The Ore Bin

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DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

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OREGON'S MINERAL AND METALLURGICAL INDUSTRY IN 1974

Ralph S. Mason, Deputy State Geologist
Oregon Department of Geology and Mineral Industries

The value of raw minerals produced in the State during 1974 increased 11.3 percent, eclipsing a gain of nearly 9 percent for the previous year. Preliminary compilations by the U.S. Bureau of Mines show mineral production of $90,703,000 in 1974. Of this amount, stone and sand and gravel accounted for 76 percent. In its annual canvass, the U.S. Bureau of Mines does not include the value, estimated to be in excess of $700 million annually, of primary metals produced in the State, such as iron and steel, aluminum, ferronickel, and the various exotics.

In a year marked by rapid increases in the value of gold and silver, mining companies showed renewed interest in Oregon mines. At the recreational level, the interest in gold was intense; if the economy worsens, an even greater number of "recreational" prospectors can be expected.

Industrial Minerals

Economic stresses and environmental constraints during 1974 resulted in a slight lowering in volume of aggregate production and a somewhat higher cost. Reduction in the amount of road and highway construction and maintenance, engineering works, and commercial and domestic construction accounted for a decline of 2.14 million tons of aggregate produced. An increase in value of $3.54 million came as a result of substantial raises in costs of all forms of energy, the price of money, and the ever-longer hauls from pit to market.

The industrial minerals industry in the State generally had a fairly quiet year. 1974 was a time of belt-tightening, increasing regulation, decreasing availability of resources, and a rising level of resistance from land and home owners located near aggregate production. Lack of adequate

SOME OF OREGON'S MINERALS AT A GLANCE

Mineral	1973	1974*
Clays	$ 291,000	$ 196,000
Gemstones	700,000	650,000
Lime	2,552,000	2,400,000
Nickel	W	W
Pumice, volcanic cinder	1,902,000	2,090,000
Sand and gravel	32,751,000	37,042,000
Silver	3,000	W
Stone	21,843,000	22,091,000
Value of items that cannot be disclosed: cement, gold, copper, diatomite, talc, tungsten, and values indicated by symbol "W"	21,424,000	26,234,000
Total	$81,466,000	$90,703,000

W = Withheld
* Preliminary

BY COMPARISON - - -

State	1972 Value	Value per capita	Rank per capita
California	$1,851,365,000	$ 93	25
Wyoming	746,743,000	2,249	1
Nevada	181,702,000	372	11
Washington	109,806,000	32	38
Idaho	106,206,000	149	17
Oregon	76,516,000	37	36
U.S. TOTAL	$32,217,000,000	159	

land-use planning plus an under-funded mined-land reclamation act were responsible for some of the industry's problems.

Other industrial minerals produced in the State included: expansible and brick-and-tile clays, bentonite, volcanic cinders and pumice, talc, limestone, cement, and silica. Oregon maintained its prominent position in the production of semi-precious gems, with the largest portion of the stones mined by amateurs or semi-professionals. Although no accurate canvass of the semi-precious gem industry is possible, it is estimated at about $750,000 annually.

The Metals

Although gold commanded world-wide attention during 1974 with its great rise in price, the impact in the State was moderate, at least at the professional level. Several mines in the Baker area of northeastern Oregon were reopened, and sampling and re-evaluation programs were underway. Great interest was displayed by the recreationist and part-time gold miner. Late in the year, a mini-gold-rush developed and hundreds of claims were staked in Baker County.

Most of the gold produced in the past in the State has come from two widely separated areas, one in northeastern and the other in southwestern Oregon. Starting in 1850 with a discovery of placer gold in Josephine Creek at its confluence with the Illinois River in Josephine County, the search widened rapidly over the next 15 years, during which time most of the known placers were discovered. Following the decline of the easily won placer gold, the development of lode deposits proceeded briskly, with most of the important mines being discovered as early as the 1880's.

The high point in gold production occurred in 1940 with a total of slightly over 105,000 fine troy ounces. The forced closure of all gold mines in 1941 by Executive Order L-208 abruptly blunted this rapid rise. For the past 3 years, gold has not even appeared in the U.S. Bureau of Mine's statistics on the State's mineral production. Undoubtedly some gold is being recovered by the small army of non-professionals, but those who find it are not talking.

