing location of lease areas.

Offshore activity

Although two companies maintained geophysical exploration permits for work along the Oregon Coast, no work is believed to have been done in 1971. Eleven major oil companies conducted exploration studies off the Oregon Coast in the period 1961-1967. No oil or gas was discovered in that time and all the leases were dropped by 1969. The moratorium following the Santa Barbara blow-out reportedly resulted in cancellation of the drilling of at least one more deep test off the Oregon Coast in 1969, a very unfortunate situation when one considers that all the machinery of nominations and lease sales have to be gone through in order to make that same test in the future.

Active Offshore Geophysical Permits 1971

Texaco, Inc.	Expires April 1972	Federal OCS lands
Standard Oil Co.	Expires August 1973	State submerged lands

The search for oil and gas will go on in Oregon for some time yet with a deep test drilling every two or three years until a discovery is made or until geologists are satisfied that little possibility exists for a commercial discovery. The continental shelf off the Oregon Coast has by no means been sufficiently explored. The Federal government offered less than half of the OCS shelf lands in the 1964 lease sale so that some promising structures have yet to be tested. For example, no leases were offered between Reedsport and Coos Bay, where one of the thickest sections of Tertiary marine rocks is known to exist (Braislin, Hastings and Snavely, 1971).

Environmental considerations

Concern for the environment has temporarily slowed development in offshore areas but dwindling energy resources in the United States will eventually take precedence. Norway, Denmark, Holland, and Britain have been pleased with discoveries made in the North Sea, and for the first time in history they have the prospect of producing adequate domestic supplies of petroleum. Improved technology has narrowed the risk of spills while subsea installations hold promise of maintaining aesthetic quality during the period of production.

Many citizens fortunate enough to live in natural surroundings characteristic of the Pacific Northwest are reluctant to encourage industrial or mineral development for fear of degrading the natural setting. Some carry this philosophy too far, however; very few of those who would like to eliminate or curtail industry and mining would be willing to relinquish the modern conveniences that result from these enterprises.

Petroleum is an example of an essential commodity finding varied use in heating, transportation, synthetic rubber, fabrics, plastics, detergents, medicines, and sundry other uses. Residents of the Pacific Northwest used 300 billion cubic feet of natural gas and 170 million barrels of liquid petroleum in 1970 (Independent Petroleum Assoc. of Amer. statistics for 1971). Oregonians accounted for more than 30 percent of this. The market value of oil and gas used in Oregon in 1970 amounted to an estimated $340 million.

The entire amount of petroleum products consumed by Oregonians had to be imported from Canada, Venezuela, Alaska, Wyoming, and New Mexico. Looking at the petroleum business from the viewpoint of internal economics, it is apparent that if oil and gas were found in quantities large enough just to supply Oregon, the economic impact would be considerable.

Too often, critics of the industry use examples of outdated methods in pointing to hazards of developing this resource. Sizeable spills from producing wells are minimal with an incidence of approximately 1 in 3,000 wells. After all the publicity and upset resulting from the Santa Barbara blowout, the effects of spillage on the ecology was found to be very light (Jones and others, 1969), and the beaches and harbor were cleaned within 45 days after the blowout occurred (USGS, 1969b). The unusual circumstances at Santa Barbara are unlikely to occur again (USGS 1969a). Drilling on land is not subject to the distributing effect of oil floating on water, but onshore spills are quickly absorbed in sediments. Also, crude oils have much less toxicity to plants and animals than refined oils (Jones and others, 1969).

It is not the intent here, however, to approve any type of development but to say that properly planned operations should be adaptable to most environments. Producing wells are closed fluid systems and should cause no pollution except by accident or through negligence. In most cases, problems with aesthetics or interference with other uses can be minimized.

The type of rock, geologic structure, and hydrodynamic conditions necessary for accumulation of petroleum are unique occurrences. We cannot choose where they will be, but if such an occurrence were found in Oregon we would be indeed fortunate.

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OREGON ACADEMY OF SCIENCE TO MEET AT PSU

The Oregon Academy of Science will hold its annual meeting at Portland State University on Friday and Saturday, February 25 and 26, 1972. Friday afternoon and evening will be devoted to a symposium "Sea, Science, and Society" to be held in the Smith Memorial Center ballroom. Saturday morning will be given to meetings of the individual science sections. Nine papers on sedimentation and volcanism in western Oregon will be presented at the Geology Section. The public is cordially invited.

