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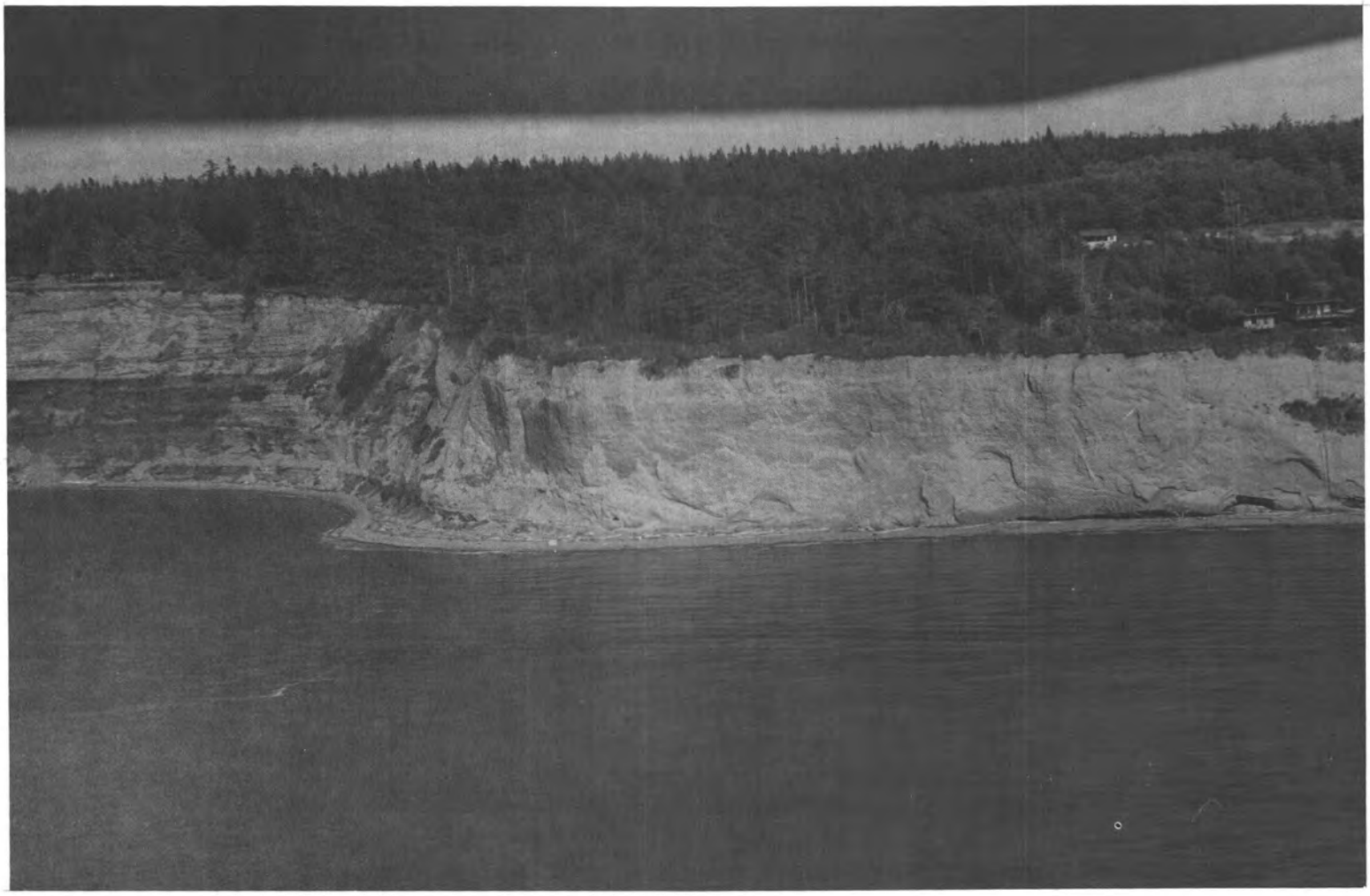

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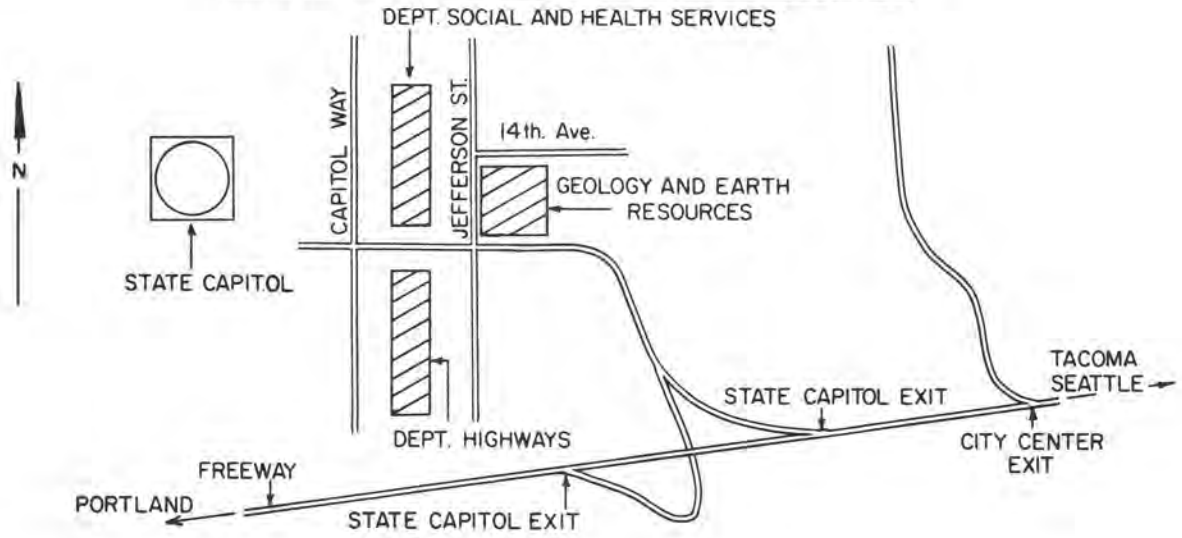