Hanna mining Co. continued to produce ferronickel at its Riddle smelter at Nickel Mountain in Douglas County. Improved plant efficiency and an increase in the price of nickel made it economic to mine nickel silicate ore of slightly lower grade than was mined in previous years. The Department of Geology and Mineral Industries, in cooperation with the U.S. Bureau of Mines, conducted a nickel study in southwestern Oregon during the year. The study is designed to identify all known and potential areas of nickel-bearing laterites in the State. Numerous samples were collected and are being analyzed in the Department's laboratories.

* * * * *

OIL AND GAS EXPLORATION IN 1974

V. C. Newton, Jr.
Petroleum Engineer, Oregon Dept. Geology and Mineral Industries

No new permits were issued for oil and gas drilling by the Department in 1974; however, increased interest in petroleum prospects of the State was reflected by renewed leasing activity and a steady stream of inquiries for geological data from the Department. Activity has been at a low ebb for the past 7 years, following termination of continental shelf exploration. Oregon is still one of the thirteen non-producing states.

Status of Federal Lands

Secretary of Interior Rogers Morton placed a moratorium on oil and gas leasing of Federal lands in Oregon in 1971 following objections by environmental groups to Texaco's drilling of a wildcat well in eastern Oregon. The intervenors wanted the Bureau of Land Management to initiate full impact procedure before issuing oil and gas leases. The BLM held the view that the full hearings process was not necessary in every case but should be applied when major conflicts arose. Officials of the BLM reported in December 1974 that the moratorium covering onshore leases has been lifted by Secretary Morton. The BLM will make regional environmental analyses in Oregon to determine what effect exploration and development will have on the environment. Specific studies will then be made for each area applied for to determine if protective stipulations are needed in the lease contract. This is the procedure now being used in other states. The four-year delay in issuing Federal leases has cost Oregon counties an estimated $300,000 in lease rentals.

The major portion of Federal lands off the Oregon Coast is not scheduled for leasing by the U.S. Department of the Interior until after 1980. Should oil be found on these outer continental shelf lands, it will not reach refineries before 1985 at the earliest. Environmental concern is currently the main factor in delaying the work, but availability of capital to fund expensive offshore development probably would slow the pace of exploration even if the environmental delays were not present. A discovery of oil and gas on Oregon submerged lands, however, would force earlier lease sales on adjacent Federal lands. In the meantime, offshore drilling and production technologies are being perfected in the North Sea operations.

Onshore Prospects

Much of the state is underlain by marine rocks ranging in age from Devonian to late Tertiary, and detailed geological and geophysical studies

in these areas should reveal many prospective drill sites. The Tertiary marine basin in western Oregon covers an estimated 25,000 square miles. Pre-Tertiary marine rocks, although fairly extensive, have a covering of younger rocks in all but the uplifted regions, and very few deep test holes have been put down thus far to allow reasonable subsurface correlation. Geology of Oregon, like that of other states along the western margin of North America, is typically complex owing to tectonism and volcanism. Volcanic rocks overlie and are interbedded with most of the marine sediments in Oregon. Three-quarters of the State is covered by Cenozoic volcanic rock which obscures structural features as well as the physical character of the older rocks.

In the search for oil and gas, 22 deep holes have been put down in western Oregon and 12 in eastern Oregon. Many of these holes encountered shows of hydrocarbons (see Figure 1). Oil was recovered in formation tests from only one hole, but cores and cuttings from 7 other deep tests showed oil was present in at least trace amounts.

Leasing Areas

Petroleum exploration onshore is divided between the western Tertiary basin and the Mesozoic-Paleozoic prospects in eastern Oregon. Mobil Oil Company is building a major lease position in the western part of the State, having filed on more than 200,000 acres. Additional leases in western Oregon, totaling approximately 15,000 acres (see Figure 2), were acquired by independents.

East of the Cascades, Texaco, Inc. and Standard are the largest leaseholders with nearly 180,000 acres each. Independents have rights on another 15,000 acres in eastern Oregon.

Shell Oil Company and Texaco began leasing in three counties of south-central Washington last summer. The leases are located within the Columbia Plateau where Pliocene-Miocene flood basalts cover older rocks. Standard Oil Company of California and others drilled a 10,655-foot test hole in 1958 in the Rattlesnake Hills of that area and bottomed in Oligocene-Eocene volcanics. Interest in the Columbia Basin may later extend to the Oregon portion of the basin if drilling results are encouraging. Gas was produced between 1929 and 1942 from the Rattlesnake Hills structure in the vicinity of Standard's well and supplied four or five small towns in the area. The gas was found in fractured zones of the Plio-Miocene lavas (Glover, 1936).

