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The Ore Bin

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NO MOSS ON OUR STONES

Ralph S. Mason

There are no simple solutions to many of today's problems, and supplying intelligent choices seems to be getting more difficult. Providing acceptable options for making decisions dealing with land use is steadily becoming one of the Department's most important functions. State, Federal, and local governments are becoming increasingly aware of the need for basic, factual data on the limitations and potentials of the surface and subsurface lands under their jurisdiction. For the past 10 years the Department has been providing just this type of information on a cooperative basis upon request. Dr. John Beaulieu, environmental geologist with the Department staff, describes some of our activities in this very important field in the article which follows.

Forty years ago the Department made its first study of the State's energy resources, publishing a report on Coos Bay coal in 1938. Since then, much effort and concern have gone into studies of the potential for oil, gas, uranium, and geothermal energy. To date no oil or gas has been found and only modest amounts of uranium have been produced. Oregon has a history of widespread, recent volcanism, with over 170 known thermal springs. In addition, results of heat-flow studies in shallow wells suggest an excellent chance of finding sufficient geothermal energy for commercial development. Dr. Donald Hull, staff geothermal specialist, enlarges on this newest source of energy and the potential for it here in the State in an accompanying article.

Concern for the quality of the environment finds its greatest champions here in Oregon. Directly as a result of this deep-rooted feeling, the Legislature created the Mined Land Reclamation Act in 1971 and designated the Department as administrator. Since that time, a small, largely fee-supported program has attempted to bring all subject surface-mining operations under the act. The principal thrust of the law is to assure that abandoned pits be cleaned up and the land reclaimed for some subsequent beneficial use. The history of one of these operations appears below as an example of complete cooperation between the landowner, operator, and the State. Jerry Gray, one of the authors, was the first staff member to work under the act and was the entire crew for 15 months until additional reserves came on board.

Geology used to be a subject of interest to geologists only. Nowadays children are interested in a wide variety of geologic

phenomena; many college students take courses in geology just to learn more about the world they live in; and adults are becoming increasingly concerned about the environment, energy, mineral resources, and the part that geology plays in land planning at the local level. Their concerns reach the Department in many ways, and trying to respond to all of them poses problems. Many requests can be satisfied by means of existing publications printed over the past 40 years. Others require some personal attention by the staff, who either rummage through their files or search memories of their own past experiences for answers. Fortunately, we have access to many years of cumulative staff experiences which enable us to answer the wide variety of questions we are asked.

Environmental Geology

John D. Beaulieu

Accommodation of orderly land development while insuring public health, safety, and welfare is difficult and complex. The complexity is greatly reduced, however, if plans for land use are made with a full understanding of the natural characteristics of the land, the processes that shape it, and local geologic hazards. Geologic hazards of concern to the planner include mass movement, slope erosion, stream flooding, stream erosion and deposition, earthquake potential, and volcanic potential.

Average annual dollar losses caused by geologic hazards in Oregon are difficult to determine, owing to incomplete and scattered data. Indications are that landslide losses may total between \$4 million and \$40 million per year. As many as nine persons have been killed by a single landslide in Oregon in recent years. Losses through coastal retreat have totaled millions of dollars, because large parts of major communities have been destroyed. Flood losses alone will total \$36 million per year by the year 2000.

In view of these losses, the Department's environmental geology program in recent years has emphasized land use geology. Projects have been completed in coastal Tillamook and Clatsop Counties, inland Tillamook and Clatsop Counties, Lincoln County, coastal Lane County, coastal Douglas County, western Coos County, and western Linn County. During the present biennium, work has been conducted in western Curry County, northern Hood River, Wasco, and Sherman Counties, and central Jackson County (see map, p. 25). The projects are briefly described below.

Land use geology of Curry County

The objective of this investigation was to provide county personnel with needed geologic information to assist them in



Slumping of roadway by undercutting of fill material is a common geologic hazard along western Oregon streams.



Floods are a frequent geologic hazard for coastal lowlands in Oregon.

planning for future growth. Major concerns are mass movement, coastal retreat, earthquake potential, flooding, and minerals as they relate to planning. Funding was provided by Curry County, LCDC, and the Department.

Curry County has undergone at least six major periods of geologic deformation. Shear zones associated with the last period of offset rocks as young as Pliocene at Cape Blanco and may still be active. Currently available information is not adequate to give a final word on the seismic potential of the coastal parts of the county.

