A PUBLICATION OF THE WASHINGTON STATE GEOLOGY AND EARTH RESOURCES DIVISION

WASHINGTON GEOLOGIC NEWSLETTER

APRIL 1974

BERT L. COLE
COMMISSIONER OF PUBLIC LANDS

VOLUME 2 - NUMBER 2

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DEPARTMENT OF NATURAL RESOURCES, GEOLOGY AND EARTH RESOURCES DIVISION, OLYMPIA WASHINGTON, 98504

GEOTHERMAL RESOURCES ACT

During the January session of the legislature, SHB 135, the Geothermal Resources Act was passed and signed into law by the Governor.

The act authorizes the Department of Natural Resources to require permits for the drilling of geothermal wells on state and private lands, requires drillers to use proper well casing, drilling, production, abandonment, and site restoration procedures, and provides that records of these activities be kept by the operator. Permit fees and performance bonds are required, and the law defines violations and prescribes penalties.

Interest in geothermal exploration is increasing rapidly in Washington, and the legislature has shown foresight in providing for safe drilling procedures and environmental protection at this early date in the development of our geothermal resources. Questions regarding the act or requests for copies of the act may be directed to the Division of Geology and Earth Resources.

Selective Summary

Sec. 3, (1). "Geothermal resources" means only that natural heat energy of the earth from which it is technologically practical to produce electricity commercially and the medium by which such heat energy is extracted from the earth, including liquids or gases, as well as any minerals contained in any natural or injected fluids, but excluding hydrocarbon substances.

(9). "Department" means the Department of Natural Resources.

Sec. 4. Geothermal resources are declared to be sui generis (neither mineral nor water, but a thing unto itself).

Sec. 5. The department shall (1) administer and enforce the provisions of the chapter, and (2) promulgate rules and regulations to implement these provisions, including (a) definition of geothermal areas, (b) establishing security requirements, which may include bonding, (c) providing for liens against production, (d) casing and safety device requirements, (e) site restoration and abandonment requirements.

Sec. 6. Local regulation of drilling and well operation is preempted except for land use laws. State water pollution, fisheries, game, and other pollution control laws apply. Byproduct water is subject to appropriation under the state water codes.

Sec. 7, (1). A permit ($200 fee) is required for any drilling, redrilling, or reworking of a geothermal well. (2) Public notices and a hearing are required. (3) No permit fee is required for core holes unless geothermal resources are discovered or the core holes are drilled deeper than 750 feet into bedrock.

Sec. 10. If electricity or usable minerals are not produced from a well, the operator must plug and abandon the well or cause jurisdiction to be transferred to the Department of Ecology for administration under laws and regulations relating to wells drilled for appropriation and use of ground waters.

Sec. 16. The department has the authority to promulgate combining orders, unitization programs, and well spacing, and to establish proportionate costs among owners or operators.

Sec. 20, (1). The operator will keep accurate logs and histories of the well drilling. (2) These records are subject to inspection by the department, and must be submitted to the department upon its written request.

Sec. 21. Within thirty days after completion, plugging and abandonment, or six months suspension of operations the operator shall submit copies of all records to the department.

Sec. 22. The operator of a producing well shall file with the department a statement of the resources being produced.

Sec. 23. Records filed with the department shall be held confidential for 24 months.

Sec. 26. Persons who violate any of the provisions of this act and in so doing cause death or injury to fish, animals, vegetation, or other resources of the state are liable to pay the amount necessary to correct the damage.

SYMPOSIUM

We were especially pleased with the response to our 2-day meeting on "The Role of Geology in Land Planning and Development" that was held at the Sea-Tac Airport Hilton Inn on March 26 and 27, 1974.

Nearly 200 people participated in the program. Presentations of particular subjects by geologists expert in these fields were given for the first day and a half and were followed by a series of workshops covering the presented subjects. We were particularly pleased with the interest shown in the workshops on slope stability, ground water, loss of mineral resources, and seismic hazards.

The participants included planners, engineers, lawyers, ecologists, architects, geologists, developers, and interested citizens. We believe it would have been a worthwhile meeting for those involved in developing land use legislation to have attended. Elected officials, who introduce legislation on land use, mineral use, energy, geology, and the best use of the land and the land resources, and who vote on proposed projects covering these same subjects would have gained considerable insight into the technical and scientific problems that are involved.