Offshore Exploration

Exploration along the Oregon and Washington coasts has been minimal since the last hole was drilled offshore in 1967. Sporadic non-explosive seismic surveys have been conducted in the past 7 years. Digicon, Inc., Houston, Texas, made air-gun studies along the Coast in April 1974. Gulf

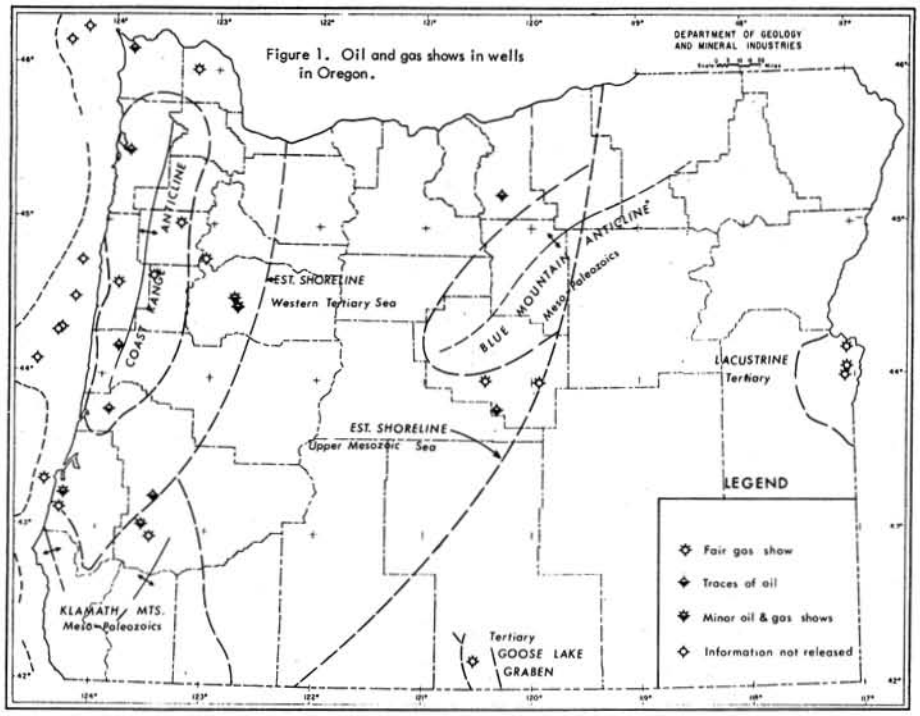


Figure 1. Oil and gas shows in wells in Oregon.

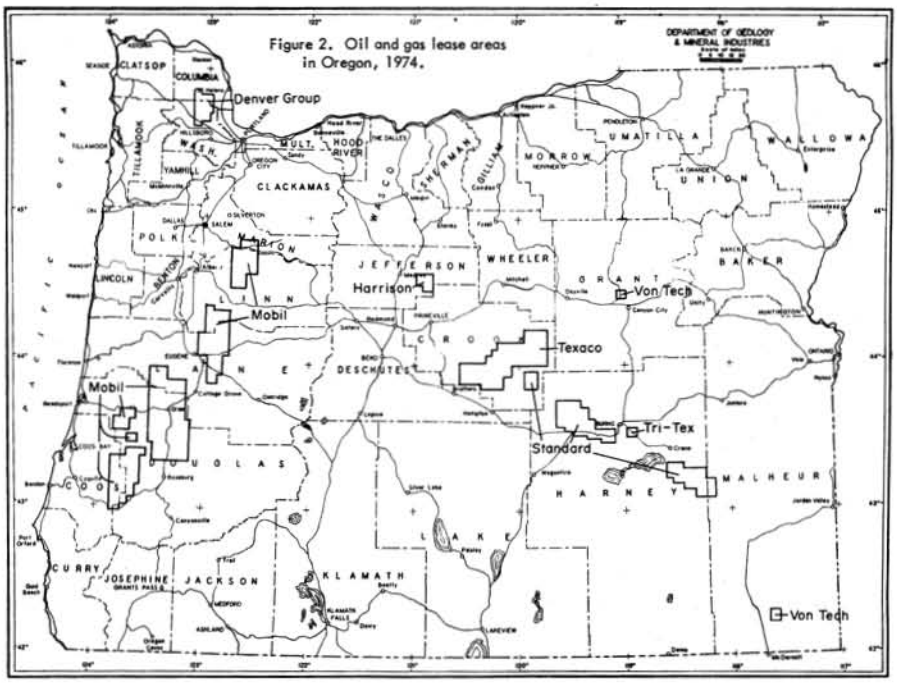


Figure 2. Oil and gas lease areas in Oregon, 1974.