Results of the investigation of western Curry County are available in Bulletin 90, "Land Use Geology of Western Curry County, Oregon."

Geologic hazards of northern Hood River, Wasco, and Sherman Counties, Oregon

The objective of this current study is to provide county personnel with needed geologic information to assist them in planning for future growth. Unlike the Curry County study, this study emphasizes geologic hazards, with a minimum of attention paid to engineering properties of geologic units and none to mineral resources. Funding was provided by LCDC and the Department.

Massive, deep bedrock landslides have been identified along major faults and joints in Columbia River Basalt as well as in tuffaceous rock units in the overlying Dalles Formation and underlying Eagle Creek Formation. At The Dalles several factors combine to produce serious landslide problems within the urbanized area of the community. These include gentle northerly dips, tuffaceous interbeds, ground-water accumulation and discharge along the contact of the Dalles Formation and the underlying Columbia River Basalt, and changing land use. More detailed information must now be developed to guide the community toward responsible handling of these problems.

Results of the investigation will be published as Bulletin 91 in the late spring or summer.

Land use geology of central Jackson County

The objective of this study is to provide a broad base of geologic information for planning purposes with special attention to hazardous ground-water conditions, stream-bank erosion as it relates to gravel management, and mass movement. The study is being funded jointly by the Department, LCDC, and Jackson County.

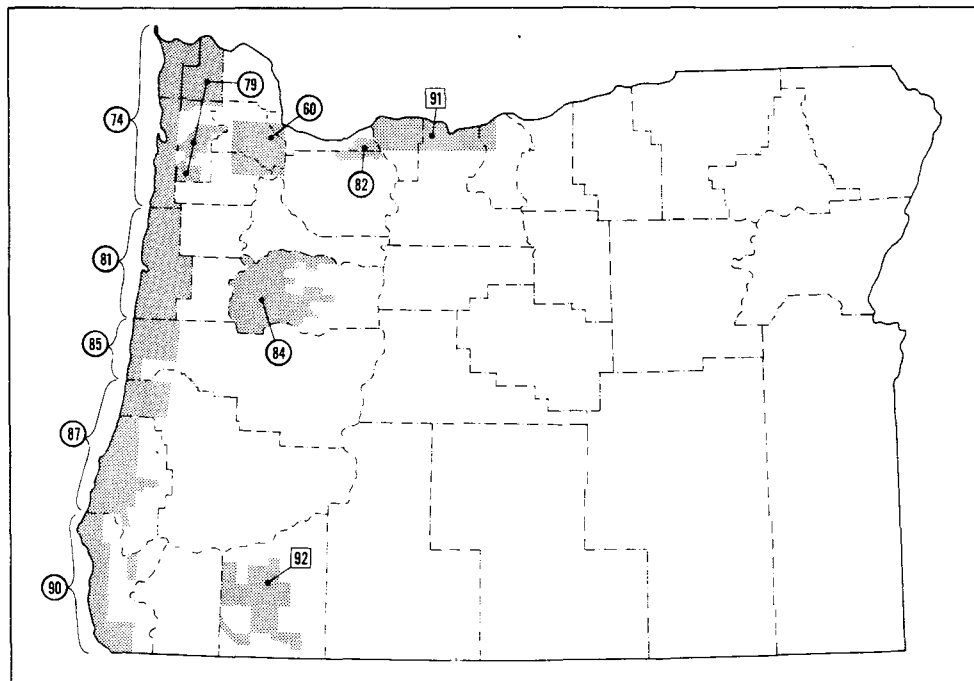
Of particular concern are the geological problems associated with the flat terrain of the Bear Creek valley. Waters debouching from the surrounding mountains feed Bear Creek and deliver sediment to the valley. The alluvial fill of the valley is relatively thin and overlies bedrock which for the most part is impermeable and does not readily accept infiltrating water. In addition, much of the deposited material is rich in clay. The net result is a

valley floor with low gradients, clay-rich soils, and poor drainage. High ground water and ponding plague the valley during the wet winter months; high ground water in the summer is a result of irrigation and unfavorable geology.

Results of this investigation will be published as a bulletin later this year.

Summary

The great variety of geologic settings and hazards encountered in the Department's environmental geology projects underscores the need for a broad base of geologic expertise in evaluating the geology of a region as it relates to land use. In addition, the ongoing program of environmental geology is making significant contributions to selected aspects of environmental protection, land management, and research.