We are now in the process of compiling the list of attendees, presented papers, and the availability of the video taped presentations. The material will be bound in loose leaf folders and presented to all attendees, and other interested persons upon request. A questionnaire is also being prepared and will be mailed to all participants for their comments.

The response to this first meeting was excellent and we have been requested to continue the coordination of these meetings.

Ernest R. Artim

THE IMPORTANCE OF MINERAL DEPOSITS IN LAND PLANNING

The Colorado Open Mining Land Reclamation Act is the first state legislation that recognizes the problem of the loss of mineral resources. The act, which was effective July 1, 1973, requires that planning agencies and the governing bodies recognize and protect commercial mineral deposits in areas with a population greater than 65,000. By July 1974, the Colorado State Geological Survey will have completed an inventory of all recognized commercial mineral deposits. Planning commissions must then prepare master plans, which are subject to public hearings prior to approval, by July 1, 1974. Upon approval of the master plans, the governing body is then prohibited from any action or lack of action that would "permit the use of any area containing a commercial mineral deposit in a manner that would interfere with the present or future extraction of such deposit."

It might have been better to go beyond "commercial mineral deposits" and include any potential commercial minerals, construction minerals, or energy sources. A potential deposit is not economical at present, however, the deposit may become economical if the demand and market price increase.

The loss of minerals, including construction minerals and energy sources, is staggering. In California, the monetary losses amount to

nearly $\$\frac{1}{2}$ billion each year; Washington's estimated losses are $100 million each year.

A house can be relocated, a building lost in an earthquake can be rebuilt, a ship lost at sea can be replaced, or a forest destroyed by fire will grow again; but a mineral deposit cannot be relocated, rebuilt, replaced, nor will it grow again. Once lost to an uncorrectable land use, the deposits are truly lost.

Some of the counties in Washington, realizing the importance that minerals play in development, growth, and maintenance, have begun to delineate and evaluate potential mineral deposits for possible future use.

Ernest R. Artim

1974 PACIFIC NORTHWEST METALS AND MINERALS CONFERENCE

A 2-day meeting on mining, metallurgy, energy, and environment will be held in Seattle at the Washington Plaza Hotel on April 25 and 26. The joint sponsors are the North Pacific Section AIME and the Puget Sound Chapter of ASM.

The program summary includes three special sessions on the following topics: Environmental Problems and Solutions, the Energy Crisis in the United States, and Energy in the Northwest. Six technical sessions will deal with nonferrous metal mining, construction aggregates, and industrial minerals.

EARTHQUAKE INVESTIGATIONS IN WASHINGTON

By Kurt Othberg

Earthquakes can be categorized by their energy output, or magnitude. On the logarithmic scale (Richter), earthquakes of magnitude 3 and below are not generally felt by people; earthquakes of magnitude 4 to 5 are moderate in strength and capable of causing some damage; those of magnitude 6 and above are capable of great damage if located close to populated areas and engineering structures.

The damage is also governed by the depth of focus and local geology. Low energy earthquakes that are measurable by sensitive seismographs occur about once every 2 days in the Puget Sound region of western Washington (Crosson, 1972). The frequence of low energy earthquakes in eastern Washington is not well known. A few of the frequent seismic events occurring west of the Cascades are large enough to be felt by individuals in the epicentral area. For all practical purposes, these earthquakes are not damaging; the general public is unaware of them and need not be concerned.

In contrast to the low energy seismic events, a large earthquake occasionally occurs in Washington, resulting in damage, injury, and loss of life. Fortunately, high energy seismic events are infrequent in comparison with other areas lying on the seismically active Pacific rim. Seismic risk in Washington is generally lower than in California, Central America, or the Aleutian Islands. However, the risk from any one large energy event is high. In fact, the infrequent nature of the strong earthquakes may make them potentially more dangerous than if they were more common. Because decades may separate the occurrence of damaging earthquakes, land planning, building codes, and research efforts expended to date do not reflect the potential severity of a single, large earthquake. The tendency is to forget past earthquakes and ignore the possibility of future ones. If a large quake does occur, more damage will result due to the greater urbanized population.

