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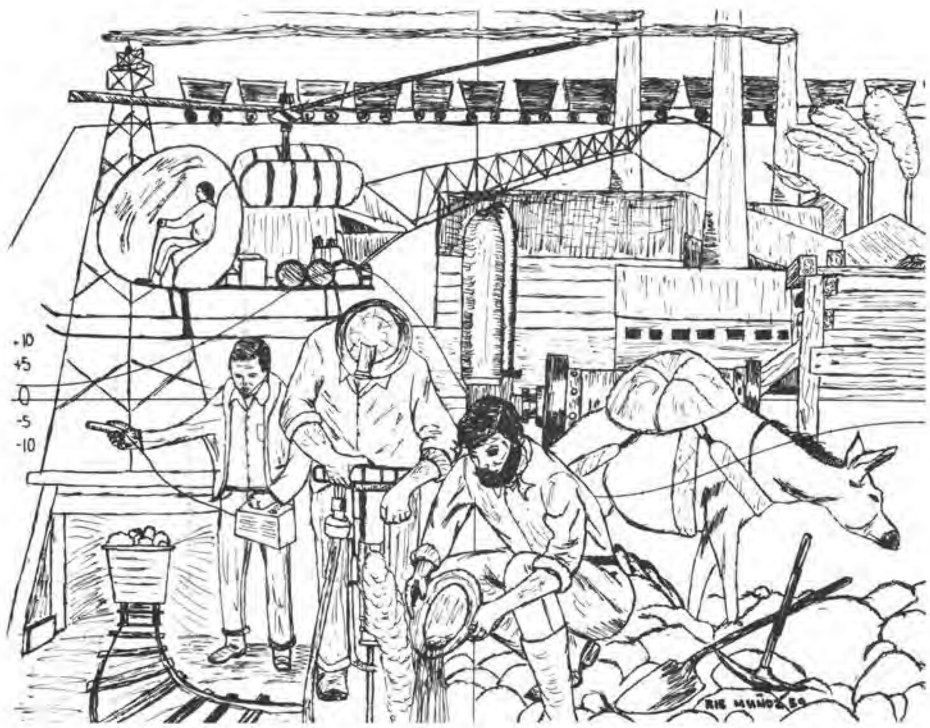
WASHINGTON GEOLOGIC NEWSLETTER



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THE OIL CITY STORY

by

Weldon W. Rau

The Olympic Peninsula coastal area has been the scene of periodic oil and gas exploration for many years. The first attempt to drill for petroleum took place around the turn of the century in an area about 3 miles south of LaPush, just inland a few hundred yards from what is now known as Third Beach. Although definite "shows" of oil were reported, the venture was abandoned after some 500 feet had been penetrated.

In 1913-14, another attempt to produce oil from the area was made near Hoh Head. Equipment was beached from a scow at Jefferson Cove and dragged inland several hundred yards where two wells were drilled, both to a depth of approximately 1,000 feet. Oil and gas were encountered in both wells but not in commercial quantities.

A big flurry of exploration took place in the 1930's in the vicinity of the Jefferson oil seep, not far from the earlier Hoh Head wells and just north of the mouth of the Hoh River. Oil fever reached near epidemic proportions in those days on the "lower Hoh." Optimism ran so high that real estate interests became active and a sizable area along the north side of the Hoh River was platted into lots. Many of these lots were sold in anticipation of the big oil boom that, according to some, would inevitably take place. Oil City, a name still seen on maps and road signs in the area, is now virtually nonexistent. However, evidence of the activity that once took place here may still be seen in places—a pile of rotting boards from a collapsed building, or the rusted remains of a vintage automobile in the grassy, alder-covered flat along the north side of the Hoh River.

The enthusiasm for petroleum exploration in the 1930's was truly justified and, according to some, still is. Bonafide oil and gas seeps had been known for years in this area. According to Mrs. Lena

Fletcher (Seattle Times, January 11, 1953), her husband Fred, sometime near the end of the last century, found several "bear wallows" that smelled of oil. She further relates that, as far as she knows, her husband may have been the first to discover the Jefferson oil seep while surveying in the area some 2½ miles northeast of the Fletcher homestead. Until a major demand for petroleum shortly after the turn of the century, oil was not considered of much value except perhaps (according to Mrs. Fletcher) for a cure of rheumatism or as a cold remedy. With the coming of the automobile and the growing need for petroleum, stories of the existence of oil seeps in the "Hoh country" soon attracted numerous people with varied talent, all interested, one way or another, in the production of petroleum from Hoh rocks.