Oil Company, U.S., applied in October 1974 to conduct geophysical surveys along the Oregon Coast. Standard and Texaco maintained exploration permits for offshore geophysical work but did not make investigations in 1974.

References

Deacon, R. J., and Benson, G. T., 1971, Oil and gas potential of Oregon, Washington, and Idaho: Am. Assoc. Petrol. Geologists Mem. 15.

Glover, S. L., 1936, Preliminary report on petroleum and natural gas in Washington: Wash. Div. of Geology R.I. no. 4, 12 p.

Kirkham, V. R. D., 1935, Natural gas in Washington, Idaho, eastern Oregon, and northern Utah, in Geology of natural gas: Am. Assoc. Petrol. Geologists, p. 221-244 (June).

* * * * *

GEOTHERMAL LEASE AREAS IN OREGON

The accompanying map outlines general areas of applications for Federal lands and existing leases on private lands. Geothermal leasing activity covers more than 2 million acres of land in the Cascade Range and volcanic terrain of eastern Oregon. Applicants and lessees by area are:

Mount Hood
- Republic Geothermal

Breitenbush Hot Springs
- Hydro Energy
- Sun Oil
- Hook, et al.

Belknap Hot Springs
- Sun Oil
- Energy Partners
- Chevron
- Hydro Energy
- Pacific Energy

McCredie Hot Springs
- Oil Resources
- Hydro Energy

Newberry Crater
- California Geothermal
- Chevron
- Sun Oil
- Phillips Steam
- Union Oil

Summer Lake
- LVO Corporation
- Chevron
- Earth Power
- Thermal Resources

Glass Butte
- California Geothermal
- Sun Oil

Klamath Falls
- Dowdle Oil
- Gulf Oil
- Hunt Family
- Earth Power
- Creslenn Oil
- Natomas
- Geothermal Resources Int'l

Lakeview-Warner Valley
- Gulf Oil
- Chevron
- Mobil
- Phillips Steam
- Union

Lakeview-Warner Valley, cont'd
- Energy Partners
- Hunt Family

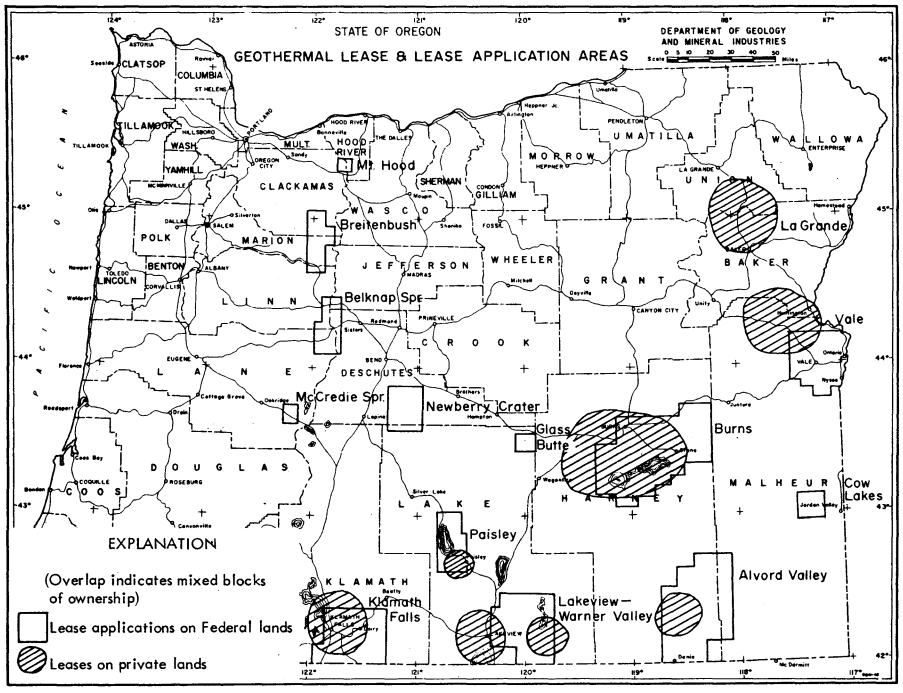
La Grande
- Gulf Oil
- Magma Power
- AMAX Exploration

Burns
- LVO Corporation
- Earth Power
- Pacific Energy
- Gulf Oil
- Geothermal Resources Int'l
- Thermal Resources
- Sun Oil

Cow Lakes
- MacColl
- Douglas, et al.