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ATLAS SERIES IN PROGRESS ON WASHINGTON COASTAL ZONE

by Jerry Thorsen

A coastal zone atlas series was conceived primarily as a means of providing technical data necessary to government units, at all levels, to carry out their regulatory and planning responsibilities. The project was financed through a federal grant from the Office of Coastal Zone Management under the National Oceanic and Atmospheric Administration (NOAA) to the Washington State Department of Ecology. It was decided to use strip maps of the coastal zone (scale 1 inch=2,000 feet) as the method of presentation in the atlas. Initially, plans were for maps to be produced on coastal flooding, sand and gravel resources, coastal drift, land cover/land use, and slope stability, with critical biological areas identified on the sand and gravel maps. This plan was modified to include geology because local geologic conditions are crucial to various land uses. In many places, the best exposures of the geology are along the shore bluffs.

In January of 1977, the Washington Division of Geology and Earth Resources began field work on the project by mapping the geology on the shorelines of the inland waters east of Cape Flattery. The shorelines of San Juan County and Clallam County, west of the mouth of the Elwha River, were subcontracted to a private consulting firm because none of the division staff had previous experience in these areas. Most of the rest of the coastal shores either had fairly good geologic mapping already available or staff geologists had some familiarity with the geology. Unfortunately, reconnaissance by boat showed much of the published mapping was not of sufficient detail for our purpose or the geologic units could not be correlated with adjoining areas. Thus, mapping went considerably slower than planned. Field work was completed in June of 1978. During this 18-month period, more than 2,000 miles of Washington's marine shoreline were scanned from a boat and studied from aerial photos.

The mapping was truly a team effort. Whatcom County was mapped by Kurt Othberg (division geologist), with the help of consultations with Dr. D. J. Easterbrook (Western Washington University). Skagit County was mapped by Ernie Artim and Jack Wunder (former division geologists) with some editing by Kurt Othberg. San Juan County and western Clallam County were mapped by Tom Gavin and Roger LeClerc II (Hart, Crowser, and Associates, Inc., Seattle). Eastern Jefferson County was mapped by Dr. R. J. Carson (Whitman College, Walla Walla) and his former graduate students—R. U. Birdseye, M. L. Gayer, and K. A. Hanson. Kitsap County was mapped by Allen Fiksdal (division geologist) and Mackey Smith (former division geologist). Snohomish County was mapped by Mackey Smith, with some edit-

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COVER PHOTO

A more than 200-foot jog or dogleg in an otherwise straight section of beach bluff shows the difference in erosion resistance of geologic materials. This shoreline, on the west side of Whidbey Island, is subject to severe wave pounding during winter storms. The bluff face on the right is a massive concretelike till deposited by the last major advance of continental glaciers. The more easily erodable material on the left consists largely of interbedded silty sand, sand, silt, and peat.

ing by Kurt Othberg. I mapped Island County. The remaining counties were mapped by a team consisting of Allen Fiksdal, Kurt Othberg, Pam Palmer and Keith Stoffel (division geologists), and me. The entire project was under the general direction of J. Eric Schuster, assistant division supervisor.

The study of the geology permitted some generalizations to be made regarding the implications of various geologic settings on land use questions. Just as agricultural soils maps can provide much useful information on the surficial characteristics of the land such as fertility, erosion, and water infiltration rates, geologic maps can provide data on the underlying materials. For each atlas, this information was summarized in a table entitled "Generalized Description of Engineering Properties of the Geologic Units." In these tables, the characteristics of each unit in relation to practical questions such as drainage, ground water, ease of excavation, resistance to wave erosion, foundation strength, and slope stability were discussed.

An angle-of-repose slope (roughly 35 degrees) in sandy materials. Such a slope was generally mapped as unstable where under attack by wave action (only locally here). Toe protection from waves by a beach or other barrier would, in many cases, change this slope to the intermediate category.

Note thoughtful installation of storm drain. Burial would have required disturbance of vegetation and subsequent slope ravel and(or) gullying.