Geologists, for a number of years, had pondered the relatively little geologic data that was available. In those days, the outcrops of rock were largely confined to the immediate coastal area. However, from those limited exposures an amazing amount of information emerged about geologic structures, oil horizons, anticlines, and faults, most of which actually would have been difficult to either prove or disprove. Nevertheless, optimism prevailed among many and thus such impressive geologic language was accepted and perhaps slightly embellished. The result was that some 11 wells were drilled during a period of time from 1931 to 1937 in the vicinity of the Jefferson oil seep, some 2 miles northwest of the Oil City land development along the Hoh River. This distance was traversed through the woods over a sawed-plank road that today can still be traced in part, through unlogged areas (fig. 1). Most of the wells of the area, some of which reached several thousand feet depth, actually did encounter excellent "shows" of oil. However, none sustained commercial quantities. As much as 100 barrels a day were claimed at first to be flowing from some of these wells but these figures soon dwindled. Today, in at least two casings that still stand above ground among tumbled-down wooden derricks and buildings, gas continues to bubble through small

FIGURE 1.—A view of the plank road that leads from Oil City on the Hoh River to the Jefferson oil seep nearly 2 miles to the northwest, as it appeared shortly after completion some 45 years ago. This road was the only access to the site of at least eleven oil wells that were drilled in the 1930's. Today, nearly hidden in underbrush, segments of this road can still be traced through unlogged areas. Photo courtesy of William D. Jones Historical collection, Aberdeen, Washington.

quantities of high-gravity (thin) oil.

Geologists now have the advantage of much better access to inland areas by numerous logging roads and many new rock outcrops along these roads. Even with new data available, the geologic picture is still very incomplete. However, the additional information does help reveal that the geologic story is considerably more complex than was originally suggested by pioneer geologists. Thus, it is becoming more apparent why oil has not yet been produced from Hoh rocks.

COAL LEASING ON STATE LANDS

The State of Washington is in the process of writing new rules and regulations to govern the leasing of state lands for coal-mining purposes.

The new rules and regulations will require, among other things, all leases to be issued to the highest bidder at public auction.

If you wish to receive a copy of the new rules and regulations, and be notified of coal lease sales, please contact the Department of Natural Resources, Lands Division, Public Lands Building, Olympia, WA 98504.

COAL KEY TO ENERGY INDEPENDENCE

According to the vice president of the U.S. Chamber of Congress, the United States has enough coal to last for centuries. But, because of the impact of public policy, the nation is short of energy.

Herbert S. Richey made some interesting observations during an energy symposium held recently at Case Western Reserve University.

"We have the coal, but for a variety of reasons, we can't mine it, we can't ship it, and we can't burn it."

"We can't mine it because the present environmental hysteria (ecomania) sees the surface mining of coal as the rape of modern-day North America." Approximately half of the current coal output comes from thick, low-sulfur coal seams that lie just below the surface in areas west of the Mississippi. These conditions dictate surface mining, if nothing else than to keep the costs down in supplying enormous quantities of coal to eastern markets. Richey cited a government report which stated that if coal output were tripled by the year 2000, and if the resulting increase were from western surface mines, total disturbed land surface would be still contained within a radius of 12.5 miles.

Carl Bagge, president of the National Coal Association, recently underscored the lack of clear thinking on the part of environmentally concerned groups. Bagge said, "The modern surface mining industry is the unwilling heir of the bad old days, of the times when society did not demand that land be restored and when society was not willing to pay for that restoration. Now the market will sustain the cost of good reclamation practices and every state where coal is mined in substantial quantity has updated and modernized its laws and regulations so that effective reclamation is being required and enforced at the state level. Land should not be mined unless it can be restored, and this is being done by responsible coal operators everywhere," Bagge said.

Richey went on to say, "Even when you can mine coal and find the rail cars to ship it, potential customers are reluctant to buy it because the government may not let them burn it under the restrictive criteria of the Clean Air Act."

Future congressional amendments are proposed that are even more restrictive than present clean air standards. This thinking tends to stifle the use of, instead of opening the door toward, a fuller utilization of our coal resources.

Richey concluded by wryly observing that "As the nation approaches its 200th birthday, the fact that it depends on foreign sources for two-fifths of its vital oil is persuasive evidence that we won't have as much to celebrate next July 4th as we really think we do."

Ellis R. Vonheeder

FAULT CAPABILITY

by

Ernest R. Artim

Seismic activity is usually associated with faulting. Faults in the region of proposed safety-related facilities, such as nuclear power plants, are therefore subject to careful study to determine their potential for movement.