In order to reduce losses incurred during an earthquake, more detail needs to be known about the origin and effects of the earthquakes in Washington. Earthquakes originate from energy released along rock fractures produced by tectonic forces. Studies aimed at learning about the tectonics and the resulting geologic structures include gravity and magnetic surveys, seismology, geodetic surveys, identification of surface faulting, and interpretation of the structural geologic history. Studies that will aid in minimizing the effects of earthquakes include slope stability

and ground failure mapping, analysis of the relation between geology and earthquake intensity, placing of strong motion accelerographs for the accurate monitoring of future shaking forces, mapping of the thickness of unconsolidated sediments, and investigations of the seismic response of geologic materials. Such studies are now or will be underway by researchers from the University of Washington, the University of Puget Sound, the U.S. Geological Survey, the Division of Geology and Earth Resources, Oregon State University, and others. The results of these studies should lay the ground work for minimizing earthquake risk to property and life through land use and building code changes. In addition, the increased knowledge of their origin may lead to earthquake prediction in the future. Many of the completed and current investigations are listed below:

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STAFF PROFILES

SUSAN NOYES

Susan is secretary to our assistant supervisor, Don Ford. Most of her work deals with the Surface Mined Land Reclamation Act and

the Oil and Gas Conservation Act; however, she is also familiar with all the diversified work areas in our division. Her job is demanding and requires good organization, and her capabilities and friendly manner are a great asset to us.

Susan has had 3 years of college—2 years in Centralia (her home town) and 1 year at the University of Washington. She has been with our division about 2 years and preiously worked at the DNR Public Information Office, the Department of Personnel, and at Centralia College.

Susan enjoys sewing and macrame, and she relaxes with music.

KURT OTHBERG

Kurt joined the division staff on August 1, 1973. After obtaining his B.A. in education at Western Washington State College in 1967, he spent 2½ years in the U.S. Navy. In 1970, Kurt taught science and math through Fort Steilacoom Community College Extension Service, and in 1971, he received his B.S. in geological sciences at the University of Washington. Kurt then became a teaching assistant at WWSC, where he taught geology laboratories, and he received his M.S. in geology there in 1973.

Kurt's work involves earthquake-related studies, including Puget Lowland faulting, short-lived seismic phenomena, and accelerograph sites. In addition, he works in geo-

morphology and late Pleistocene paleomagnetism. He is also co-author of our thickness of unconsolidated sediments map in the Puget Sound area (in preparation). Kurt gave an interesting talk at the division symposium in March that included all the different working areas of soils engineers, geologists, and soils scientists as applied to soils.

Kurt and his wife Penny have one daughter Alina, who is 4 years old, and they are expecting a baby in June. Kurt grew up in Seattle and loves Puget Sound; he says he is looking forward to spending some leisure time on his sailboat when the sunshine arrives.

ALLEN FIKSDAL

Allen graduated from Western Washington State College in 1969. He joined the Department of Natural Resources in January 1972, and conducted landslide surveys as

part of an investigative study concerning the effects of logging on the fisheries resources. He became a geologist on our staff in February 1973. Allen works as a geologic advisor for the foresters on state-owned lands; and he is also involved in stratigraphy and structure in geologic mapping, examination of landslides, gravels, rock quarries, and mineral deposits. He participates in field and office work with land use planners and others concerning slope stability, construction minerals, excavating ease of materials, and other geologic areas.

Allen and his wife Susan live on Black Lake. Susan is a member of the faculty (foreign language) at The Evergreen State College. Allen likes to travel. He has spent 4 months in Europe and North Africa, gone to Argentina and Peru, and traveled extensively in Mexico. While in Norway, he visited the town Fiksdal where his family name originated. He and Susan plan to go to Europe again this summer. They will visit friends in France, where Susan went to school for 2 years, and then will go on to the Balkan countries. They have a large collection of slides and pictures from their travels.

GEOLOGIC RESEARCH PROJECTS AT UNIVERSITY OF WASHINGTON

The faculty and graduate students at the Department of Geological Sciences, University of Washington, have been conducting the following research projects:

A stratigraphic investigation of the Eocene Puget Group of central Pierce County, Washington: W. A. Buckovic

Alpine till genesis: Hugh Mills

Application and evaluation of ERTS imagery in the evaluation of the regional structure in southeastern Washington and northeastern Oregon: Keith E. Klosterman

Bedrock geology of Fidalgo Island, Washington: M. T. Mulcahey

Chemical weathering of Puget Lowland unconsolidated sediments: Linton Wildrick

Early and middle Paleozoic stratigraphy, structure, and tectonics of northwestern Washington: Joseph A. Vance

Economic geology of the greenstone belts of Washington: Eric S. Cheney

Factors affecting trace metal content of Williamson Creek, Snohomish County, Washington: David P. Dethier