Perched ground water triggers dozens of landslides each rainy season along Puget Sound bluffs. Bulkheads are no protection against such slides. Where too small to show on the maps as individual slides, areas such as this and adjoining banks were all shown as unstable.

Slope stability analysis was the major original effort by the division so considerable text space is devoted to discussion of factors related to slope stability. The angle of slope is generally important but may be overemphasized. A vertical slope in compact till is apt to be much more stable than the gentle slopes of an ancient landslide surface. The nature of the geologic materials is also very important but the sequence of layers may be more important than their characteristics alone. For example, sand overlying a silt unit causes most of the landslide activity in the Puget Lowland because of its ground-water perching character-

istics. The opposite, silt over sand, rarely causes problems. Other factors, such as compaction by the weight of the continental ice sheet or the unpredictable results of some of man's works, are also discussed.

A common form of slope failure along Puget Sound shore bluffs. Here, sliding was triggered by careless disposal of land-clearing debris from above rather than bank undercutting by wave action. Such slopes, generally in silty materials, tend to gully severely and can be difficult to revegetate. This slope would be mapped as unstable even without the man-made slide.

Slope stability, like many other properties of natural systems, has an infinite number of increments between extremes. This was one of the first problems encountered in the project. How many levels of stability could be meaningfully differentiated in an area varying, for example, between a horizontal bedrock surface at sea level and a wet, near-vertical, 300-foot bank of silt and sand that was being actively undercut by wave action? After much discussion and many text drafts, we concluded that a team reconnaissance project such as ours should probably not attempt more than a three-level hierarchy of stability. Thus we decided on stable, intermediate, and unstable (known slides were included in unstable) as the three general categories. No attempt was made to evaluate the stability of manmade cuts or fills, and such areas were simply designated as modified slopes.

Another difficulty that had to be tackled early was what to do about the "setback" problem. For example, where a steep, unstable shore bluff borders a flat, stable upland area, where does one draw the line between stable and unstable? For instance, is a 50-foot setback of a house from an unstable bluff adequate to ensure that the house will not become involved in a landslide during its useful lifetime? It was decided that it would be impossible to sufficiently analyze the nature and rate of bluff erosion (for example, a continuous particle-by-particle erosion or a periodic deep-seated landslide) during a reconnaissance job of this magnitude. Therefore, boundaries between stability categories were drawn at the present-day change in stability characteristics.

This decision meant that there would be no inclusion of a hazard zone at the top of a slope or at the base. (The last episode of slide activity in

In places, a suspicious-looking landform, such as an amphitheater in an otherwise straight bluff line, might be visible in aerial photographs. Such a feature could have several causes. The tilted silt beds in the beach confirm that this one was an ancient deep-seated landslide. Such slides commonly reactivate during unusually wet years.

Seattle's Alki district resulted in damage to homes along the base of the bluff by mud and debris flows.) Reliable judgments of the existence or width of such hazard or suggested setback zones can only be made through on-site investigations by an experienced engineering geologist and are beyond the scope of regional studies such as this one.

Several single county atlases have already been published as limited printings. They are available from the Washington State Department of Ecology as follows: Whatcom ($50), Clallam ($72), and Skagit ($84). Eventually they will all be published as three-county volumes—Whatcom, Skagit, and San Juan Counties; Clallam, Jefferson, and Kitsap Counties; Island, Snohomish, and King Counties; and Pierce, Thurston, and Mason Counties. The first set of three counties (Pierce, Thurston, and Mason) is presently scheduled for publication in 1979. The atlases will be distributed to the county, state, and federal agencies that have shoreline regulatory responsibilities. A limited number will be available to private individuals or organizations, but the cost and the size (19 by 25 inches) are likely to rule them out as a popular coffee table item.

U.S. GEOLOGICAL SURVEY CURRENT ACTIVITIES IN WASHINGTON, 1978

MINERAL RESOURCES ACTIVITIES

Mineral resources of Spirit Lake quadrangle, N. G. Banks. Evaluation and petrographic study of samples collected during last field season will be completed, including compilation of field data collected. Geologic mapping, geochemical sampling, and alteration study will be conducted of southwest quarter of quadrangle.

Togo Mountain quadrangle, R. C. Pearson. Two months will be spent on the petrography and preparation of quadrangle maps.

Indian lands resource studies, W. P. Puffett. Prepare administrative reports for Yakima, Chehalis, Hoh River, Lower Elwah, Lummi, Makah, Muckleshoot, Nisqually, Nooksack, Ozette, Port Gamble, Port Madison, Puyallup, Quileute, Quinault, Shoalwater, Skokomish, Squaxin, Swinomish, and Tulalip Indian Reservations summarizing unpublished and published mineral resource information and make recommendations on further work to fully evaluate and develop the mineral resources on these lands. Reports will be prepared jointly by USGS and USBM personnel.

Salmo-Priest Wilderness area, F. K. Miller. Complete geologic, geochemical, and geophysical mapping, including data compilation, and prepare final report for publication.