A fault along which there is recurrent movement, usually indicated by small, periodic displacements or seismic activity, is called an active fault. More precisely, an active fault is one that has moved in historic time, or along which offset of Holocene (last 11,000 years) materials can be demonstrated. If Holocene materials are not offset or are absent, but numerous epicenters have been recorded on or in close proximity to the fault, a classification of active may be used. In order to distinguish faults which have a potential for surface displacement from active faults, the term "capable" was introduced. A capable fault is a tectonic structure that exhibits differential movement that is capable of causing rupture (Atomic Energy Commission, 1973). Such a fault has also been termed a potentially active fault.

Fault "capability" is dependent upon the following arbitrary criteria:

1. Movement at or near the ground surface at least once within the past 35,000 years, or movement of a recurring nature within the past 500,000 years.
2. Instrumentally determined macro-seismicity with records of sufficient precision to demonstrate a direct relationship with the fault.
3. A structural relationship to a known capable fault such that movement on one could reasonably expect to be accompanied by movement on the other.

The first criterion requires evidence of geologically recent surface rupture (within the past 500,000 years). The second criterion requires records from instrumentation (seismographs), which have been available for only the past half century or so. The third criterion depends upon the relationship of a fault to another fault that exhibits some aspect of the first two criteria.

A "capable" fault requires a very detailed investigation over a considerable area to determine its geometry, length, displacement, age, and the potential magnitude of an earthquake, which might occur on the structure. It is of prime importance to consider the possibility of "capability" very carefully before a site evaluation is even begun. Any fault within 200 miles of a proposed safety-related facility site, such as a nuclear reactor, must be investigated to determine its "capability."

There undoubtedly are areas in which surface rupture must be considered a real possibility. There are other areas in which the threat of surface rupture as a practical matter simply does not exist. The siting criteria apply to all potential sites, however, and the "capability" of faults must be considered in all cases.

It should be pointed out that the absence of surface rupture in recent geological material may not be a valid criterion to classify a fault as being "not active" or "not capable." Recent investigations (Quick, 1974) of two active thrust faults in southern California indicate that poorly consolidated soil and alluvium have been folded and, in places, overturned but not ruptured or sheared.

Investigations by this writer of normal faults in southern California have also indicated that recent geological materials may not always be ruptured or sheared. In such cases, the question of activity arises: Are these active faults or are they capable faults? At present, most geologists think that along faults on which there is recurrent movement indicated by small periodic displacements or along which fault creep is continuously occurring, shearing or rupture of Holocene materials will have occurred. It is only on faults which apparently have long recurrence intervals with small displacements that the Holocene materials do not become sheared or ruptured.

For example, a fault (fault A) along which fault creep is continuously occurring or along which displacement occurs, possibly every 50 to 100 years, some of any Holocene materials present would eventually shear or rupture. However, a fault (fault B) along which displacement is small (a few inches to a foot or so) and the recurrence intervals are on the order of every 1000 to 5000 years, Holocene materials may not become sheared.

	Recurrence interval (years)	Recurrence movement (ft)	Selected total movement (ft)	Time required for selected total movement (years)
Fault A	100	1	10	1,000
Fault B	5,000	1	10	50,000

Geologists still have a lot to learn about fault activity, and such terms as "active fault" and "capable fault" should be used with caution and discretion. Typically, along a capable fault certain land uses can be utilized, such as agriculture, light industry, storage yards for noncombustible or nonexplosive materials, parks, possibly even single-family residences, which would be compatible with our present knowledge of fault activity. The important point to remember is that the criteria of fault capability should be used only in applicable cases.

References

Atomic Energy Commission, 1973, Reactor siting criteria: 100 CFR 100, Appendix A, November, 1973.

Quick, G. L., 1974, Absence of soil rupturing in some active fault zones [abstract]: Geological Society of America Abstracts with Programs, v. 6, no. 3, p. 239.

GOLD AND MONEY

Available through the Oregon Department of Geology and Mineral Industries is the 200-page proceedings of the gold and money session and gold technical session held in Portland in April 1975 in conjunction with the Pacific Northwest Metals and Minerals Conference.

The publication contains articles on "Gold and the Economy," "Twentieth Century Inflation," and on other subjects on gold related to world monetary problems.

Proceedings of the gold technical session includes papers on gold deposits in parts of the United States, Canada, and Australia. Other papers cover Oregon's gold potential, the history of gold exploration in the United States, and cost analyses of gold placer mining operations.

Orders for the book "Proceedings of the Fifth Gold and Money Session and Gold Technical Session" should be sent to the State of Oregon, Department of Geology and Mineral Industries, 1069 State Office Building, Portland, OR, 97201 (price - $5.00).