Fluid inclusions in Cascade crystalline rocks: B. W. Evans

Foundation problems in earthquake prone areas, Puget Sound-Seattle area: Michael Pilson

Geology of the basalt surface at the Hanford Reservation near Richland, Washington: Wes Ward

Geology of the Bren-Mac copper-molybdenum deposit: David Hedderly-Smith

Geology of the Chiwaukum graben: John Whetten, Bates McKee, and Susan Cashman

Geology of the Methow Valley, Okanogan County, Washington: Julian D. Barksdale

Geology of west-central Methow-Pasayten graben, North Cascades, Washington: Marilyn E. Tennyson

Geology, petrochemistry, and petrogenesis of Golden Horn batholith, North Cascades: Peter Misch and R. S. Stull

Glaciation and meltwater sculpturing of the northwestern Columbia Plateau: Larry G. Hanson

Heteromorphic ammonites from the San Juan Islands, Washington: V. Standish Mallory and Peter Ward

Inside out hydrothermal zoning at Quartz Creek, Snoqualmie batholith: Eric S. Cheney and John Trammell

Landslides in western King County during early 1972: Don Tubbs

Late Tertiary evolution of Grays Harbor and adjacent areas: A. D. Horn, Univ. of Washington and North Seattle Community College

Mima mounds: A. L. Washburn

Mineralogy and petrology of the Twin Sisters Dunite: A. Onyeagocha and B. W. Evans

Nuclear plant siting in the Pacific Northwest: Howard A. Coombs

Origin of clay in Pleistocene outwash gravels: John Whetten and Linton Wildrick

Origin, emplacement, and metamorphism of the Sultan mafic-ultramafic complex, Snohomish County, Washington: Mike Dungan

Origin of serpentine conglomerate in the Leavenworth area: John Whetten and Susan Cashman

Origin of the Ventura Formation, Methow graben: John Whetten

Paleoecology of the Kulshan Glaciomarine Drift, Bellingham Bay, Washington: V. Standish Mallory, John Armentrout, Kristin McDougal, and John Shaw

Paleontology and stratigraphy of the Cretaceous rocks in the northern Methow Valley, Washington: V. Standish Mallory and Julian D. Barksdale

Paleontology and stratigraphy of the Ringold Formation, eastern Washington: Eric Gustafson

Petrology and metamorphism of graywackes in the western Olympic Peninsula, Washington: R. J. Stewart

Petrography of a small (one square mile) area in the Twin Sisters Dunite (involves study of preferred orientations of olivine and enstatite): Tim Hersch

Petrology of metamorphic ultramafic rocks, Mount Stuart and central and North Cascades: B. W. Evans, Peter Misch, and B. R. Frost

Petrology (etc.) of Shuksan metamorphic suite of North Cascades (history of mineral equilibrium in subfacies of blueschist facies): Peter Misch

Petrology, petrochemistry, mineralogy, and history of metamorphic rocks of Skagit suite, North Cascades (a Barrovian-type suite, ranging from chlorite to sillimanite zone); includes quantitative study of metasomatic processes: Peter Misch

Quaternary geology, Washington coast: A. D. Horn, University of Washington and North Seattle Community College

Stratigraphy and structure of Gable Mountain, Benton County, Washington: Earl Brooks, Jr.

Stratigraphy and structure of the San Juan Islands: Joseph A. Vance

Structural evolution of melanges and broken formations in the Olympic Mountains, Washington: R. J. Stewart

Structural history of the Chiwaukum graben and Wenatchee Mountains: John Whetten and Sue Cashman (Field Courses)

Structure and regional geotectonic setting of North Cascades (includes preparation for publication of geologic quadrangle maps; also includes guide books with road logs for new cross-state highway (Wash. 20) and for Mount Baker highway): Peter Misch

Tertiary sedimentary rocks in the southwest corner of the Chiwaukum graben: Sue Cashman

Tertiary stratigraphy and structure of the Darrington area: Joseph A. Vance

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CORRELATION CHART OF COASTAL WELLS (open file)

A tentative correlation of 29 Washington coastal wells has recently been placed on open file by the Division of Geology and Earth Resources. The chart is a compilation and interpretation of geologic data from the oil and gas files of the division.

It includes information on most of the coastal wells that were drilled prior to 1967. In addition to a graphic interpretation of the lithology encountered in each drill hole, suggested correlations are made from well to well, together with brief comments on pertinent data from each.