LAND-USE GEOLOGY STUDIES

85 PUBLISHED DEPARTMENT BULLETINS

91 DEPARTMENT BULLETINS TO BE PUBLISHED DURING BIENNium

- | | |
|------------------------------------|-------------------------------------|
| 60. Tualatin Valley | 85. Coastal Lane County |
| 74. Coastal Tillamook-Clatsop Cos. | 87. Western Coos-Douglas Cos. |
| 79. Inland Tillamook-Clatsop Cos. | 90. Curry County |
| 81. Lincoln County | 91. N. Hood R., Wasco, Sherman Cos. |
| 84. Western Linn County | 92. Parts of Jackson Co. |

Geothermal Assessment

Donald A. Hull

During the 1975-1977 biennium, our geothermal research was directed toward regional assessment of potential resources throughout Oregon and more detailed evaluation of favorable areas. These studies were financed mainly with Federal grants from the U.S. Geological Survey, the Energy Research and Development Administration, and the U.S. Bureau of Mines. The assessment techniques included geological mapping, heat-flow drilling, electrical resistivity surveying, and geochemical sampling of hot springs.

The products of these studies consist of a heat-flow map of the State, a library of geochemical analyses of geothermal fluids, and a variety of maps and reports describing promising geothermal resource areas in detail. These data will be of value to both public and private groups engaged in land use planning and exploration for geothermal resources. In addition, we anticipate that the results of our geothermal work during the 1975-1977 biennium will serve as a basis for environmental monitoring during future development of Oregon's geothermal resources.



Department's drilling project to measure heat flow along the Brothers fault zone in Harney County, central Oregon. Measurement of heat flow patterns in this area of young volcanic rocks assists in regional evaluation of potential geothermal energy resources.

Oil and Gas

Vernon C. Newton

The biennial period 1975-1977 was a time of renewed oil and gas activity for Oregon. The Department issued six oil and gas drilling permits during the biennium (five in western Oregon and one in central Oregon). The "energy crisis" and large increases in the price of petroleum products brought a surge of interest in the potential of frontier areas such as Oregon. This activity extended to all of the State's 27,000 square miles of sedimentary basins.

The Department's staff provided basic geologic data for Reichhold Energy and Northwest Natural Gas companies' joint venture in western Oregon to explore for natural gas. The State Geologist gave testimony at a Public Utility Commission hearing in favor of allowing Northwest Natural Gas to take part in the search for gas deposits. The two companies drilled four deep test holes in the summer of 1975 but were not successful in making a discovery. The drilling did, however, lend encouragement; and the companies have planned additional test drilling in western Oregon.

A study was undertaken and completed by the Department during the biennium to determine the prospects for commercial natural gas deposits in the upper Nehalem basin of northwestern Oregon. The investigation was also directed toward finding a gas storage structure if discovery of natural gas did not appear likely. Three companies now hold oil and gas leases in the area: Reichhold Energy, Northwest Natural Gas Company, and Gas Producing Enterprises.

A moratorium covering oil and gas leasing of Federal lands in Oregon has existed for the past 5 years; but starting late in 1976, the U.S. Bureau of Land Management began issuing leases again. The leases are being issued on an area-by-area basis, following environmental assessments. The Department has given the USBLM assistance by supplying geologic and exploration data for the preparation of its environmental reports.

Department representatives attended three conferences on oil and gas leasing of the Federal outer continental shelf lands in the two-year period. All of the sessions were conducted by the U.S. Bureau of Land Management with the purpose of keeping the various states informed of progress. A tentative Pacific Coast sale date has been set by the USBLM for late in 1978. A call for nominations of prospective areas by industry was issued in January 1977. Environmental studies will take approximately 2 years, during which time the Department will be asked for input related to geology, drilling, and development.

Farming Mined Farm Land

Ralph S. Mason and Jerry J. Gray

This is a story about a farm that was improved by mining. It is a success story with a cast of only three - a landowner, a mine operator, and the State Mined Land Reclamation Division. Of the three, the landowner and the operator are by far the most important. The State played a minor, but legally necessary, role by helping out from time to time. Great credit must go to the landowners, Jack and Mary Chapin of Salem, who insisted that the utility and livability of their farm should not be permanently lessened by the mining operation. Much credit is also due to Gordon H. Ball, Inc. of Danville, California, the firm responsible for the entire mining and reclamation program. The firm worked closely with the Chapins and the State, exceeding the requirements of the contract with the owners and the reclamation plan submitted to the State.