U.S. GEOLOGICAL SURVEY RELEASES MAP

The U.S.G.S. recently released a new map related to waste-disposal planning in the Hood Canal area that was prepared in cooperation with the Division of Geology and Earth Resources.

Carson, R. J.; Smith, Mackey; Foxworthy, Bruce, 1976, Geologic conditions related to waste-disposal planning in the southern Hood Canal area, Washington. Map I-853-D, scale - 1:62,500, map and text on 1 sheet.

Map I-854-D may be purchased for 75 cents from the U.S. Geological Survey, Denver, CO 80225; and Reston, VA 22092. The map is also available for inspection at our Division reference library in Olympia.

GEOLOGIC RESEARCH PROJECTS

Current geologic work in Washington State is always of interest to consultants, industries, schools, and many others in related work areas. In an attempt to provide information that is not readily available, the division requested listings of current geologic research projects being conducted in Washington colleges and universities. The responses we received are listed as follows:

Central Washington State College

- Faculty Research Projects -

Structure and stratigraphy of the Columbia River Basalts. Robert D. Bentley.

Geology of the Parke Creek area, Kittitas County. Steven E. Farkas.

Glacial geology of the Waterville Plateau area. Don Ringe.

Eastern Washington State College

- Master's Theses Proposals -

Petrography of the crystalline rocks south of Okanogan, in north-central Washington. Lloyd G. Fritz.

Sand and gravel deposits in part of the Spokane (SE and SW) quadrangles, Washington. Mark Powers.

A detailed gravity study of the Cheney quadrangle, Spokane County, Washington. Carl Yost, and W. K. Steele.

Carbonate petrology and paleoecology of carbonate units in the Mission Argillite, northeastern Washington. Barbara West.

- Faculty Research Projects -

Petrology of the Mount Stuart batholith, central Cascades, Washington. Erik H. Erikson.

Thermal history of the Mount Stuart region from apatite fission-tracks. Erik H. Erikson.

Geothermal ice caves and volcanic gases, Mount Baker and Mount Rainier. E. P. Kiver and W. K. Steele.

Petrochemistry of Columbia River Basalts. Felix E. Mutschler, William L. Wilkerson, and Dale F. Stradling.

Geologic map of the Inchelium quadrangle, Washington (U.S. Geological Survey). J. R. Snook and Campbell.

Late Permian Bryozoa of western North America and their relationship to other faunal provinces. E. H. Gilmour.

Permian bryozoans from the Kettle Falls area, Stevens County, Washington (with Miriam Majofis, Reed College). E. H. Gilmour.

University of Washington

Department of Geological Sciences

– Faculty Research Projects –

Geologic hazards of the Skagit nuclear power site. Eric S. Cheney.

Stratigraphy and structure of the Okanogan Highlands. Eric S. Cheney.

Structure and origin of the Twin Sisters Dunite. Nikolas I. Christensen.

Physical properties of Olympic Peninsula graywackes. Nikolas I. Christensen.

The origin of Washington State ophiolites. Nikolas I. Christensen.

Gravity studies south and southwest of Mount Baker. Nikolas I. Christensen.

Review of geologic conditions at proposed nuclear plant sites in Washington. Howard A. Coombs.

Petrology of ultramafic hornfelses, Icicle Creek, central Cascades. B. R. Frost.

Stratigraphy and structural geology of the Wenatchee formation. Randall L. Gresens.

Marblemount 15' quad. Geology by Peter Misch 1949-1967. Peter Misch.

Mount Baker 15' quad., being compiled by Peter Misch from 1949-1975 field data.

Mount Shuksan 15' quad., compilation under preparation. Peter Misch.

Metamorphic facies and petrogenesis of Shuksan Greenschist. Peter Misch.

Petrology of Cascade River Schist and its associated metaplutonic rocks. Location: largely in Marblemount 15' quad., but includes part of Eldorado Peak, Cascade Pass and Sonnyboy Lakes $7\frac{1}{2}$' quads. Peter Misch.

Metasomatic progressive metamorphism of ultramafic rocks in Skagit Metamorphic Suite (Skagit Gneiss and Cascade River Schist). Peter Misch.

Symplectite breakdown of Ca-rich almandines in upper amphibolite-facies Skagit Gneiss. (In press) in: Contrib. Mineral. and Petrol. Peter Misch with A. C. Onyegocha.