Glacier Peak Wilderness and additions, Thor Kiilsgaard. Plan reconnaissance geologic mapping, geochemical sampling, and study of known mineral deposits to determine resource potential in southern parts of Glacier Peak Wilderness and potential additions in Index, Monte Cristo, Grizzly Peak, and Lake Wenatchee areas.

ENERGY RESOURCES ACTIVITIES

Mineral matter in western coals, B. F. Bohor. Study mineral matter content of western coals by low-temperature ashing. This low-temperature ash will be characterized mineralogically by X-ray diffraction and by chemical analysis in an attempt to assign trace elements to specific mineral phases. Collect kaolinitic bentonites and other partings for mineralogical and textural characterization. Radiometric ages of zircon content will be measured.

Chemical analysis and geologic evaluation of of coal in the western U.S., J.R. Hatch. Continue to make available to the public completed chemical analyses on coal and coal-associated rock samples from states west of the Mississippi through publications by State Geological Surveys and USGS reports; to collect 200 to 300 coal samples from fields lacking modern, complete analyses to improve data base; and to conduct research on changes in coal chemical composition with increasing rank, and on distributions in coal of Zn, Cd, Pb, Ni, Co, and Mo.

Geochronology of uranium ores and their host rocks, K. R. Ludwig. Continue to provide the best possible radiometric-age data for every major uranium deposit in the U.S., particularly for Powder River Basin, Wyoming, Midnite Mine, Washington, and Marysvale District, Utah. Where necessary, novel methods and concepts of uranium-ore dating will be developed and applied.

Midnite Mine uranium studies, J. T. Nash. Entire effort will be in completing reports in preparation, including final summary paper on the geology and geochemistry of Midnite uranium mine.

Trace-metal geochemistry of offshore marine sediments, M. H. Bothner. Plan to use lead-210 data in areas of recent sediment accumulation to provide a time reference for trace metal changes with sediment depth and to estimate metal fluxes to the sediment; to determine association of trace metals with different chemical phases of sediment in effort to determine their mode of transport to sediments and their potential for remobilization after deposition; and to use lead-210 profiles in relict sediments from continental shelf to estimate depth and rate of sediment mixing due to currents and benthic organisms.

Resource assessment, Oregon-Washington continental margin, P. D. Snavely, Jr. Plan geophysical cruise in Puget Sound to conduct approximately 500 km of high-resolution seismic-reflection profiling; prepare a land-sea geologic transect that includes geology of the coastal zone and continental margin; complete interpretation of the 24-channel seismic-reflection data of Oregon and Washington OCS; and continue interpretation and compilation of geologic and geophysical data from various sources on the OCS, including the petrographic and paleontological studies on samples from OCS wells made available by oil companies.

Pacific Coast sedimentology, H. E. Clifton. Continue studies in estuarine deposits in Willapa Bay, Washington, focusing on the development of a model for an estuary fill sedimentary complex. Of major importance in current year is development of a system to measure currents, waves, and profile changes in surf zones during storms as well as during normal conditions.

Marine organic geochemistry, K. A. Kvenvolden. Complete study to establish relative and absolute ages of terrace deposits at Willapa Bay by means of amino acid racemization techniques, and expand study of organic chemical geochronology to include other terraces, bone, sharks teeth, and bulk marine and lake sediments.

ENVIRONMENTAL GEOLOGY ACTIVITIES

Quaternary geologic map of the U.S., G. M. Richmond. State compilations are in various stages of being completed. Completed compilations are being edited and reviewed prior to drafting of information onto 1:1 million World Map Series. Final publication will be in color on 50 sheets.

Northwest Olympic Peninsula, P. D. Snavely, Jr. Complete compilation and interpretation of geologic mapping of Cape Flattery, Clallum Bay, Ozette Lake, and Lake Pleasant quadrangles, including reports. Geologic reconnaissance along Calawah fault zone in southern part of Pysht quadrangle, and stratigraphic studies of Makah turbidites in western part of the quadrangle are being conducted. Petrochemical studies of Crescent Formation to de-

scribe lower tholeiitic member and upper alkalic member will begin.

Puget Sound urban studies, B. L. Foxworthy. Activities will concentrate on preparation of data for bedrock and surficial geologic map compilations, regional ground-water appraisals, and maps showing natural land slopes and thickness of overburden. Studies of isostatic and eustatic histories and regional tectonic framework of lowland will be continuing. New studies include preliminary assessment of extent of natural and man-induced modification of marine wetlands, mid-1800's to present.

Wenatchee 2° quadrangle, R. W. Tabor. Studies will be concentrated on Swauk Formation and younger fluviatile units and their relationship to Tertiary volcanic accumulations to west; deformation along Olympic-Wallowa lineament; faults along west side of Cascade Range, such as Straight Creek Fault; and Quaternary stratigraphic history in Wenatchee, Columbia River, and various other drainages to west. Tephrochronology and fission-track, K-Ar, and radiocarbon dating will be primary tools of investigations.