The author, Weldon W. Rau, wishes to stress the tentative and interpretive nature of this report.

Copies of the chart can be purchased upon written request from Ivor McCray's Copy Center, 121 Legion Way, Olympia, Washington 98501. Cost information is available from the above address or phone 206-357-6707.

NEW DIVISION PUBLICATION

The Division of Geology and Earth Resources published Information Circular 50, "Energy Resources of Washington," early in 1974. The report, a summary of the energy reserves in the state, contains five articles. They are as follows:

- Geothermal Energy Potential of Washington, by J. Eric Schuster
- Terrestrial Heat Flow and its Implications on the Location of Geothermal Reservoirs in Washington, by David D. Blackwell
- Coal in Washington, by Vaughn E. Livingston, Jr.
- Oil and Gas in Washington, by Weldon W. Rau and H. C. Wagner
- Uranium in Washington, by A. E. Weissenborn and Wayne S. Moen
- Electrical Energy Resources of Washington, by Lloyd C. Buchanan

Information Circular 50 may be purchased for $1.00, prepaid, from the Department of Natural Resources, Division of Geology and Earth Resources, Olympia, WA 98504.

YOUR STATE GEOLOGIST REPORTS

On March 26 and 27, the Division of Geology and Earth Resources held a 2-day seminar that dealt with geology and land use planning. I would like to publicly congratulate the fellows on our staff who put the program together. I think they did an outstanding job.

The division is very interested in the application of geologic principles to land use planning, and we feel an obligation to the planners of the state to help them wherever we can in solving the geologic-related problems that they encounter.

During the past year we have assisted some 10 counties and cities in developing interpretative maps that depict potential areas of landsliding, relative infiltration rates, suitability of the land for waste disposal, and location of urban mineral deposits. The county planners, who have been the recipients of this work, have found the information useful, which in turn is encouraging to us.

One of the problems we've faced is that, by training, geologists are prone to "hedge their bets" and are reluctant to make a definite commitment whether something is or is not potentially dangerous. In the past, most geologists just simply threw up their hands when they saw what appeared to be a geologic hazard and said, "it's dangerous and should be avoided," without really examining the problem. Experience has shown that by making an effort to evaluate landslides many of them have turned out to be stable and safe to build on, while on the other hand we have found areas that looked like they were safe, but in fact are not.

We are pleased to have the opportunity to help the land use planners of the state and hope that we can continue to provide a useful service to them.

Ted Livingston

GOVERNOR'S ENERGY POLICY COUNCIL RELEASES REPORT

"Energy in the State of Washington" was recently published by the Washington State Energy Policy Council. It was prepared by the Task Force on Energy Profile of Washington (Uses, Sources, and Alternatives); George Hinman, Washington State University, Environmental Research Center, is the chairman of the task force.

The report relates the uses of energy in the state to the resources and economy. An interesting comparison is state versus national industrial energy consumption per capita, which shows Washington consumption per capita at 67 million BTU while the national figure is 107 million BTU.

Requests for the report should be directed to Dr. William Brewer, Executive Director, Energy Policy Council, 312 First Avenue N., Seattle, WA 98109.

ERRATUM

There was an error in our January Geologic Newsletter (v. 2, no. 1). On page 4, column 2, in the article "Papers Presented at Northwest Mining Association's 79th Annual Convention" some decimal points were omitted. The corrected sentences should read as follows: In the United States, only 0.16 percent of our land area has been disturbed by mining from 1930 to 1971. Nearly 40 percent of this land has been reclaimed. In Washington, only 0.08 percent of the land has been disturbed by mining, and 24 percent of the land disturbed since January 1, 1971, has been reclaimed.

DIVISION BULLETIN 42 OUT OF PRINT

Our supply of Bulletin 42 GOLD IN WASHINGTON is gone, and consequently we can no longer fill the many requests that we have had for it. However, it is available to the public at most of the libraries in the state.

USGS OPEN-FILE MAPS AND REPORTS

The Division of Geology and Earth Resources has the following recently released USGS material on open file in our reference library:

Aeromagnetic map of parts of the Okanogan, Sandpoint, Ritzville, and Spokane 1° by 2° quadrangles, northeastern Washington. 1 sheet, scale 1:250,000. [Material from which copy can be made at private expense is available at the division library.]