Geology, geochemistry and origin of the Golden Horn batholith. With R. T. Stull. Includes parts of Crater Mtn., Azurite Peak, Slate Peak, Mount Arriva, Washington Pass, Silver Star Mtn., $7\frac{1}{2}$' quads., etc. Peter Misch.

Outline of the petrology of the Yellow Aster Complex (the pre-Devonian basement of the Northwestern Cascades). Peter Misch.

Glacier Peak tephra in the eastern North Cascades. Stephen C. Porter.

Paleontology of the Ringold Formation. John M. Rensberger and Eric Gustafson.

Stratigraphy and structure of rocks in the Hoh River—Clearwater River area, western Olympic Peninsula. Richard J. Stewart.

Geology of the San Juan Islands. John T. Whetten.

– Graduate Program –

Geology and petrology of the Chaval Mountain area, North Cascades, Washington. Jeremy Boak.

Geology of the McClure Mts. area, Okanogan County, Washington. F. William Burnet.

Paleocurrent analysis of early Tertiary sandstones in the Leavenworth-Wenatchee area, Washington. John Buza.

Factors affecting the geochemistry of Williamson Creek, Snohomish County, Washington. David Dethier.

Hydrothermal clay and thermal activity in source areas of debris avalanches at Mount Rainier and Mount Baker. David Frank.

A structural and petrologic study of the Chiwaukum schist north and east of Stevens Pass, Washington. Jennifer Getsinger.

Paleoecology of the sagebrush region of eastern Washington. Dennis Hibbert.

Late Quaternary evolution of western Washington coast. A. Dan Horn.

Reconnaissance mapping of Entiat fault zone. J. A. Laravie.

Stratalogic analysis of the Intra-Miocene Ochoco unconformity in Washington-Oregon. Sandra Leo.

Fossil vertebrates from the Clarendonian and Hemphillian of Oregon and Washington. James Martin.

Structure and petrology of the Ingalls Complex, Central Cascades. Robert Miller.

Quaternary glaciation and faulting in the Northwestern Chiwaukum graben, Washington. David Nimick.

Detailed structure of a segment of the Ross Lake Fault west of Ross Lake. Wesley Wallace.

Chemical alteration of Quaternary sediments, Puget Lowlands, Washington. Linton Wildrick.

Paleontology of the Skookumchuck Formation in the Central-Chehalis area, Washington. Bruce Wiley.

Geophysics Program

– Geophysical Research Projects –

Earthquake swarms at Wooded Island (on Columbia River by Richland). G. Rothe, S. W. Smith, J. Booker.

Seismicity and gravity changes at Mount Baker. S. Malone, S. W. Smith.

Gravity and magnetic investigation of the Skagit Valley. W. Foxall.

Gravity and seismic investigation of the Chiwaukum graben. R. Silling.

Methods of avalanche prediction and control. E. LaChapelle.

Investigation of the Blue Glacier, Mount Olympus. C. Raymond.

Seismicity in the Puget Sound region. R. Crosson.

Seismicity in the Lake Chelan-Grand Coulee region. S. W. Smith.

Seismicity in the Hanford region. N. Rasmussen.

Seismic velocity from Centralia explosions. R. Crosson, J. Wu, H. Zuercher.

Heat flow on the Juan de Fuca ridge. C. R. B. Lister.

Structure of the ocean-continent transition. B. Lewis.

Gravity and elevation changes in western Washington. N. Rasmussen, R. Bostrom.

Washington State University

– Faculty Research Projects –

Study on Ringold Formations of Hanford Reservation. J. W. Crosby III.

Geophysical investigation of Washington groundwater resources. J. W. Crosby III.

Water resources of Klickitat County. J. W. Crosby III.

Pullman-Moscow test observation well. J. W. Crosby III and J. Brown.

Exploratory drill hole logging near Usk, Washington. J. W. Crosby III.

Petrochemistry of the Columbia River Basalts. P. R. Hooper.

Structural and economic geology of northeast Washington. J. W. Mills.

Cretaceous stratigraphy of the San Juan Islands, Washington. W. F. Scott.

Measurement of deformation in northeast Washington. A. J. Watkinson.

— Master's Theses Proposals —

Geology of the "Wiley prospect," Northport, Washington. Francis Beka.

Structural geology of China Bend, Stevens County, Washington. Jason R. Bressler.

Examination of localized energy and weather conditions, and their influence on beach grain size distribution along the southern coast of Washington. John Dombrowski.

Physical properties of Ringold sediments on the Hanford Reservation. Eileen Jackson.

Structures in the southern portion of the Shuswap Metamorphic Complex. George LeBret.

Three copper-manganese deposits of the Olympic Peninsula. Scott Lee.