Tectonic analysis, F. P. Fox, Jr. Plan to compile a tectonic map of the State of Washington at 1:500,000 scale on which major petrotectonic assemblages and tectonic features are delineated; to summarize tectonic history of state with available data; and to identify areas for additional mapping.

Physical and geologic characteristics of catastrophic rockfall avalanches, R. D. Brown, Jr. Conduct field investigation of well-documented rockfall avalanche localities in California, Washington, Wyoming, Montana, Nevada, and Alaska. Includes reconnaissance geologic mapping of deposit and source area to decipher the geologic setting and failure mechanism. Prepare summary report and demonstration map to illustrate how potentially hazardous areas can be recognized and delineated.

Tephrochronology, western U.S., A. M. Sarna-Wojcicki. Correlate late Cenozoic ashes and tuffs by means of instrumental neutron activation analyses of separated volcanic glass, by petrography, and by their deposits. Investigate areas in California (Huichica and Pasa Robles Formations, Livermore Gravels, Nomlaki Tuff, Ventura Basin, Lake Tecopa), Washington (Mount St. Helens), and western Nevada.

Sandpoint 2° quadrangle, F. K. Miller. New project activities include modal analyses, petrography, report writing, preparation for field work, and geologic mapping and ground scintillometer survey of area in and around Salmo Mountain and Upper Priest River.

Soil correlation and dating, western region, D. E. Marchand. Identify suitable locations for first group of sampling and soil descriptions, laboratory analysis, and data interpretation.

Flysch tectonics, Western U.S., T. H. Nilsen. Examine development through time of flysch basins by plotting various paleotectonic data. Apply new techniques developed in Europe for recognition of major facies in flysch successions to data on a regional scale. Initial project work includes compilation of geologic data, map plotting of flysch sequences, and field work.

Seismo-tectonic analysis of Puget Sound province, H. D. Gower. Investigate suspected Quaternary faults by marine seismic profiling in southern Strait of Georgia, Admiralty Inlet, Lake Washington, and Commencement Bay; conduct aeromagnetic modeling, detailed gravity investigation, and reconnaissance geologic mapping of Seattle-Bremerton structure; and examine prominent arcuate topographic feature east of Seattle in western Cascade Range by surficial and bedrock reconnaissance geologic field studies.

Okanogan 2° quadrangle, K. F. Fox, Jr. Map extreme northeastern corner of quadrangle and establish structural and stratigraphic relations between miogeoclinal and eugeosynclinal provinces, and

structural relation of possibly tectonically displaced rocks containing an early Triassic fauna that are present in area to nearby autochthonous Triassic greenstones.

Reactor site investigations, R. H. Morris. Continue technical investigations and reviews of geologic and seismologic aspects of license applications to the Nuclear Regulatory Commission for nuclear power reactors. Reviews evaluate regional and local geologic structure, seismology, and geologic foundation conditions that are related to safety of nuclear facilities. Resulting reports to NRC become part of the public record of licensing proceedings of the Commission.

Volcanic hazards, D. R. Crandell. Rocks and unconsolidated deposits of volcanic origin and of late Quaternary age are being studied and dated at volcanoes in Washington, Oregon, California, and Hawaii for the purpose of evaluating potential geologic hazards to communities, reservoirs, recreation facilities, and proposed nuclear power plants. Maps are being prepared where needed to show areal distribution of various kinds of hazards.

GEOCHEMISTRY AND GEOPHYSICS ACTIVITIES

Genesis of basalt, T. L. Wright. Continue studies of Columbia River basalt in southeastern Washington and northeastern Oregon. Investigations include regional mapping, major element chemistry on individual flows and feeder dikes, and trace-element, paleomagnetic, and isotopic studies. Companion studies will emphasize similarities and differences in source material, depth of melting and differentiation, eruption rates and volumes, and inferred magma storage and conduit complexes.

Regional volcanology, R. L. Smith. Research continues in an attempt to find out what relationships exist among specific types of volcanic systems, hydrothermal systems, and geothermal anomalies, and in the development of criteria that can be used as a guide for geothermal exploration, volcanic activities, geothermal processes, and conceptualization of magma chamber models.

Columbia River basalt, D. A. Swanson. Resume mapping of basalt in Spokane and Ritzville 2° quadrangles, Washington, and in Pendleton 2° quadrangle, Oregon. Complete papers dealing with chemical correlation of basalt flows, intracanyon flows along Snake River, and feeder dikes for Columbia River basalt.

Geologic map of Columbia Plateau, D. A. Swanson. Begin preparation of reconnaissance geologic map of Columbia River Basalt Group. Evaluate previous mapping for incorporation of data into final compilation and for mapping areas of inadequate data. Anticipate two-thirds of Plateau will be adequately covered by map by the end of the year.

Magnetic observatories, J. D. Wood. Magnetic observatories continue to record the strength and direction of the Earth's magnetic field. Operations are maintained at Barrow, College, and Sitka, Alaska; Boulder, Colorado; Fredericksburg, Virginia; Tucson, Arizona; Newport, Washington; Guam; and San Juan, Puerto Rico.