Aeromagnetic map of part of the Puget Sound area, Washington. 1 sheet, scale 1:125,000. [Reproducible material for this sheet and for the sixteen 1:62,500 quadrangles covering this area, from which copy can be made at private expense, is available at USGS offices in Menlo Park and Spokane, and in the division library in Olympia.]

Preliminary gravity and magnetic maps of the Strait of Juan de Fuca, British Columbia, Canada, and Washington, United States, by the U.S. Geological Survey and the Geological Survey of Canada. 10 p., 3 figs. [Material from which copy can be made at private expense is available in the Menlo Park, San Francisco, and Los Angeles offices of the USGS.]

Reprint

We have also recently received this reprint in our library and it is available for reference:

Satellite telemetry of fumarole temperatures, Mount Rainier, Washington, by R. M. Moxham, G. R. Boynton, and C. E. Cote. Reprinted from Bulletin Volcanologique, Tome 36-1, 9 p., 1972.

"Every one therefore that heareth these words of mine, and doeth them, shall be likened unto a wise man, who built his house upon the rock: and the rain descended, and the floods came, and the winds blew, and beat upon that house; and it fell not: for it was founded upon the rock. And every one that heareth these words of mine, and doeth them not, shall be likened unto a foolish man, who built his house upon the sand: and the rain descended, and the floods came, and the winds blew, and smote upon that house; and it fell: and great was the fall thereof."

Matthew, 7.24-27

PRESENTATIONS AT GEOLOGY AND EARTH RESOURCES SYMPOSIUM

Geology—A profession in evolution, by Guido Zemgals, Dames & Moore

Soil, what is it?, by Kurt L. Othberg, Division geologist

Geomorphology—A tool for land planning, by Norman R. Anderson, University of Puget Sound

Seismic hazards, by Lloyd S. Cluff, Woodward-Lundgren & Associates

Methods for the detection and mapping of landslides, by Gerald W. Thorsen, Division geologist

Landslide studies—A team effort of geologist and engineer, by L. Keith Bestwick, Shannon & Wilson

Activities of the Division of Geology and Earth Resources in land planning, by Vaughn E. (Ted) Livingston, Jr., State Geologist

Loss of mineral resources, by John L. Hutsell, President, Associated Sand & Gravel Company

Surface Mining and Land Reclamation, by Donald M. Ford, Division Assistant Supervisor

Ground water resources and the effect upon planning and development, by Bruce L. Foxworthy, U.S. Geological Survey

Land use planning and development around seismic hazards, by Charles L. Taylor, Woodward-Lundgren & Associates

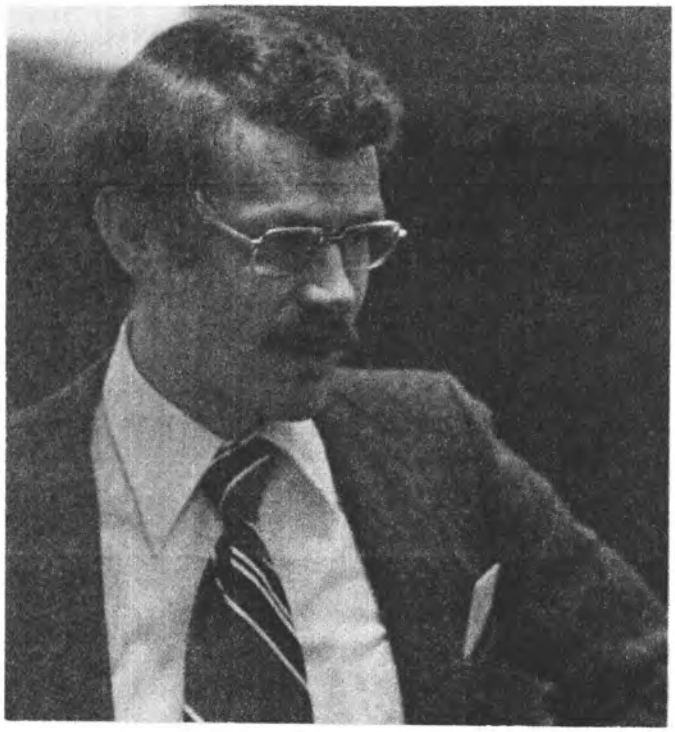
Bert L. Cole, Commissioner of Public Lands, giving the introduction at "Geology in Land Planning and Development" Symposium