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AIME HONORS FAY LIBBEY

The Oregon Section of AIME dedicated its December 16, 1971 annual meeting in honor of Fay W. Libbey, director of the Oregon State Department of Geology and Mineral Industries from 1944 to 1954. Mr. Libbey has been a member of the Oregon Section since 1936. He served as its chairman in 1942 and was a director of the board of National AIME for 3 years. Recollections of his mining experiences in Canada and Arizona prior to his coming to Oregon were read at the December meeting and were greatly enjoyed by the mining group.

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GEOTHERMAL ACTIVITY IN 1971

Richard G. Bowen*

The Geysers field in Sonoma County, California, continues to be the only site of electric power production from geothermal resources in the United States. Two new turbine-generator units were brought into production during the year, increasing the installed capacity from 82 to 192 megawatts. Two other plants, each of 110 megawatt capacity, are under construction at the field by Pacific Gas and Electric Company; one is scheduled for completion in the fall of 1972 and the other a year later.

In another development at The Geysers field, the Northern California Power Agency, an 11-city combine, has committed $60,000 for a feasibility study for a projected $35 million, 220-megawatt power plant on a portion of the field under lease to Signal Oil Company.

Eleven new wells were drilled at The Geysers field during the year: eight by Union Oil Company and its partners, Magma Power and Thermal Power Companies; two by Pacific Energy Corporation, which took over the operation of Geothermal Resources International, and one by Signal Oil Company. This new drilling has extended the boundaries of the field to an area covering about 9 by 2 miles. One new well, the most northern drilled, has the largest capacity of the field with a flow of 386,000 pounds per hour, sufficient for a plant of over 19 megawatts.

Outside of The Geysers area, four other wells were drilled during the year. Near Clear Lake, 8 miles north of The Geysers, a shallow well drilled by Magma Power showed elevated bottom-hole temperatures but failed to produce any fluid. Plans are being made to deepen that well. Near Mono Lake, in eastern California two wells were drilled, one by Mono Power and another by Geothermal Resources International; both wells failed to find temperatures high enough to be of economic interest. In New Mexico a well drilled to extend the steam zone found in 1970 on Baca Ranch near Los Alamos was not successful.

During 1971 work progressed on implementing the Federal geothermal leasing act. As a part of the pre-leasing requirements, 1.7 million acres of land were designated by the U.S. Geological Survey as known geothermal resource areas (KGRA's) and the Federal land included will be subject to competitive leasing. In the northwest, the KGRA classification covered 84,000 acres in Oregon, 17,000 acres in Washington, and 21,000 acres in Idaho.

The USGS report lists an additional 97 million acres of land as having prospective value. The Federal land in this category does not require

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competitive leasing and can be leased by the first qualified person making the necessary deposit. Oregon and Idaho each have about 15 million acres and Washington about 6 million acres that are considered to be of prospective value.

Both of the above categories are subject to continual modification as knowledge of geothermal exploration increases.

The Interior Department has issued rules and regulations concerning the leasing, exploration, drilling, and production activities for geothermal resources on Federal lands. Also, in compliance with the National Environmental Policy Act of 1969, an Environmental Impact Statement for the Geothermal Leasing Program has been prepared and public hearings will be held in Reno, Sacramento, and Portland regarding the implementation of the law. After the period of time allotted for public comment, these rules, with any necessary modifications, will be accepted; then applications may be filed for leasing public lands. Because the Federal government is such a large landowner in the western states--about 55 percent of Oregon and 85 percent of Nevada, for example, are owned by various Federal agencies--any major exploration effort must await the promulgation of these regulations. It appears that it will be early 1972 before the first leases will be made available, over one year after President Nixon signed the act into law.

During the past year, articles on geothermal power have appeared in many widely circulated publications; newspapers in particular have published many feature stories. There have been several announcements of joint exploration efforts by utilities and other companies. In Oregon, Pacific Power and Light Company and Weyerhaeuser Company announced the formation of a joint venture to explore and develop geothermal resources on Weyerhaeuser's extensive land holdings in southern Oregon. Eugene Water and Electric Board, according to a recent press release, is considering giving financial support to studies of geothermal sources by the University of Oregon Department of Geology and is exploring joint venture possibilities.