Vale
- Union Oil
- Magma Power
- Republic Geothermal
- LVO Corporation
- Gulf Oil
- Hydro Energy
- Thermo Resources

Alvord Valley
- Anadarko
- California Geothermal
- Chevron
- Getty
- Gulf Oil
- Magma Power
- Mobil
- Thermex
- Republic Geothermal
- Union Oil
- Pacific Energy



GEOTHERMAL ACTIVITY IN 1974

Richard G. Bowen
Consultant in Geothermal

The level of geothermal activity showed significant increases in some categories but decreases in others. Most importantly, the U.S. Department of the Interior started implementing the 1970 Geothermal Steam Act to lease Federal lands for exploration and development. The number of exploratory wells drilled throughout the West has increased, and several pilot studies in the Imperial Valley of California are underway to utilize the high-temperature brines found in that region. At The Geysers, new step-out wells have continued to enlarge the field. Direct use of geothermal energy for heating or process use is increasing worldwide. The realization that fossil fuels are finite and subject to political manipulation has triggered an increased interest in geothermal potential. On the national scene some companies associated with high-energy use, such as producers of aluminum and chemicals, have also entered the geothermal field to assure themselves of a reliable energy source.

Delays in the development of geothermal resources have been numerous and frustrating during the year. The complex leasing procedure set up by the Federal Geothermal Steam Act of 1970 requires much more time and expense than does the leasing of lands for other fuels, such as oil and gas or uranium. The imposition of environmental studies prior to each step - leasing, exploration work, drilling, development, plant construction - has caused many delays and added greatly to the over-all expenses. These delays are now being resolved, however, and a few competitive leases have been signed. The Interior Department expects that some non-competitive leases will be granted in 1975. At The Geysers field, the local requirements for extensive environmental studies have caused a two-year holdup on new plant construction within the field.

World-wide, the oil embargo has caused countries to re-evaluate their geothermal potential and accelerate development to reduce the drain of funds to pay for oil. In Italy, a new steam field was discovered at Alfino, 60 miles south of the Larderello field between Florence and Rome. In New Zealand, studies have been started to assess the geothermal potential in areas away from Wairakei, and efforts are also underway to increase heating and process use in several areas. In Japan, new discoveries have been made and a new field, Hachimantai, came into production this year. Exploration and development activities continue in Mexico, El Salvador, Chile, the Philippines, Indonesia, Greece, Turkey, The Azores, Iceland, Martinique, and Canada.

In Oregon and other western states, a flurry of leasing started in January 1974, with a steady follow-up during the rest of the year. By the time the year ended, applications and deposits for over 1.6 million acres in Oregon had been received by the BLM. Similar patterns developed in Washington, with approximately .6 million acres under application; California with 1.6 million; Idaho, 1.1 million; Utah, .8 million; and Nevada, 2.1 million acres. Most of these states have had some additional leasing activity on private and State lands. The accompanying map shows areas where geothermal lease applications have been filed. Applicants are listed below by geographic areas.

Although the level of interest is high, as shown by leases, drilling activity has not kept pace. During the year only one geothermal test was drilled, that by Magma Energy near La Grande. This well, planned as a 5,500-foot test, was abandoned at 2,800 feet after encountering difficult drilling conditions costing more than the funds budgeted for the job. A well drilled near Klamath Falls by the Presbyterian Intercommunity Hospital intersected a flow of 200°F water at 1,500 feet. The successful geothermal heating installation at nearby Oregon Institute of Technology, together with the rising price of natural gas, were the deciding factors in this enterprise. The system will be modified to run the water directly through the existing natural-gas-fired hot water heating system. Based on the 10 years experience at OIT, it appears this method should be successful and over the next few years give a good return on the drilling investment.

If impediments are removed, 1975 should see the beginning of serious geothermal exploration within the State.