The locale is gently rolling farm land in the Willamette Valley 9 miles north of Salem, the State Capitol. Figures 1-A and 1-B show how the Chapin farm looked before the Gordon H. Ball company started its work. At that time, an old gravel pit, scattered mining refuse, and an adjacent swampy area made quite a bit of the land useless for farming. Here are the highlights of the story:

1. Prior to July 1, 1972: As 7 acres of the Chapin farm had been mined for sand and gravel prior to enactment of the Mined Land Reclamation Act, they were not covered by the Act and, therefore, had not been reclaimed.
2. April 1973: Gordon H. Ball, Inc., successful bidder for improving Interstate Highway I-5 between Salem and Woodburn, submits application for a provisional operating permit from the State Mined Land Reclamation Division.
3. May 1973: Mining contract is signed between the Chapins and Gordon H. Ball, Inc. for 50 acres, including the old gravel pit.
4. July 1973: Marion County issues conditional use permit for mining sand and gravel on the Chapin property.
5. July 1974: A performance bond of \$25,000 is received by the Chapins from the Gordon H. Ball company.
6. August 1974: Reclamation plan is submitted to the Mined Land Reclamation Division.
7. November 1974: Reclamation Division is made co-holder of performance bond with the landowners.
8. December 1974: Surface Mining Permit is issued to Gordon H. Ball, Inc. by Reclamation Division.
9. October 1976: Mining and reclamation of the site is completed and operator is released from bond by landowners and the Reclamation Division.

And now for the program notes. You have already had a bird's-eye view of the mining site before it was opened up by the Gordon



Figure 1-A. Farm before mining began under a reclamation plan.

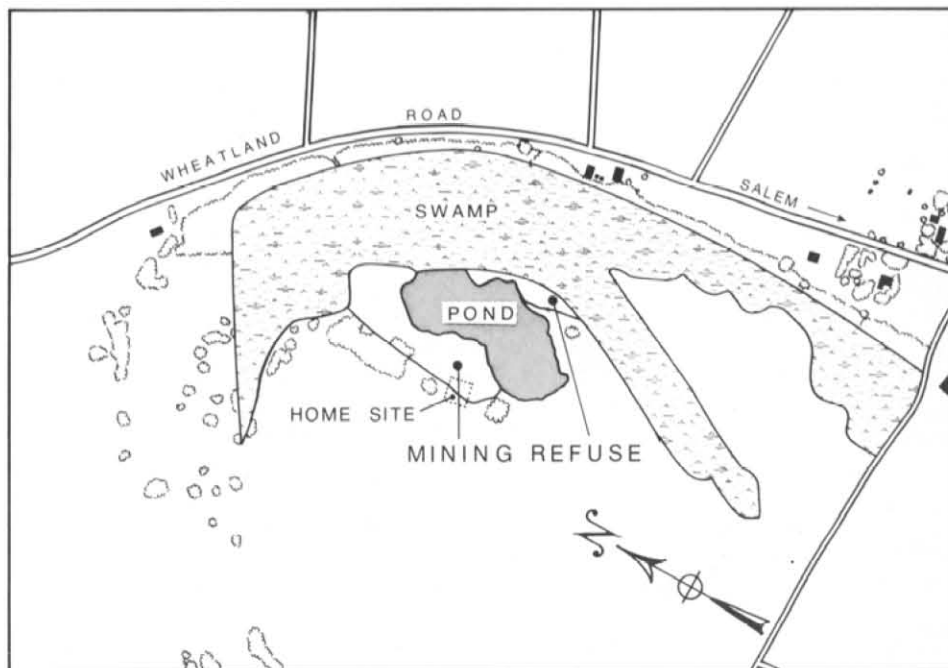


Figure 1-B. Sketch map identifying details of above photo.

Ball company. Figure 2 shows what it looked like during the peak production period. If you are confused by all the changes, keep your eye on the trees at lower left of the pond. They are part of the reclamation plan and are on stage in all three scenes. The scene is reminiscent of an Army proving ground when viewed from this angle, but please note that a dense line of trees along Wheatland Road forms a most effective visual barrier. Only the tip of the tall boom on the dragline by the edge of the pond was ever visible from the road.