Magnetic observatory and field data processing and analysis, R. G. Green. Continue to monitor, evaluate, assemble, and perform other related activities associated with converting raw observatory data and results of field magnetic survey operations into reliable, meaningful, and comprehensive data to meet engineering, research, commercial, and defense needs from the nine magnetic observatories listed in preceding project. Results are processed and made available through the World Data Center A.

Digital data processing, L. R. Wilson. Digital fluxgate magnetometers are being used to record the variation of Earth's magnetic field in millivolts at observatories in Barrow, College, and Sitka, Alaska; Newport, Washington; Tucson, Arizona; and Boulder, Colorado. Continue to design, develop, and main-

tain a data processing system for these observatories that provide data in formats suitable for a broad spectrum of users. Conversion and writing of computer programs for processing on Honeywell computer has begun.

Uranium geophysics in frontier areas, J. W. Cady. Plan on geophysical interpretation of gneiss terrains of northern Washington and British Columbia; geophysical investigations of crustal structure of Sweetwater Uplift, Wyoming, and of uranium potential of Ekiek Creek nepheline syenite pluton, western Alaska; and pattern recognition studies to be applied to uranium exploration.

EARTHQUAKE STUDIES

Seismological observatories (Newport, Washington), Harry Whitcomb. Operation and maintenance of a National and Worldwide network of observing and reporting systems will be continuing at various observatories. Data serve as input for government research and outside scientific programs. Also, continue to support Tsunami Warning Service by providing input on a 24-hour basis.

Coastal tectonics of the western U.S., K. R. Lajoie. Maps and reports are being prepared of marine terraces and their deformation along the west coast. Major areas of study are Santa Barbara, Ventura, San Diego, and San Mateo Counties, California, and coastal Oregon and Washington.

NRC site seismicity, S. R. Brockman. Seismological reports of four sites (Skagit, Washington; Pebble Springs, Oregon; Stanislaus, California; Arecibo, Puerto Rico) submitted to NRC by electrical power companies seeking permits to construct nuclear power facilities will be under review during the year.

U.S. seismogenic zones, J. I. Ziony. Continue development and testing of methodologies to characterize earthquake source zones and to estimate likely upperbound events. Evaluate the seismotectonic framework and prepare preliminary maps delineating earthquake zones of coastal Washington and Oregon, Atlantic Coast, and Gulf of Mexico. These maps, together with similar maps for Alaska and coastal California, will be the basis for a summary report providing the rationale for selection of earthquake zones for the U.S. continental shelves.

OCS seismic risk, D. M. Perkins. Seismic hazard maps for U.S. OCS will be prepared for six OCS regions: Alaska, Pacific Coast south of Cape Mendocino, Pacific Coast north of Cape Mendocino, North Atlantic, South Atlantic, and Gulf Coast. Maps will display peak acceleration and velocity for three different probability levels—90 percent probability of not being exceeded in 10, 50, and 250 years.

Crustal strain, J. C. Savage. Resurvey all major California networks, and networks of Utah, Montana, Washington, and Nevada. Also, conduct analysis of surveys along Palmdale uplift and in Hollister area.

Earthquake-hazard evaluation in the Pacific Northwest, S. W. Smith and R. S. Crosson, University of Washington, Seattle, Washington. Operation of 21-station telemetered array in western Washington for purpose of obtaining basic data on earthquake occurrence and tectonics will be continuing. Acquisition, analysis, and publication of seismic network data are extended by investigations of time-dependent velocity variations using fixed quarry explosions, of methods of obtaining three-dimensional velocity structure, and of ground motion computer modeling from realistic earthquake sources.

Simultaneous measurement of dilatancy, pore pressure, and resistivity in faulted specimens undergoing direct shear, R. E. Goodman, University of California, Berkeley, California. Continue to measure water-pressure changes and electrical resistivity changes along active faults. Studies of water pressure and resistivity measurement on clean surfaces will be extended to surfaces with artificial gouge.

Laboratory and field investigations of fault gouge, J. M. Logan, Texas A&M University, College Station, Texas. To provide an understanding of the mechanics of earthquake generation, laboratory and field studies are being conducted to investigate the frictional properties of rocks, fault gouge, and the mechanical properties of the host rock-fault gouge system.

U.S. GEOLOGICAL SURVEY REPORTS ON WASHINGTON STATE PUBLISHED SINCE MAY 1977

(Cooperative efforts and open-files included)

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Whetten, J. T., 1977, Tertiary sedimentary rocks in the central part of the Chiwaukum graben, Washington [abstract]. In Geological Society of America Abstracts with Programs, v. 8, no. 3, p. 420.

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ADDITIONAL INFORMATION AVAILABLE ON DIVISION OPEN FILE

The following information is now available in our division library and may be used for reference:

Cross, stratigraphic, and type sections of the Columbia Basin and adjoining areas of Washington, by Glennda Tucker, 9 maps, scale 1:100,000, 10 p.
[This accompanies our Open-File 78-3, Bibliography of the geology of the Columbia Basin and surrounding areas of Washington with selected references to Columbia Basin geology of Idaho and Oregon, by Glennda Tucker and James Rigby, which was released in April of this year.]