* * * * *

BOWEN RESIGNS TO DO CONSULTING WORK

Richard G. Bowen, Economic Geologist with the Oregon Department of Geology and Mineral Industries for the past 15 years, resigned January 1, 1975 to enter private consulting in geothermal resource investigations and development. Bowen is a well-known expert in geothermal realms and for the past 4 years has been in considerable demand at national and international conferences on energy. He has been president of the Geothermal Resources Council and has served as chairman, co-chairman, speaker, and panelist at numerous energy conferences at both local and international levels. His strong belief in the merits of geothermal energy and his enthusiasm for promoting this idea have put Oregon on the map for its geothermal potential.

Bowen expects to be kept busy doing consulting work for private companies and plans to travel in areas of the West where geothermal activity is anticipated. At the present time his office is in his home in Portland.

* * * * *

FIELD-ORIENTED GEOLOGY STUDIES IN OREGON DURING 1974

John D. Beaulieu
Geologist, Oregon Dept. of Geology and Mineral Industries

During the 1974 field season at least 115 geologic field investigations were conducted in Oregon. The list below includes those of which the Oregon Department of Geology and Mineral Industries is aware. For convenience, the State is divided roughly into six sections, and several investigations of more regional extent are included in a seventh category - Regional.

The Department would appreciate receiving information about studies in progress in the State which are not listed here. The resumés received thus far have been invaluable in completing this list, and the compiler is grateful for this assistance. An annotated list will be issued later in 1975 as a Department open-file report, and availability of copies of that report at cost will be announced in The ORE BIN.

The Department has no information on completion dates of research or reports of other organizations; inquiries should be directed to individual named.

Northwestern Oregon

1. Oligo-Miocene biostratigraphy: Warren O. Addicott, U.S.G.S., Menlo Park
2. Ferruginous bauxite in Columbia, Washington, and Marion Counties: U.S. Bur. Mines, R. N. Appling, Jr., Chief
3. Biostratigraphy of the type Nestucca Formation: Arden Callender, Master's cand. P.S.U.
4. Factor analysis of mass movement: Vern Cimmery, Master's cand., Dept. Geography, P.S.U.
5. Breitenbush Hot Springs - geology: Michael Clayton, Master's cand., P.S.U.
6. Astoria Formation - petrology, stratigraphy, paleoenvironment: M. D. Cooper, Ph.D. cand., O.S.U.
7. Hillslope processes and sediment formation on a basaltic headland: William Dietrich, Master's cand., U. of Wash.
8. Bagby Hot Springs area - geology: Richard Dyhrman, Master's cand., O.S.U.
9. Recent fluvial history of Siuslaw and Alsea Rivers: Joe Feiersen, Ph.D. cand., Dept. Geography, U. of O.
10. Water resources of coastal Lincoln County: F. J. Frank and A. Laenen, U.S.G.S. Portland in coop. with State Engineer
11. Western Cascades from Clackamas River to Santiam Pass: Paul Hammond, Dept. of Geology and Mineral Industries (DOGAMI)

12. Lower Tertiary mollusks: Carole S. Hickman, Ph.D. cand. and Adj. Res. Assoc., Stanford U.
13. Siletz Spit erosion: Paul D. Komar and C. C. Rea, Dept. Oceanography O.S.U.
14. Ground water in the Newberg area: A. R. Leonard, U.S.G.S. Portland in coop. with State Engineer
15. Ground water of northern Clackamas County: A. R. Leonard, U.S.G.S. Portland, in coop. with State Engineer
16. Oil and gas prospects and underground storage: Vernon C. Newton, Jr., DOGAMI
17. Astoria and Yaquina Formations deltaic-turbidite model: A. R. Niem, Prof., O.S.U.
18. Geomorphology of northern and central Coast Range: W. Niem, Master's cand., O.S.U.
19. Saddle and Humbug Mountains area - geology: Peter Penoyer, Master's cand., O.S.U.
20. Foraminifera and biostratigraphy of the Alsea Formation: Weldon Rau, State of Wash. Div. of Geology and Earth Resources
21. Marion Forks area - geology: Tony Rollins, Master's cand., O.S.U.
22. Oregon-Washington continental margin: Parke D. Snavely, Jr., U.S.G.S. Menlo Park
23. Seaside to Young River Falls - geology: Pat Tolson, Master's cand., O.S.U.
24. Aggregate source areas: R. O. Van Atta, Prof., P.S.U.
25. Battle Ax-Outerson-Triangulation Peaks area - geology: Craig White, Ph.D. cand., U. of O.
26. Tillamook earthquake of June 16, 1973: Stephen Woodcock, Dept. Oceanography, O.S.U.