The Chapin property was underlain by more than 40 feet of excellent sand and gravel, and the mining contract was written to encourage the operator to excavate as deeply as possible in order to gain the maximum amount of gravel per acre mined and to leave a viable lake. Since the aggregate processing would disturb good farm land and since the reclamation plan required restoring that land, the Chapins required that the topsoil in all areas to be disturbed had to be stockpiled and subsequently replaced and smoothed. In addition to restoring the disturbed areas, the operator had to grade the beach area around the lake to a slope not greater than 2:1. A strip in front of the home site was leveled with a 4:1 slope to form a bathing beach.

Figure 3 shows things all tidied up. Where once there were useless odd-shaped pieces of farm land, there are now usable areas. The brushy, swampy land has been filled in and replanted. A gently undulating heavy-duty access road leads to the home site. The Chapins' new home will command a view across a 24-acre lake fringed by tall trees. The lake is an esthetically pleasing private recreational facility, a fishing hole, and a handy source for water during the dry season. Furthermore, the beaches have a slope of 3:1 and 5:1 - better than the contract called for.

Finances are often a painful subject, especially for artistic productions like this one. Not here. The Chapin property happened to be 2.4 miles closer to the center of the I-5 highway project than an existing commercial pit nearby. Approximately 700,000 cubic yards of gravel were delivered to the highway project, with a royalty of 21.8 cents per cubic yard paid to the Chapins. At a cost of 10 cents per cubic yard per mile of haul, the 2.4-mile saving amounted to \$168,000 for Gordon H. Ball, Inc. The reclamation work is estimated to have been worth about \$50,000 to the Chapins; but since it was accomplished on a rolling basis as the work progressed, the actual expense to Ball was considerably less. A total of about 1,000,000 cubic yards of gravel was involved in the total project.

In a program such as this, the tax man cometh sooner or later. In this instance, he was ever present; and the following figures for the assessed valuation of the Chapin farm are of interest. In 1973 the Chapins' farm land was assessed at \$24,470. During the first year of the Gordon H. Ball operation, the value climbed to \$76,610, declining to \$69,130 the next year. In 1976, after the mining was completed and the farm reclaimed, the assessed valuation was placed at \$57,550. In other words, the farm land in-



Figure 2. Land use during mining and aggregate processing.

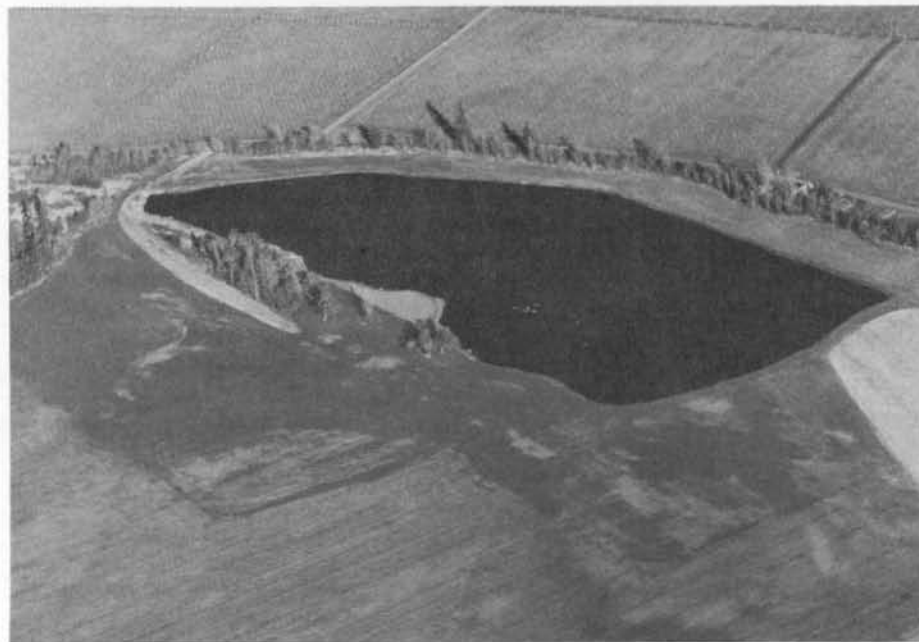


Figure 3. Land use after mined land reclamation completed.

creased in value over the 3-year period by \$33,080, which amounts to 135 percent.

Ironically, a July 1973 letter written to the Marion County Planning Commission regarding the operations at the Chapin farm asked, "When will the raping of good farm land for mineral extraction stop?" This is a classic example of the way uninformed observers misinterpret what they see.