Other cooperative ventures include the agreement between San Diego Gas and Electric Company and Magma Power Company to explore and develop geothermal energy resources in the Imperial Valley area. If hot water is found, they plan to build a "Magmamax" type power plant, utilizing an intermediate low-boiling-point fluid to transfer the energy from the hot water to the turbine-generator, the first installation of this type in the United States. Also in the Salton Sea-Imperial Valley area several groups, including the U.S. Bureau of Reclamation, Union Oil Company, Standard Oil of California, Southern California Edison Company, and the University of California, are making a serious effort toward a multipurpose development of the hot waters found there. Another result of collective action was the formation of the Mono Power Company by Getty Oil Company and Southern California Edison.

In California, legislation at the State level to regulate and supervise the exploration and production of geothermal resources has been in effect

since 1968. In Oregon the 1971 Legislature passed the necessary law to authorize the State Department of Geology and Mineral Industries to regulate geothermal activities in Oregon. Several of the other states are studying the California and Oregon regulations prior to preparing their own.

During 1971 several meetings and symposia were held to present papers and stimulate discussion of geothermal developments. In February, at the meeting of the Geological Society of America's Cordilleran Section in Riverside, California, several papers were presented concerning the geothermal phenomena of the Imperial Valley and a field trip was made into the area. In May the West Coast Oil Scouts at their meeting in Los Angeles presented a seminar and panel discussion on geothermal resources.

On May 21 in Olympia the Washington State Department of Natural Resources held the first Northwest Conference on Geothermal Power. This meeting brought together people from electrical utilities, government agencies, petroleum companies, mining firms, and members of the interested public. As the result of a post-conference meeting, a Steering Committee was formed to organize a Geothermal Resources Council covering the western states. The committee included representatives of the geothermal development industry, equipment suppliers, public and private electric power companies, energy suppliers, universities, concerned governmental agencies, environmental organizations, and the general public. The Steering Committee held two organizational meetings and set up committees to cover such areas as Exploration and Drilling, Resource Utilization, Regulation, Environment, Economics, and Education and Information.

The Geothermal Resources Council is sponsoring a 3-day meeting in El Centro, California February 16, 17 and 18, 1972. This will be the largest conference on geothermal resources yet held in the United States. The program of this meeting is given below.

GEOTHERMAL RESOURCES COUNCIL EL CENTRO CONFERENCE

WEDNESDAY, FEBRUARY 16

Morning session at Imperial Valley Country Club

8:00 Welcoming addresses:
Richard Bowen, Chairman, Geothermal Resources Council
James G. Stearns, Director, California Department of Conservation
Bert L. Cole, Commissioner of Public Lands, Washington

9:20 "Worldwide Review of Geothermal Exploration and Development" by James Koenig, Executive Officer, California Div. of Mines and Geology

10:25 "Federal Geothermal Leasing and Operating Regulations and Environmental Impact Statements" by Reid Stone, Geothermal Coordinator, U.S. Dept. of the Interior

11:10 "U.S.G.S. Research in Geothermal Resources: by Patrick Muffler, Coordinator, U.S.G.S. Geothermal Resources Program

12:30 Luncheon speaker: Hamilton Hess, Sierra Club
"Environmental Priorities, Human Needs, and Geothermal Power"

Afternoon session at Imperial Valley College

2:20 "Welcome to Imperial Valley College" by Buck Paoli, Dean of Instruction
2:35 "Dry Steam Power Plants" by David Barton, Pacific Gas and Electric Co.
3:10 "Flashed Steam Power Plants" by Jorge Guiza L., Jefe del Departmento de Recursos Geothermicos, Comision Federal de Electricidad, Mexico
3:45 "Geology of the Imperial Valley" by Robert Rex, Univ. of Calif., Riverside
4:20 "Review and Discussion of Geothermal Exploration Techniques" by James B. Combs, University of California, Riverside

Evening activities

7:30 No-host cocktail party
8:30 Banquet at Holiday Inn, El Centro. Speaker: Joseph Aidlin, Aidlin, Martin, and Mamakos. "Review of Some of the Legal Problems in Geothermal Development"

THURSDAY, FEBRUARY 17

"Overviews of the Western United States in Respect to Geothermal Exploration and Development"