Petrology of Cretaceous rocks on Stuart Island, San Juan County, Washington. John Mercier.

Lava tubes near Trout Lake. Luurt Nieuwenhuis.

Basalt stratigraphy and structure of Saddle Mountains. Terry Taylor.

— Ph.D. Theses Proposals —

Petrochemistry of the Columbia River Basalts between Clarkston and the Grande Ronde River. Victor Camp.

Mineral deposits of the Sultan Basin, Snohomish County, Washington, and their relation to structural features. Robert Griffis.

Nature of the Ledbetter-Metaline Contact and its relation to zinc-lead ores. Bruce Hurley.

Petrochemistry of the Columbia River Basalts south of the Grande Ronde River. Steve Reidel.

Petrology and chemistry of Mount Baker volcano. Victor Swan.

Western Washington State College

— Recently Completed Master's Theses —

Biochemical origin of coastal weathering features in the Chuckanut Formation of northwest Washington. George Mustoe.

A geochemical study of the Tertiary volcanic rocks of northwestern Washington. Frank Videgar.

A gravity survey and structural analysis of the Republic graben, northeastern Washington. Ralph Soule.

— Master's Theses Proposals —

Metamorphism of the crystalline complex rocks of Vedder Mountain and Vancouver Island, B.C. (and related rocks of the Pacific Northwest). Mitchell Bernardi.

Cenozoic geology of Snohomish County. Gerard Capps.

Phase relations of the Ca-Al silicates in the Shuksan Metamorphic Suite. North Cascade Mountains, Washington. Jami Fernette.

Seasonal foraminiferal distribution and how it relates to seawater and substrait characteristics in Samish and Chuckanut Bays. Garry Jones.

Geochemistry and metamorphism of the Yellow Aster Complex and a comparison to the Turtleback Complex, northwest Washington. Daniel Wilson.

Slope stability along the Skagit River valley, Skagit County, Washington. Paul Heller.

— Senior Thesis in Progress —

Chemical composition and metamorphic facies of the Chilliwack Group near Concrete, Washington. William Sayre.

— Faculty Research Projects —

Geology of Fidalgo Island, Washington. Edwin H. Brown.

Progression of Mount Baker steam activity. Don J. Easterbrook.

Investigating possible National Park sites, National Monuments, etc., in the northwestern United States. Don J. Easterbrook.

Whitman College

Department of Geology

Landslides along Hood Canal. Jeff Gryta, North Carolina State U.; R. J. Carson.

Quaternary faults of southeastern Olympic Peninsula. Joe Wilson, Gardner-Webb College; R. J. Carson.

Quaternary and environmental geology of eastern Jefferson County. R. J. Carson; Richard Birdseye* and Marty Gayer*, North Carolina State University; Kathyrn Hanson*, University of Oregon.

Slope stability in the southern Hood Canal area. Mackey Smith, Washington Division of Geology and Earth Resources; R. J. Carson.

Pleistocene tephra of western Puget Lowland. R. J. Carson; W. H. Spence and Richard Birdseye*, North Carolian State University.

* students

Yakima Valley College

Geologic hazards of Yakima County, Washington. Newell Campbell.

DIVISION RELEASES NEW PUBLICATIONS

The following reports were recently released by the Division of Geology and Earth Resources:

GM-14, Preliminary surficial geologic map of the Edmonds East and Edmonds West quadrangles, Snohomish and King Counties, Washington, by Mackey Smith: GM-14, 1975. Prepared in cooperation with the U.S. Geological Survey. Scale: 1:24,000. Free.

GM-15, Slope stability map of Thurston County, Washington, by Ernest Artim: GM-15, text and map on 1 sheet, 1976. Prepared in cooperation with the U.S. Geologic Survey. Scale: 1 inch=2 miles. Price, $1.00.

GM-16, Relative ground settlement hazards of Thurston County, Washington, by Ernest R. Artim: GM-16, text and map on 1 sheet, 1976. Prepared in cooperation with the U.S. Geologic Survey. Scale: 1 inch=2 miles. Price. $1.00.

Information Circular 58, Engineering geologic studies, 40 p. Price - $1.00 I.C. 58 consists of four articles: Soil—What is it?, by Kurt L. Othberg; The role of ground water in slope stability, by Walter D. Paterson; Potential land use problems of Puget Sound shore bluffs, by D. W. Mintz, R. S. Babcock, and T. A. Terich; and Seismic risk, by Ernest R. Artim.

These reports may be purchased from the Department of Natural Resources, Division of Geology and Earth Resources, Olympia, WA 98504.