As we stated at the beginning, the Mined Land Reclamation Division played a small part in this entire program. If any credit is to be given to the agency, it would be for its role in making periodic inspections, assisting both the landowner and the operator from time to time, and, more importantly, recognizing that here was an excellent example of how good farm land underlain by valuable sand and gravel can be treated so that the farmer not only enjoys an economic advantage but ends up with a greatly improved farm, with a higher value and increased productive capacity.

If you are interested in learning just what the Mined Land Reclamation Act is all about, please write the Mined Land Reclamation Division, P.O. Box 1028, Albany, Oregon 97321, c/o Mr. Stan Ausmus, Administrator. Basically, the act applies to mining operations that disturb more than one acre of land annually or that produce more than 2,500 cubic yards annually; however, the Division's expertise is available for any reclamation problem.

If you reclaim what you disturb, we'll not disturb while you're reclaiming.

Department Publications

As the final step in many of its activities, the Department publishes results of its findings. The nature and complexity of the study determines the type of publication, distribution, and press run, ranging from limited numbers of open-file reports to several thousand copies of some environmental geology studies issued as bulletins complete with numerous multi-color maps. All formal publications are routinely distributed to repository libraries for dispersal of the information and preservation of the record. Additional copies are supplied to the cooperating agencies or local governments, and the rest are available for purchase.

Over the years much attention has been given to the problem of how much to charge for Department publications. Our basic philosophy currently revolves around two main considerations - first is to set sales prices at a level that will assure availability to those for whom the publication was intended; second is to try to recapture direct printing, handling, and mailing costs, plus a little more to provide for future publications. Printing is the "art preservative of the arts." It is also very expensive and, coupled with soaring postal rates, has closed the "freebies" window, perhaps forever.

Publications: 1975-1976

Bulletins

- Bull. 87 - Environmental Geology of Western Coos and Douglas Counties, Oregon (1975)
- Bull. 88 - Geology and Mineral Resources of the Upper Chetco Drainage including the Kalmiopsis Wilderness and Big Craggies Botanical Areas, Oregon (1975)
- Bull. 89 - Geology and Mineral Resources of Deschutes County, Oregon (1976)
- Bull. 90 - Land Use Geology of Western Curry County, Oregon (1976)

Oil and Gas Investigations

- Inv. 5 - Prospects for Natural Gas Production and Underground Storage of Pipeline Gas in the Upper Nehalem River Basin, Columbia-Clatsop Counties, Oregon (1976)

Miscellaneous Papers and Publications

- Index to the ORE BIN - 1950 to 1974 (1975)
- Thermal Springs and Wells in Oregon (rev. 1975)
- Proceedings of Citizens' Forum on Potential Future Sources of Energy (1975)
- Fifth Gold and Money Session and Gold Technical Session Proceedings (1975)
- Short Paper 25 - Petrology of the Rattlesnake Formation (1976)
- Open-file - Bauxite (DOGAMI-USBM) (1976)
- Open-file - Stream Sediment Sampling (1976)

Manuscripts in progress

- Geologic Map Series 7 - The Baker 1° by 2° Quadrangle
- Geothermal Report 1 - Geothermal Exploration Studies in Oregon
- Bulletin 91 - Geologic Hazards of Parts of Northern Hood River, Wasco, and Sherman Counties, Oregon
- Rock Material Resources of Umatilla County, Oregon
- Fossil Reprints from The ORE BIN

The ORE BIN

Our monthly periodical, The ORE BIN, now in its 39th year, continues in good health with a paid subscription list of 2,205 (as of December 1976), plus copies for libraries and over-the-counter sale. Copies go to every county in the State, every State in the U.S., and to 14 foreign countries as well.

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NATURAL GAS STUDY PUBLISHED

The Department recently published Oil and Gas Investigation No. 5, "Prospects for Natural Gas Production and Underground Storage of Pipeline Gas in the Upper Nehalem River Basin, Columbia-Clatsop Counties." Authors are Vernon C. Newton and Robert O. Van Atta.

The report discusses the stratigraphy of the area, the findings in two deep Texaco test holes, and petrographic descriptions of sedimentary units. Also included in the publication is a description of the Jackson Prairie gas-storage field near Chehalis, Washington. A geologic map showing interpreted fold and fault structures accompanies the report. Price of the publication is \$5.00.