Kurt L. Othberg, Division geologist

Mackey Smith,
Division geologist

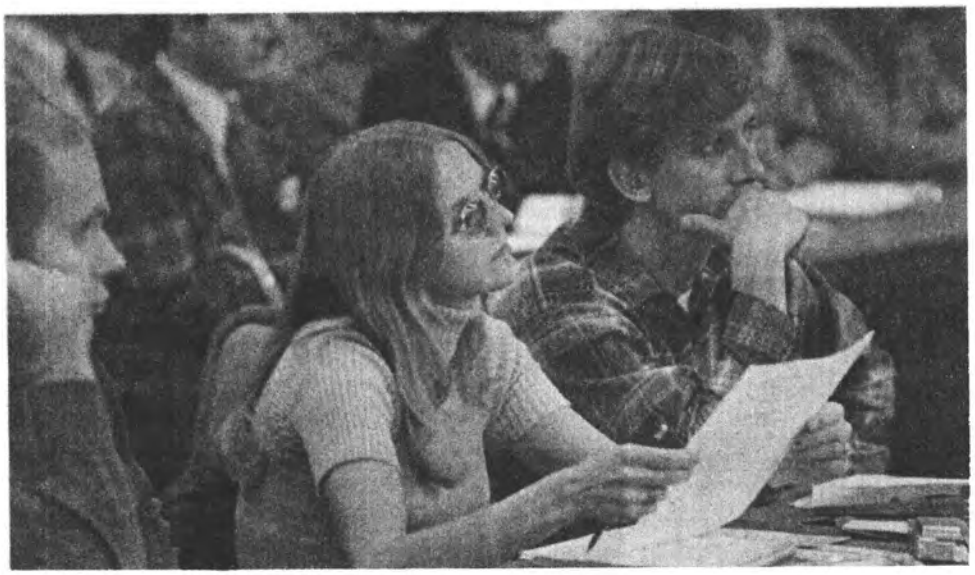
Donald M. Ford,
Division Assistant Supervisor

Ernest R. Artim, Chairman of Symposium



Gerald W. Thorsen, Division geologist

Allen J. Fiksdal,
Division geologist



Symposium participants

U.S. GEOLOGICAL SURVEY 7½-MINUTE TOPOGRAPHIC QUADRANGLES
(New maps received in Division of Geology and Earth Resources Library since January 1, 1974)

Name	Latitude (indicates southeast corner)	Longitude	County
Ariel	45°52'30"	122°30'00"	Cowlitz, Clark
Bellingham North	48°45'00"	122°22'30"	Whatcom
Bellingham South	48°37'30"	122°22'30"	Whatcom, Skagit
Bertrand Creek	48°52'30"	122°30'00"	Whatcom
Blaine	48°52'30"	122°37'30"	Whatcom
Blue Lake	46°22'30"	121°37'30"	Lewis, Skamania
Castile Falls	46°15'00"	121°07'30"	Yakima
East Canyon Ridge	46°15'00"	121°37'30"	Skamania
Fairview Ridge	46°22'30"	121°07'30"	Yakima
Ferndale	48°45'00"	122°30'00"	Whatcom
Hamilton Buttes	46°22'30"	121°30'00"	Lewis, Skamania, Yakima
King Mountain	46°00'00"	121°22'30"	Yakima, Klickitat
Lake Whatcom	48°37'30"	122°15'00"	Whatcom, Skagit
Lewiston Orchards South	46°15'00"	116°52'30"	Asotin
Lost Horse Plateau	46°15'00"	121°00'00"	Yakima
Lummi Bay	48°45'00"	122°37'30"	Whatcom
Lynden	48°52'30"	122°22'30"	Whatcom
Outlet Falls	46°00'00"	121°07'30"	Yakima, Klickitat
Point Roberts	48°52'30"	123°00'00"	Whatcom
Poland Butte	46°07'30"	121°00'00"	Yakima
Rufus	45°37'30"	120°37'30"	Klickitat
Signal Peak	46°07'30"	121°07'30"	Yakima
Sleeping Beauty	46°00'00"	121°37'30"	Skamania
Sumas	48°52'30"	122°15'00"	Whatcom
Twin Buttes	46°00'00"	121°00'00"	Yakima, Klickitat
Walupt Lake	46°22'30"	121°22'30"	Lewis, Yakima
Yacolt	45°45'00"	122°22'30"	Clark

Department of Natural Resources
Division of Geology and Earth Resources
Olympia, WA 98504

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