THESES RECENTLY ADDED TO THE DIVISION OF GEOLOGY AND EARTH RESOURCES LIBRARY COLLECTION

These theses can be examined in our division library; they cannot, however, be copied or taken from the premises.

Bryant, Vicki Y., 1975, A study of the occurrence of garnet in siliceous igneous rocks of the Mt. Pilchuck area, Snohomish County, Washington: University of Washington M.S. thesis, 31 p.

Dethier, David P., 1974, Dissolved constituents in Williamson Creek, Snohomish County, Wash-

ington—A preliminary report: University of Washington M.S. thesis, 33 p. plus 7-page appendix.

Hedderly-Smith, David A., 1975, Geology of the Sunrise breccia pipe, Sultan Basin, Snohomish County, Washington: University of Washington M.S. thesis, 60 p.

Hersch, John T., 1974, Origin of localized layering in the Twin Sisters Dunite, Washington: University of Washington M.S. thesis, 65 p.

Hirsch, Robert M., 1975, Glacial geology and geomorphology of the Upper Cedar River Watershed, Cascade Range, Washington: University of Washington M.S. thesis, 48 p.

Konicek, Daniela L., 1974, Geophysical survey in south-central Washington: University of Puget Sound M.S. thesis, 35 p.

Lovseth, Timothy P., 1975, The Devils Mountain fault zone, northwestern Washington: University of Washington M.S. thesis, 29 p.

Mulcahey, Michael T., 1975, The geology of Fidalgo Island and vicinity, Skagit County, Washington: University of Washington M.S. thesis, 49 p.

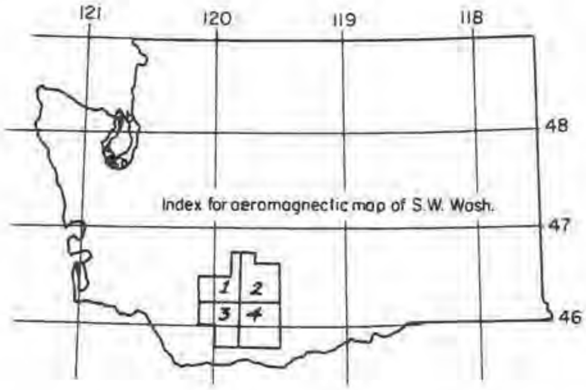
Stricklin, Claude R., 1975, Geophysical survey of the Lemei Rock-Steamboat Mountain area, Washington: University of Puget Sound M.S. thesis, 23 p.

Tubbs, Donald W., 1975, Causes, mechanisms, and prediction of landsliding in Seattle: University of Washington Ph.D. thesis, 88 p.

Wilson, Joseph R., 1975, Geology of the Price Lake area, Mason County, Washington: North Carolina State University M.S. thesis, 79 p.

U.S. GEOLOGICAL SURVEY OPEN-FILE REPORTS

The following open-file reports by the U.S. Geological Survey are now available for inspection in the Division of Geology and Earth Resources library:



Aeromagnetic map for part of southwestern Washington, 4 sheets, map scale - 1:62,500. Open-file report No. 75-648.[1/]

Ground magnetic and VLF studies at Midnite uranium mine, Stevens County, Washington, by J. Thomas Nash, 17 p., 5 figs., 1 table. Open-file report No. 76-230.

Stratigraphy and distribution of tephra from Glacier Peak (of 12,000 years ago) in the Northern Cascade Range, Washington, by S. C. Porter, map and text on 1 sheet. Open-file report 76-186.

These reports may also be inspected at USGS offices, including Spokane, Room 678, U.S. Courthouse.

[1/] The map sheets for No. 75-648 are in reproducible form; arrangements can be made with a commercial firm for copying.

YOUR STATE GEOLOGIST REPORTS

It has been my hope ever since hearing about the "pet rock" fad to avoid being caught up in the craze. Unfortunately, I noted that some of my colleagues from other states have become involved and lest I be labeled a traitor to the cause I thought I had better make my contribution.

First of all I must confess I have had many pet rocks. In my experience with rocks I have found them to be very much like people, and a lot can be learned about human nature by studying them. I had one rock when I was in graduate school, a large healthy specimen of siliceous magnetite from the Mesabi Range in Minnesota, that was vicious and when struck by a hammer would strike back. Funny thing was it only got mad when it was hit. The rest of the time it laid contentedly in the black recesses of a mineral cabinet. I could be wrong, however, it may have been angry all the time without my knowing it since it was the most undemonstrative rock I have ever owned. I remember well one time when I fetched it a good lick with a geology pick only to have it shoot off a small chip that embedded itself in my hand. It took a couple of painful weeks before I could dig the chip out of my hand with my pocket knife.