Morning session at Imperial Valley Country Club - 7:30 to 11:30

California: Lawrence Axtell, Division of Oil and Gas
Bureau of Reclamation - Imperial Valley Project: R. T. Littleton, Regional Geol.
Arizona: John Harshbarger, University of Arizona
Oregon: Richard Bowen, Department of Geology and Mineral Industries
Washington: Vaughn Livingston, Division of Mines and Geology
New Mexico: Kelly Summers, Bureau of Mines and Mineral Resources
Wyoming: Edward Decker, University of Wyoming
Idaho: Mont Warner, Boise State College
Utah: William Hewitt, Geological and Mineral Survey

Afternoon session at Imperial Valley College - 2:30 to 4:00

Nevada: Larry Garside, Bureau of Mines and Geology
Montana: Cliff Balster, Bureau of Mines
Colorado: Richard Pearl, Colorado Geological Survey
Hawaii: Representative, University of Hawaii
Alaska: Tentative

Evening: Geothermal Resources Council, Executive Committee Meeting - 8:00p.m.

FRIDAY, FEBRUARY 18

Field trip to Cerro Prieto Steam Field, Mexico - 7:30 a.m. to 5:00 p.m.

At Cerro Prieto the Comision Federal de Electricidad is developing the first flashed steam geothermal power plant in North America. A 75,000 kw plant is under construction and is expected to be on line in 1972.

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Registration for the conference is $10. For further information and pre-registration form contact Sam Dermengian, Citrus College, Azusa, California 91702. Phone: (213) 335-0521

FIELD WORK IN OREGON DURING 1971

During the 1971 field season at least 116 geologic field studies were conducted in the State of Oregon. Listed below are the studies about which this Department is aware. For convenience, the state is subdivided into six sections, and the studies are grouped according to location. Also, a section dealing with water-resource studies is included in the list.

The list is probably not complete, and the Department would appreciate receiving information about other studies in progress in this state. Resumés received thus far have been of immeasurable help, and the Department expresses its gratitude for these contributions.

Regional Studies

Northwestern Oregon

1. Recent sedimentation in Tillamook Bay: Gennaro Avolio, graduate student, PSU
2. Limestone west of Dallas: Sam Boggs, Ewart Baldwin, Bill Orr, professors of geology, UO
3. Nodules within the Oligo-Miocene shales: Sam Boggs, professor of geology, UO
4. Boundary of the High Cascades and the Western Cascades: Richard Bowen, DOGAMI
5. Nestucca Formation: Arden Callender, graduate student, PSU
6. Ground water study, with emphasis on pollution: Roger Dickinson, graduate student, UO
7. Western Cascades, mapping between Detroit and Eugene: Andrew Duncan and Jaroslav Lexa, Postdoctoral residents, UO
8. Cascade volcanoes, thermal surveillance: J. D. Friedman, USGS, Washington, D.C.
9. Surf transformation near Newport: Mike Gaughan, oceanography, OSU
10. Yaquina Formation, stratigraphy and sedimentary petrology: Clinton Goodwin, OSU
11. Mollusca of the Keasey Formation: Carole S. Hickman, Adjunct Research Associate, Swarthmore College, Swarthmore, Pennsylvania
12. Coastal geology with emphasis on landforms: Ernest Lund, professor, UO
13. Tertiary calcareous plankton: Daniel McKeel and Jere H. Lipps, UCal, Davis, California
14. Eocene geology and inferred early Tertiary rifting: Robert McWilliams, professor, Miami U, Hamilton, Ohio
15. Environmental geology of the Lake Oswego area: Roger A. Redfern, graduate student, PSU

16. Petrology of the Mt. Hebo intrusive: Joe Rohleder, graduate student, UO
17. Eocene stratigraphy west of Salem: Herb Schlicker, DOGAMI; Robert Deacon, Shannon and Wilson; John Beaulieu, DOGAMI
18. Geologic hazards of Clatsop and Tillamook Counties: Herb Schlicker, DOGAMI; Robert Deacon, Shannon and Wilson; John Beaulieu, DOGAMI; Gordon Olcott, DOGAMI
19. Late Quaternary geology of the Mt. Jefferson area: William E. Scott, graduate student, UW
20. Coastal geology, remapping of Hebo quadrangle: Parke Snavely and Norman MacLeod, U.S.G.S., Menlo Park, California
21. Columbia River Basalt: Donald Swanson and Thomas Wright, U.S.G.S., Menlo Park, California
22. Beach processes in Tillamook Bay: Tom Terrick, oceanography, OSU
23. Geologic map of the Columbia River Gorge: Aaron C. Waters, professor of geology, UCal, Santa Cruz
24. Seismic behavior of the Portland area: Paul White, graduate student, PSU
25. Portland Hills Silt: Cheryl Wilgus, graduate student, PSU