RECENT USGS OPEN-FILE REPORTS ADDED TO OUR DIVISION LIBRARY

The following reports are now available for inspection in our division library:

Low-flow characteristics of streams on the Olympic Peninsula, Washington, by W. L. Haushild and D. E. LaFrance. USGS Open-File Report 77-812, 1 plate, 5 figs., 25 p. (Prepared in cooperation with the Washington State Departments of Fisheries and Game.)

Geologic map of the Mount Bonaparte quadrangle, Okanogan County, Washington, by Kenneth F. Fox, Jr. USGS Open-File Report 78-732, scale 1:48,000.

Short papers of the Fourth International Conference, geochronology, cosmochronology, isotope geology, 1978, edited by R. E. Zartman [conference held August 20-25, 1978, in Snowmass-at-Aspen, Colorado.] USGS Open-File Report 78-701, 476 p. (228 short papers).

BOB WELCH RETIRES FROM USBM

J. R. (Bob) Welch retired from the Olympia office of the U.S. Bureau of Mines in July. He plans to spend his retirement years in El Paso, Texas. Herbert R. Babitzke is the new Liaison Officer, with offices in the Evergreen Plaza Building on Capitol Way, in Olympia.

YOUR STATE GEOLOGIST REPORTS

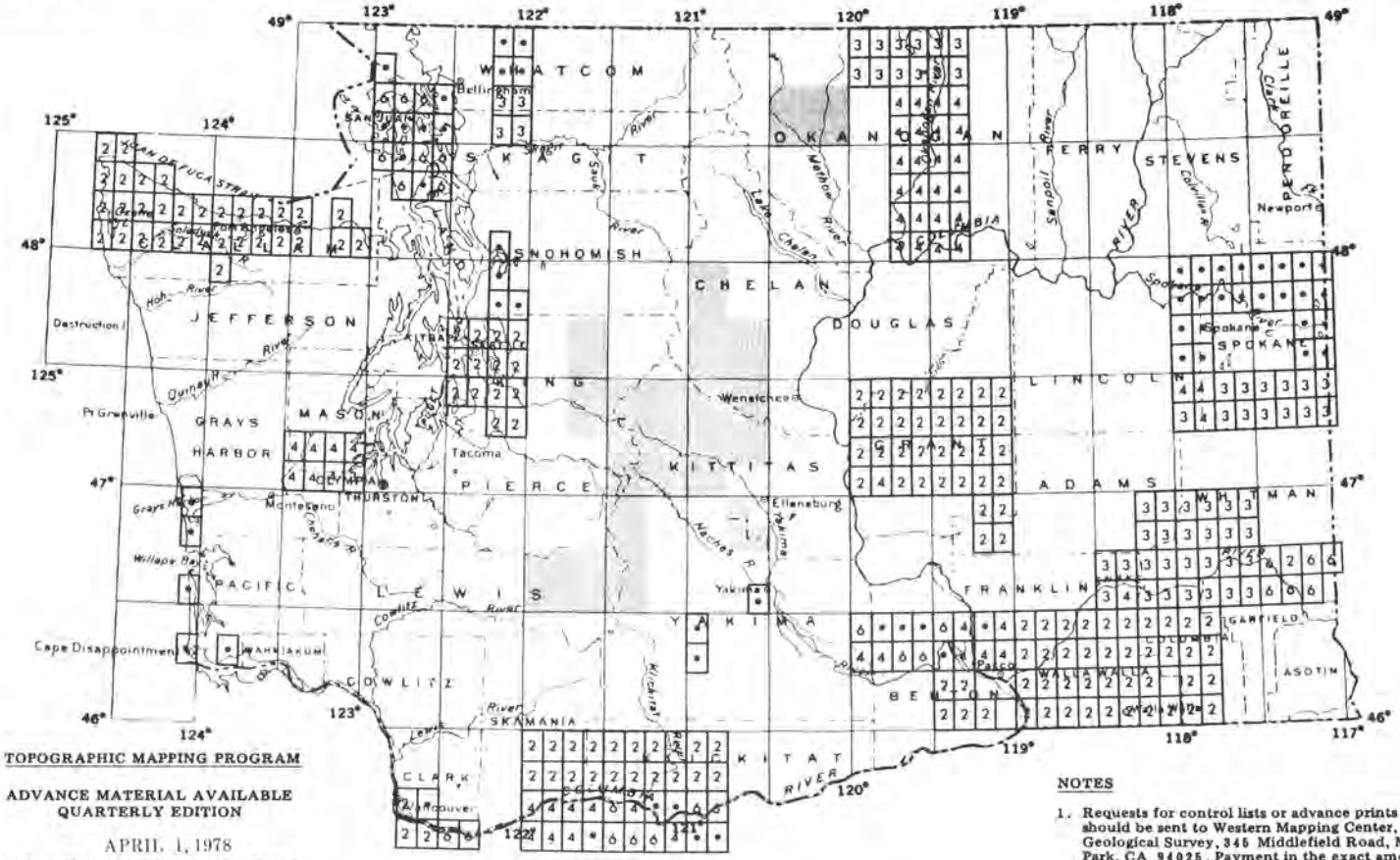
I was at a meeting recently where the speaker talked on the problems we are having with land withdrawals from mineral entry. One of the things he pointed out really got my attention because it is so true, and I had never even considered it before. He said our problems are not with environmentalists but with "zero growth" advocates. He certainly was right. The important thing that I must do now is change my nomenclature so that it reflects this new (to me) concept. The zero-growth people have been using the environment as their vehicle to accomplish their ends, which has put the developers in a bad light because it makes them appear as though they are against the environment. The last thing in the world the zero-growth people want is abundant cheap power, new mineral resources, or anything else that will cause economic growth. To prevent these things from happening they have beaten the drum loud and long, pointing out that the development of new industry will certainly degrade the environment—which is not true. They have been successful in getting all kinds of restrictive oppressive laws passed. They have and are achieving the greatest land steal in the history of the world through the wilderness withdrawals. And all this has been done in the name of protecting the environment. Obviously, this type of tactic is going to eventually sink the United States economy if it is not stopped. The sad thing is that it can go on many years before the full impact is felt. Somehow we need to reverse the trend before we fall into an economic hole and can't get out.