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FEDERAL OIL AND GAS LEASE FEES RISE

Certain fees on non-competitive Federal oil and gas leases increased February 1, under new regulations announced by the U.S. Department of the Interior. The annual rental for leases awarded non-competitively, including the "simultaneous" leases, is now one dollar per acre, rather than 50 cents; but leases that were already in force are not affected.

* * * * *

M'DERMITT CALDERA REPORT ON OPEN FILE

"Volcanic Rocks of the McDermitt Caldera, Nevada-Oregon," by Robert C. Greene, has been issued as Open-file Report 76-753 by the U. S. Geological Survey. The report describes the sequence of Miocene volcanic rocks centering around the McDermitt Caldera, the probable source of an alkali rhyolite covering an area of about 60,000 square miles in Oregon and Nevada. A copy of the report is available for inspection at the Department's library in Portland.

* * * * *

GRAVITY SURVEY DATA ON OPEN FILE

The U.S. Geological Survey has issued Open-file Report 76-702A, "Principle facts for a gravity survey of Summer Lake Known Geothermal Resource Area, Oregon," by D.L. Peterson and R.F. Meyer. A reproducible copy of the three-page report is on file in the Department library.

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DEPARTMENT RECEIVES WALTERS FOSSIL COLLECTION

The fossil collection of the late George and Jennie Walters of Portland, Oregon was recently donated to the Department by their son, Glen Walters. The collection is made up of a wide diversity of beautifully preserved fossils, identified and labeled, which won for the Walterses numerous awards in Mineralogical Society shows. The fossils are on display in the museum at the Department's Portland office.

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FISH AND WILDLIFE DEPARTMENT ISSUES PLACER MINING GUIDELINES

The Oregon Department of Fish and Wildlife has issued a leaflet, "Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources," which lists "preferred work periods" in Oregon streams. The DFW suggests that placer miners, particularly those using suction dredges larger than 4 inches, restrict their activities to the periods listed. Failure to do so might subject operators to penalties provided in Oregon Revised Statutes 498.006 and 509.040. Chapter 498 prohibits "chasing wildlife" and Chapter 509 prohibits "molesting spawning salmon."

Since the time required for the eggs to hatch and the fry to emerge varies among fish species at various water temperatures, and since weather conditions and stream flows vary considerably from year to year, the dates set forth in the Guidelines could be altered by the Department of Fish and Wildlife to assure optimum protection for the spawning fish. To avoid uncertainty and the threat of punishment, check before commencing placer operations. Write to the Department of Fish and Wildlife, 506 S.W. Mill Street, Portland, OR 97208; or call 229-5408.

* * * * *

NATIONAL PARK AREAS CLOSED TO MINERAL DEVELOPMENT

Six areas in the National Park system which had remained open to mineral entry under the general Mining Laws are now closed to new mining exploration and development by Public Law 94-429, recently enacted. The areas affected are: Death Valley National Monument, Glacier Bay National Monument, Crater Lake National Park, Organ Pipe Cactus National Monument, Mount McKinley National Park, and Coronado National Memorial.

Under the new law, existing mining claims within any of the six areas will be presumed to be abandoned unless recorded with the Secretary of the Interior by September 28, 1977. This procedure will enable the agency to determine valid mineral rights.

* * * * *

QUARTZVILLE AREA REPORT ON OPEN FILE

"Geology and mineral deposits of the Quartzville mining district, central Western Cascades, Oregon," by Steven R. Munts, is on open file in the Department library in Portland. The 150-page report is preliminary and subject to revisions and additions. The Department plans to publish the work upon its completion by the author.

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SPOKANE OFFICE FURNISHES U.S. GEOLOGICAL SURVEY BOOKS

The Spokane branch of the U.S. Geological Survey is now the closest source for USGS bulletins, professional papers, water-supply papers, and miscellaneous leaflets on areas in Western states.

Order from: Public Inquiries Office, USGS; Room 678 U.S. Court-House Bldg.; West 920 Riverside Avenue; Spokane, WA 99201.

Make checks payable to U.S. Geological Survey.

Please note that the Spokane Branch of the Survey does not handle maps. To order maps of the Western states, write to: Branch of Distribution, USGS; Box 25286, Federal Center; Denver, CO 80225.