Southwestern Oregon

1. Mineral deposits reconnaissance of Douglas, Jackson, and Josephine Counties: U.S. Bur. Mines, R. N. Appling, Jr., Chief
2. Marial and Agness quadrangles - geology: Ewart M. Baldwin, Prof., U. of O.
3. Eocene stratigraphy of southwest Oregon: Ewart M. Baldwin, Prof., U. of O.
4. Environmental geology of western Coos County: John D. Beaulieu, DOGAMI, and Paul W. Hughes, consultant
5. Alpine ultramafic rocks: R. G. Coleman, U.S.G.S., Menlo Park
6. Josephine peridotite and associated rocks: Henry Dick, Yale U., Ph.D. cand.
7. Ashland pluton - geology: Mary Donato, Master's cand., U. of O.
8. Rogue Formation and related units: Michael Garcia, Ph.D. cand., U.C.L.A.

9. Ground water near Winston: D. D. Harris, U.S.G.S. Portland, in coop. with State Engineer
10. Jurassic of North America: R. W. Imlay, U.S.G.S. Menlo Park
11. Marine-fluvial Quaternary sedimentation: R. J. Janda, U.S.G.S. Menlo Park
12. Cretaceous of Pacific Coast: D. L. Jones, U. S.G.S. Menlo Park
13. Blanco Fracture Zone microearthquakes: Paul Jones, Master's cand., Dept. Oceanography O.S.U.
14. Hypersthene source on coast of southwest Oregon: Tom Judkins, Master's cand., U. of O.
15. Compilation map in Wrangle Camp-Dutchman Peak area: M. A. Kays and S. Boggs, Profs., U. of O.
16. Siuslaw jetty extension: Paul D. Komar, Prof., Dept. Ocean. O.S.U.
17. Eocene stratigraphy northwest of Roseburg: E. R. Orwig, Mobil Oil
18. Medford-Coos Bay quadrangles: N. J. Page, U.S.G.S. Menlo Park
19. Pacific Coast sedimentology: R. L. Phillips, U.S.G.S. Menlo Park
20. Dutchman Butte quadrangle - geology: R. Perttu, Master's cand., P.S.U.
21. Nickel occurrences: Len Ramp, DOGAMI
22. Ground water in the Drain-Yoncalla area: J. H. Robison, U.S.G.S. Portland, in coop. with State Engineer
23. Ground water in the Sutherlin area: J. H. Robison, U.S.G.S. Portland, in coop. with State Engineer
24. Gravel resources of Josephine County: Herbert Schlicker, DOGAMI
25. Biostratigraphy of the Roseburg, Lookingglass, and Flournoy Formations: R. E. Thoms, Prof., P.S.U.
26. Galice, Dothan, and Josephine units: Scott Vail, Ph.D. cand.,O.S.U.

North-central Oregon

1. Devonian of Oregon: Tom Amundson, senior res., P.S.U.
2. Canyon Mountain Complex: Hans Ave Lallement, Prof., Rice U.
3. Columbia River Basalt stratigraphy: Robert Bentley, Prof., C.W.S.C.
4. Landslides, community of John Day: Howard Brooks and Herbert Schlicker, DOGAMI
5. Erosion processes of the Willamette Basin: W. M. Brown and S. A. Vickers, U.S.G.S. Menlo Park, and David Rickert, U.S.G.S. Portland
6. Clarno Formation - Mitchell area: H. E. Enlows and E. M. Taylor, Profs., O.S.U.
7. Rattlesnake Formation - type section: H. E. Enlows, Prof., O.S.U.
8. Ground water in the Harrisburg-Halsey area: F. J. Frank, U.S.G.S. Portland, in coop. with State Engineer
9. Volcanoes - infrared surveillance: J. D. Friedman, U.S.G.S. Menlo Park