Ted Livingston

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WASHINGTON

TOPOGRAPHIC DIVISION
WESTERN MAPPING CENTER
MENLO PARK, CALIFORNIA



TOPOGRAPHIC MAPPING PROGRAM

ADVANCE MATERIAL AVAILABLE
QUARTERLY EDITION

APRIL 1, 1978

2 Aerial photography completed. Information available from Western Mapping Center, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, CA 94025 or National Cartographic Information Center, U.S. Geological Survey, 507 National Center, Reston, Virginia 22092.

3 Basic horizontal and vertical control completed. Descriptions and unadjusted coordinates and/or elevations are available. Price is 50 cents for each 15-minute quadrangle horizontal or vertical control list. See notes 1 and 2.

4 Prints of manuscripts compiled from aerial photographs are available at $1.25 each. Contours are shown in areas suitable for stereo-plotting. See notes 1 and 2.

6 Final drafting completed. Partially-edited one color advance print (with names) are available for $1.25 each. See notes 1 and 2.

• Maps published since the latest edition (JULY 1976) of State Sales index to published maps. See note 3.

Maps published at 1:62,500 scale in 15-minute units ONLY. However, 1:24,000 scale prints in 7.5-minute units, with appropriate accuracy and contour interval are available at $1.25 each. See notes 1 and 2.

NOTES

1. Requests for control lists or advance prints should be sent to Western Mapping Center, U.S. Geological Survey, 345 Middlefield Road, Menlo Park, CA 94025. Payment in the exact amount should accompany order and may be made by check or money order payable to U.S. Geological Survey. Please do not send stamps. NO DISCOUNT ALLOWED.

2. In ordering material or requesting information, mark your area of interest on this index and forward it with your order. A new copy of the index will be returned to you for future use.

3. State sales indexes listing all published maps are available free from the Branch of Distribution, U.S. Geological Survey, P. O. Box 25286, Federal Center, Denver, CO 80225. Published quadrangle maps at 1:24,000 scale are available from the same address at a price of $1.25 each. Remittance may be by check or money order payable to the U.S. Geological Survey. On an order amounting to $300 or more at the list price, a 30% discount is allowed. The discount applies to all printed maps and charts distributed by the Geological Survey, but not to photographic reproductions.

Status of topographic mapping in Washington, April 1, 1978

U.S. GEOLOGICAL SURVEY 7½-MINUTE TOPOGRAPHIC QUADRANGLES
(Maps received in the division library since July 1978)

Name	New edition	Photo revised	Latitude (indicates southeast corner)	Longitude	County
Almota	1964	1975	46°37'30"	117°22'30"	Garfield; Whitman
Biggs Junction, Oregon-Washington	1977		45°37'30"	120°45'00"	Klickitat
Camas, Washington-Oregon	1961	1970;1975	45°30'00"	122°22'30"	Cowlitz
Colton	1964	1975	46°30'00"	117°07'30"	Whitman; Garfield
Horn Rapids Dam	1977		46°22'30"	119°22'30"	Benton
Moclips	1955	1973	47°07'30"	124°07'30"	Grays Harbor
Moscow West, Idaho-Washington	1964	1975	46°37'30"	117°00'00"	Whitman
Ocean Park	1949	1973	46°22'30"	124°00'00"	Pacific
Pullman	1964	1975	46°37'30"	117°07'30"	Whitman
Snipes Creek	1977		46°15'00"	119°37'30"	Benton
Sulphur Spring	1978		46°22'30"	119°52'30"	Yakima
The Dalles South, Oregon-Washington	1977		45°30'00"	121°07'30'	Klickitat-Oregon
Winchester SE	1966	1978	47°00'00"	119°30'00"	Grant

Department of Natural Resources
Division of Geology and Earth Resources
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