Southwestern Oregon

1. Cenozoic molluscan faunas: Warren O. Addicott, U.S.G.S., Menlo Park, California
2. Oligocene fossils: John M. Armentrout, graduate student, UW
3. Plio-Pleistocene megafossils: John M. Armentrout, graduate student, UW
4. Drill evaluation program: Donald Baggs, graduate student, PSU
5. Mapping of the Ivers Peak, Camas Valley, Sitkum and Tyee quadrangles: Ewart Baldwin, professor of geology, UO
6. Lower Cenozoic geology: Ewart Baldwin, professor of geology, UO
7. Sedimentary processes: Sam Boggs, professor, UO
8. Heavy mineral concentrations: K. C. Bowman, graduate student, oceanography, OSU
9. Mapping of the Langlois quadrangle: Michael Brownfield, graduate student, UO
10. Glacial and neo-glacial geology of the Mountain Lakes area: Gary Carver, graduate student, UW
11. Black sands: H. E. Clifton, U.S.G.S., Menlo Park, California
12. Tectonic history of the Josephine peridotite: Henry Dick, graduate student, Yale University
13. Crater Lake National Park: Jack H. Hyde, geology instructor, Tacoma Community College
14. Mapping of the northeast quarter of the Bone Mountain quadrangle: Nils Johannesen, graduate student, UO

15. Estuaries of the Sixes and Rogue Rivers: Charles Jones, graduate student, UO
16. Bone Mountain quadrangle, southeastern quarter: Richard Kent, graduate student, PSU
17. Josephine peridotite: Robert A. Loney, U.S.G.S., Menlo Park, Cal.
18. Geology of Mt. McLoughlin: Leroy Maynard, graduate student, UO
19. Kalmiopsis Wilderness: Len Ramp, DOGAMI
20. Tiller area: Len Ramp, DOGAMI; and Dr. M. A. Kays, UO
21. Nickel prospects: Len Ramp, DOGAMI
22. Microfossils from well cuttings: Weldon Rau, paleontologist, Washington Division of Mines and Geology
23. Mapping of southwest quarter of Bone Mountain quadrangle: John Rud, graduate student, UO
24. Detection of chromite: Gerald Shearer, graduate student, Ohio State U.
25. Geochemistry of High Cascades volcanoes: Terry Steinborn, graduate student, UO
26. Coarse sediment in the Elk River: Fred Swanson, graduate student, UO
27. Southcentral Bone Mountain quadrangle: William Utterback, graduate student, OSU

North-central Oregon

1. Columbia River Group, deep resistivity soundings: L. A. Anderson, U.S.G.S.
2. Canyon Mountain Complex: Dr. Hans Ave Lallement, assistant professor, Rice U., Houston, Texas
3. Zeolites in the John Day Formation: Donald Baggs, graduate student, PSU
4. Heat flow: Richard Bowen, DOGAMI
5. Clarno Formation: Harold Enlows, professor of geology, OSU
6. Flat-topped volcanic landforms: Brian Gannon, graduate student, PSU
7. Cretaceous mudstones, clay mineralogy, and sedimentary petrology: (Mrs.) Clara Jarman, graduate student, UO
8. Canyon Mountain Complex: Robert A. Loney, U.S.G.S., Menlo Park
9. Clarno flora: J. William Schopf, professor of geology, UCLA
10. Deschutes Formation (Dalles and Madras Formations of authors): Don Stensland, instructor of geology, Coos Bay Community College
11. High Cascades geology between Three Sisters and Mt. Bachelor: Ed Taylor, professor, OSU
12. Ultramafic rocks of the Canyon Mountain Complex: Thomas P. Thayer, U.S.G.S., Washington, D.C.
13. Radioactive materials disposal site: Vernon C. Newton, DOGAMI
14. Metolius Springs: Norm Peterson, DOGAMI, Grants Pass Field Office
15. Columbia River Group: T. L. Wright, U.S.G.S.