10. Columbia River Basalt - geochemistry: John S. Fruchter, Battelle-Northwest, Richland (formerly Ph.D. cand., U. of O.)
11. Plio-Pleistocene volcanics of the Portland area and Columbia River Gorge - chemical analyses: Gary L. Millhollen, Prof., Purdue U.
12. Quartzville District - geology and mineral deposits: Stephen R. Munts, Master's cand., O.S.U.
13. Lawson Mountain and Stevenson Mountain quadrangles - geology: Philip C. Owen, Master's cand., O.S.U.
14. Mineral resources of Deschutes County: Norm Peterson, DOGAMI, and Ed Groh, consultant
15. Water resources of the Warm Springs Indian Reservation: J. H. Robison, U.S.G.S. Portland in Coop. with State Engineer
16. Jurassic paleontology of the Izee area: Paul Smith, grad. student, PSU
17. Volcanology of the western United States: R. L. Smith, U.S.G.S. Menlo Park
18. Mount Jefferson: Ken Sutton, Master's cand., U. of O.
19. Columbia River Basalt - petrochemistry and isotopic analysis: D. A. Swanson, U.S.G.S. Menlo Park
20. Cascade volcanoes - strain monitoring: D. A. Swanson, U.S.G.S. Menlo Park
21. Biostratigraphy of the Snowshoe Formation: Dave Taylor, Senior res. P.S.U.
22. Broken Top volcano and ash-flow sequence near Bend: E. M. Taylor, Prof., O.S.U.
23. John Day area - geology: T. P. Thayer, U.S.G.S. Menlo Park
24. Geology of chromium: T. P. Thayer, U.S.G.S., Menlo Park
25. Salamanders of the John Day Formation: Bruce J. Welton, Ph.D. cand., U. Cal. Berkeley
26. Columbia River Basalt - genesis: T. L. Wright, U.S.G.S. Menlo Park

South-central Oregon

1. Earth temperature - temporal variations: Dwight Eggers, Dept. Oceanography, O.S.U.
2. Paisley Mountain Intrusive Complex - geology and mineral deposits: J. W. Hammitt, Master's cand., O.S.U.
3. Geothermal investigations: A. H. Lachenbruch, U.S.G.S. Menlo Park
4. Mount McLoughlin to California - Geology: R. H. Naslund, Master's cand., U. of O.

Northeastern Oregon

1. Clover Creek Greenstone - stratigraphy: D. A. Bostwick, Prof., O.S.U.
2. Burnt River Schist - paleontology: D. A. Bostwick, Prof., O.S.U.
3. Elkhorn Ridge Argillite - micropaleontology: D. A. Bostwick, O.S.U.

4. "Little Dog Creek Limestone" - micropaleontology: D. A. Bostwick, Prof., O.S.U.
5. Baker AMS sheet - geology: Howard Brooks, DOGAMI
6. Huntington quadrangle - geology: Howard Brooks, DOGAMI
7. Glacial morphology in eastern Oregon uplands: Elton Bentley, Dept. Geography, C.W.S.C.
8. Gold availability in Grant and Baker Counties: U.S. Bur. Mines, R. N. Appling, Jr., Chief
9. Mineral resources of the proposed Hells Canyon Wilderness area: U.S. Bur. Mines, R. N. Appling, Jr., Chief
10. Baker Observatory: Marvin Carlson, U.S.G.S.
11. Geophysical measurements in the Vale (KGRA) geothermal area: R. Couch, Prof., Dept. Ocean., O.S.U., W. French (affiliation undet.), and A. Johnson, Prof., P.S.U.
12. Water resources of the Umatilla Indian Reservation, Umatilla County: J. B. Gonthier, U.S.G.S. Portland, in coop. with State Engineer
13. Quartzburg mining district - geology: F. R. Johnson, Master's cand., O.S.U.
14. Columbia River Basalt - Imnaha Canyon: W. D. Kleck, Ph.D. cand., W.S.U.
15. Columbia River Basalt - between Imnaha and Grande Ronde Canyons: Steve Riedel, Master's cand., W.S.U.
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12. Seismic monitoring: Stephen Woodcock and Jon Hansen, Dept. Ocean., O.S.U.

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SNAKE RIVER CANYON MAP PUBLISHED

A geologic map of the Snake River Canyon, Oregon-Idaho, together with a preliminary report describing the geology, has been published as GMS-6 in the Department's Geologic Map Series. Map and report were prepared by Tracy L. Vallier, formerly at Indiana State University and now with Scripps Institution of Oceanography in California. Dr. Vallier began his field work as a graduate student at Oregon State University and spent eight summers studying and mapping the complex geology of this rugged canyon of the Snake River. The area mapped extends from the Oxbow, south of Homestead, to the Oregon-Washington boundary.

The Snake River Canyon map, at a scale of 1:125,000, and the 15-page descriptive report are for sale by the Oregon Department of Geology and Mineral Industries at its Portland, Baker, and Grants Pass offices. The price is $5.00.

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