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ALSEA FORMATION BOOKLET PUBLISHED BY SURVEY

"Alsea Formation, an Oligocene marine sedimentary sequence in the Oregon Coast Range," by P.D. Snavely, Jr., N.S. MacLeod, W.W. Rau, W.O. Addicott, and J. E. Pearl, has been issued as U.S. Geological Survey Bulletin 1395-F. The 21-page publication is illustrated and is for sale by U.S. Geological Survey, Public Inquiries Office, Room 678, U.S. Court House Building, West 290 Riverside Avenue, Spokane, Washington 99201. The price is 65 cents.

The Alsea Formation crops out in an arcuate belt in Lincoln County, contains abundant molluscan and foraminiferal faunas of early Oligocene age, and dips westward beneath the upper Oligocene-lower Miocene Yaquina Formation. Formerly designated as the upper part of the Toledo Formation, the Alsea has been given formational rank. Because the lower part of the Toledo is now considered to consist of Eocene Yamhill and Nestucca Formations, the name "Toledo Formation" has been abandoned by the Survey.

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TIME TO RENEW? Note your ORE BIN expiration date on the back cover of the October issue. Renew in time to avoid "losing" an issue.

AVAILABLE PUBLICATIONS

(Please include remittance with order; postage free. All sales are final - no returns.
A complete list of Department publications, including out-of-print, mailed on request.)

BULLETINS	Price
26. Soil: Its origin, destruction, and preservation, 1944: Twenhofel	\$.45
33. Bibliography (1st suppl.) geology and mineral resources of Oregon, 1947: Allen	1.00
35. Geology of Dallas and Valsetz quadrangles, Oregon, rev. 1964: Baldwin	3.00
36. Papers on Tertiary foraminifera: Cushman, Stewart and Stewart, 1949: v. 2,	1.25
39. Geol. and mineralization of Morning mine region, 1948: Allen and Thayer	1.00
44. Bibliog. (2nd suppl.) geology and mineral resources of Oregon, 1953: Steere	2.00
46. Ferruginous bauxite deposits, Salem Hills, 1956: Corcoran and Libbey	1.25
49. Lode mines, Granite mining district, Grant County, Oregon, 1959: Koch	1.00
52. Chromite in southwestern Oregon, 1961: Ramp	5.00
53. Bibliog. (3rd suppl.) geology and mineral resources of Oregon, 1962: Steere, Owen	3.00
57. Lunar Geological Field Conf. guidebook, 1965: Peterson and Groh, editors	3.50
60. Engineering geology of Tualatin Valley region, 1967: Schlicker and Deacon	7.50
61. Gold and silver in Oregon, 1968: Brooks and Ramp	7.50
62. Andesite Conference guidebook, 1968: Dole	3.50
63. Sixteenth biennial report of the Department, 1966-1968	1.00
64. Mineral and water resources of Oregon, 1969: USGS with Department.	3.00
65. Proceedings of Andesite Conference, 1969: [copies]	10.00
66. Geol. and mineral resources of Klamath and Lake Counties, 1970	6.50
67. Bibliog. (4th suppl.) geology and mineral resources of Oregon, 1970: Roberts	3.00
68. Seventeenth biennial report of the Department, 1968-1970	1.00
69. Geology of southwestern Oregon coast, 1971: Dott	4.00
71. Geology of selected lava tubes in Bend area, Oregon, 1971: Greeley	2.50
72. Geology of Mitchell quadrangle, Wheeler County, 1971: Oles and Enlows	3.00
75. Geology and mineral resources of Douglas County, 1972: Ramp	3.00
76. Eighteenth biennial report of the Department, 1970-1972	1.00
77. Geologic field trips in northern Oregon and southern Washington, 1973	5.00
78. Bibliog. (5th suppl.) geology and mineral resources of Oregon, 1973: Roberts	3.00
79. Environmental geology inland Tillamook and Clatsop Counties, 1973: Beaulieu	7.00
80. Geology and mineral resources of Coos County, 1973: Baldwin and others	6.00
81. Environmental geology of Lincoln County, 1973: Schlicker and others	9.00
82. Geol. hazards of Bull Run Watershed, Mult., Clackamas Counties, 1974: Beaulieu	6.50
83. Eocene stratigraphy of southwestern Oregon, 1974: Baldwin	4.00
84. Environmental geology of western Linn County, 1974: Beaulieu and others	9.00
85. Environmental geology of coastal Lane County, 1974: Schlicker and others	9.00
86. Nineteenth biennial report of the Department, 1972-1974	1.00
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