I had another rock, a piece of fine-grained massive pyrite, that was vain and liked to fool people into thinking it was gold. When held up to a bright light, it would really turn on and sparkle and glitter, but when the bright lights were taken away its personality faded and its color turned to a dull dirty yellow.

One of the most exciting rocks (a piece of pumice) I ever owned was a terrific swimmer. I found it wandering around on Mount St. Helens one day. I'll let you decide who was wandering, me or the rock. Anyway, I brought it off the mountain and tossed it into Spirit Lake and to my enjoyment and amusement it swam. I brought the rock home and let it put on swimming demonstrations for my children and neighbors. It had a sad demise. One day one of children took it swimming and forgot about it. When I chanced upon it there my rock lay on the bottom of the bathtub all waterlogged and drowned.

I had two other pet rocks, angular pieces of bull quartz, that I bought at Ray Rock Springs on the Stevens Pass Highway. They were either madly in love or hated each other with a passion—I was never able to figure out which. They were both a beautiful translucent white and when rubbed together in the dark would spark in a most wonderful way. As I say, I never did know if they were sparks of passion or hate. Anyway, either way I didn't think it was too good to keep them together so I got rid of them.

I still have one rock that keeps me busy. It is a piece of itacolumite (flexible sandstone) from North Carolina. I presume it became permanently inebriated on "mountain dew" before it left the beautiful Smoky Mountains because now when it is held upright it staggers and wobbles about in a most distressing fashion. I have tried to straighten it out but every time I remove my support it slumps over in the most discouraging way as if to say, "Aw, whats the use." Anyway, it is the saddest rock I have ever owned and presents a very forlorn figure as it shudders and totters from side-to-side whenever someone tries to hold it upright. I might add that practically everyone in our office has taken a shot at straightening up this pet rock but no one has succeeded. If you stop by our office, feel free to see it in action.

I guess there is one last pet rock I should mention. I had to get rid of it because it caused so much trouble. It was a pseudocoprolite from Salmon Creek down in Lewis County. It was a real trickster and deceiver in that it looked so real you felt a little squeamish about picking it up. My father-in-law borrowed it one day to show some friends who owned a couple of dachshunds. Grandpa, being the mischievous type, put the pet rock carefully in the middle of a brand new davenport without telling anyone. When the mistress of the house spied it, she didn't ask any questions, but dispatched the dogs out of the door with considerable enthusiasm and a couple of comments that would have warmed the cockles of a muleskinner's heart.

Well, there it is, now you know. I have owned pet rocks for years and am not ashamed of it. It has been a choice experience, I have learned much, and I wouldn't have missed it for the world.

Ted Livingston

U.S. GEOLOGICAL SURVEY 7½-MINUTE TOPOGRAPHIC QUADRANGLES
(Maps received in the division library since January 1, 1976)

Name	Photo revised	Longitude (indicates southeast corner)	Latitude	County
Bremerton East	1968;1973	122°30'00"	47°30'00"	Kitsap
Buckley	1968;1973	122°00'00"	47°07'00"	Pierce, King
Burley	1968;1973	122°37'30"	47°22'30"	King, Pierce
Cumberland	1968;1973	121°52'30"	47°15'00"	King
Edmonds East	1968;1973	122°15'00"	47°45'00"	Snohomish, King
Everett	1968;1973	122°07'30"	47°52'30"	Snohomish
Fall City	1968;1973	121°52'30"	47°30'00"	King
Juniper Beach	1968;1973	122°22'30"	48°07'30"	Snohomish, Island
Lake Lawrence	1973	122°30'00"	46°45'00"	Thurston, Lewis
Maytown	1968;1973	122°52'30"	46°52'30"	Thurston
McKenna	1968;1973	122°30'00"	46°52'30"	Thurston, Pierce
Olalla	1968;1973	122°30'00"	47°22'30"	Kitsap, King, Pierce
Port Townsend North	1973	122°45'00"	48°07'30"	Jefferson, Island
Poulsbo	1968;1973	122°37'30"	47°37'30"	Kitsap
Puyallup	1968;1973	122°15'00"	47°37'30"	Pierce
Selah	1974	120°30'00"	46°37'30"	Yakima, Kittitas
Snohomish	1968;1973	122°00'00"	47°52'30"	Snohomish
Toppenish	1974	120°15'00"	46°22'30"	Yakima
Wapato	1974	120°22'30"	46°22'30"	Yakima

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