South-central Oregon

1. Trace elements in obsidian: Marv Beeson, Paul Hammond, professors of geology, and Al Waible, graduate student, PSU
2. Newberry Caldera: Robert Beyer, graduate student, UO
3. Crust and geochemistry of Klamath Mountains: A. H. Lachenbruch U.S.G.S., Menlo Park
4. Geothermal prospects and induced earth currents: William MacFarland, graduate student in oceanography, OSU
5. Alkali Lake Basin, chemical waste disposal: Vernon C. Newton, DOGAMI
6. Pliocene ignimbrites: Don Parker, Ph.D. candidate, OSU
7. Mineral resources of Klamath and Lake Counties: Norm Peterson, DOGAMI, Grants Pass Field Office
8. Geothermal ground noise: Norm Peterson, DOGAMI, Grants Pass Field Office
9. Geothermal resources: Norm Peterson, DOGAMI, Grants Pass Field Office
10. Silica deposits: H. E. Reed, Assistant Manager, Raw Materials Research, Burlington Northern, Seattle
11. Geothermal ground noise: Gerald W. Thorsen, Washington Division of Mines and Geology
12. Geomorphology of the Warner Valley: David Weide, professor, UCLA
13. Geothermal prospects and microseisms: Robert Whitsett, oceanography, OSU

Northeastern Oregon

1. Pliocene diatoms in the Durkee Basin: George W. Andrews, U.S.G.S. Washington, D.C.
2. French Gulch and Lost Basin quadrangles: Roger P. Ashley, U.S.G.S. Menlo Park, California
3. Drill evaluation program: Don Baggs, graduate student, PSU
4. Geologic reconnaissance: John Beaulieu, DOGAMI
5. Alpine glaciation: Elton Bentley, graduate student, UO
6. Huntington quadrangle: Howard Brooks, DOGAMI, Grants Pass Field Office
7. Martin Bridge Formation: Jeffrey C. Brown, graduate student, WSU
8. Canyon Creek quicksilver area: Al Edwards, graduate student, UO
9. Columbia River Group: M. J. Grolier, U.S.G.S.
10. Trace elements in banded rhyolites: Gary Hallock, graduate student, PSU
11. Origin of copper deposits near Keating: Ray Hammitt, graduate student, UO

12. Mineralization north of Huntington: Tom Henricksen, Ph.D. candidate, OSU
13. Pre-Tertiary structure: Robert Lawrence, professor, OSU
14. Cenozoic rocks of the Baker AMS sheet: James R. McIntyre, Southern Oregon College, Ashland, Oregon
15. Seven Devils Volcanics: John M. Morganti, graduate student, WSU
16. Geology near Dale: Robert Olsen, Master's student, UO
17. Geochemical stream sampling: Allen Preisler, DOGAMI
18. Pliocene zeolites: Richard A. Sheppard, and A. J. Gude, III, U.S.G.S., Federal Center Building, Denver, Colorado
19. Geologic mapping: Bill Taubeneck, professor, OSU
20. Mineral potential of the Eagle Cap Wilderness: E. T. Tuchek and A. B. McMahon, U.S. Bureau of Mines, Spokane, Washington
21. Pre-Tertiary geology: Tracy Vallier, professor of geology, Indiana State U., Terre Haute, Indiana
22. State geologic map project: George W. Walker, U.S.G.S., Menlo Park, California
23. Eagle Cap Wilderness: A. E. Weissenborn, U.S.G.S., Spokane, Wn.
24. Greenhorn Mountain district, Greg Wheeler, graduate student, UW
25. Pre-Tertiary geology of the Snake River area: David L. White, graduate student, Indiana State U., Terre Haute, Indiana
26. Eocene flora: J. A. Wolfe, U.S.G.S.

Southeastern Oregon

1. Isotope analysis of thermal waters: Richard Bowen, DOGAMI
2. Geologic mapping adjacent to Nevada, R. C. Greene, U.S.G.S.
3. Pueblo Mountains: Jerry L. Harold, graduate student, OSU
4. Zeolitic tuff: W. L. Rice, U.S. Bureau of Mines, Spokane, Wash.
5. Diamond Craters: Lawrence C. Rowan, U.S.G.S., Menlo Park, Ca.

Water Resource Studies

1. Ground water of the Corvallis-Albany area: F. Frank, U.S.G.S., Portland
2. Ground water in the dune-sand area north of Coos Bay: J. Robison, U.S.G.S., Portland
3. Ground water of part of the Klamath River basin: A. Leonard, U.S.G.S., Portland
4. Ground water in northern Clackamas County: A. Leonard, U.S.G.S., Portland
5. Movement of radionuclides in the Columbia River estuary: D. Hubbell and J. Glenn, U.S.G.S., Portland

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

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. Vol. 1. Five papers on western Oregon Tertiary foraminifera, 1947: Cushman, Stewart, and Stewart 1.00
Vol. 2. Two papers on foraminifera by Cushman, Stewart, and Stewart, and one paper on mollusca and microfauna by Stewart and Stewart, 1949 1.25
37. Geology of the Albany quadrangle, Oregon, 1953: Allison 0.75
39. Geology and mineralization of Morning mine region, Grant County, Oregon 1948: R. M. Allen & T. P. Thayer. 1.00
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
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
62. Andesite Conference Guidebook, 1968: Dole, ... 3.50
63. Sixteenth Biennial Report of the State Geologist, 1966-68 . . . . . Free
64. Geology, mineral, and water resources of Oregon, 1969 . . . . . 1.50
66. Reconnaissance geology and mineral resources, eastern Klamath County & western Lake County, Oregon, 1970: Peterson & McIntyre . 3.75
67. Bibliography (4th supplement) geology & mineral industries, 1970: Roberts 2.00
68. The Seventeenth Biennial Report of the State Geologist, 1968-1970 . . Free
69. Geology of the Southwestern Oregon Coast W. of 124th Meridian, 1971: R. H. Dott, Jr. 3.75
70. Geologic formations of Western Oregon, 1971: Beaulieu 2.00
71. Geology of selected lava tubes in the Bend area, 1971: Greeley . . . 2.50

GEOLOGIC MAPS

Geologic map of Oregon west of 121st meridian, 1961: (over the counter) . . . 2.00
folded in envelope, $2.15

Geologic map of Oregon (12" x 9"), 1969: Walker and King 0.25
Preliminary geologic map of Sumpter quadrangle, 1941: Pardee and others . . 0.40
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
GMS-4: Gravity maps of Oregon, onshore & offshore, 1967: [Sold only in set] flat, $2.00; folded in envelope, $2.25; rolled in map tube . . . 2.50
GMS-5: Geology of the Powers quadrangle, 1971: Baldwin and Hess 1.50

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Available Publications, Continued:

SHORT PAPERS

2.	Industrial aluminum, a brief survey, 1940: Motz	$ 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
21.	Lightweight aggregate industry in Oregon, 1951: Mason	0.25
24.	The Almeda mine, Josephine County, Oregon, 1967. Libbey	2.00

MISCELLANEOUS PAPERS

1.	Description of some Oregon rocks and minerals, 1950: Dole	0.40
2.	Key to Oregon mineral deposits map, 1951: Mason	0.15
	Oregon mineral deposits map (22" x 34"), rev. 1958 (see M. P. 2 for key)	0.30
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: Schlicker	0.50
7.	(Supplement) Bibliography of theses, 1959 to Dec. 31, 1965: Roberts	0.50
8.	Available well records of oil & gas exploration in Oregon, rev. 1963: Newton	0.50
11.	A collection of articles on meteorites, 1968: (reprints, The ORE BIN).	1.00
12.	Index to published geologic mapping in Oregon, 1968: Corcoran	Free
13.	Index to The ORE BIN, 1950–1969, 1970: M. Lewis	0.30
14.	Thermal springs and wells, 1970: R. G. Bowen and N. V. Peterson	1.00
15.	Quicksilver deposits in Oregon, 1971: Howard C. Brooks	1.00

MISCELLANEOUS PUBLICATIONS

Landforms of Oregon: a physiographic sketch (17" x 22"), 1941	0.25
Index to topographic mapping in Oregon, 1969	Free
Geologic time chart for Oregon, 1961	Free
The ORE BIN – available back issues, each	0.25

OIL and GAS INVESTIGATIONS SERIES

1.	Petroleum geology of the western Snake River basin, Oregon–Idaho, 1963: Newton and Corcoran	2.50
2.	Subsurface geology of the lower Columbia and Willamette basins, Oregon, 1969: Newton	2.50