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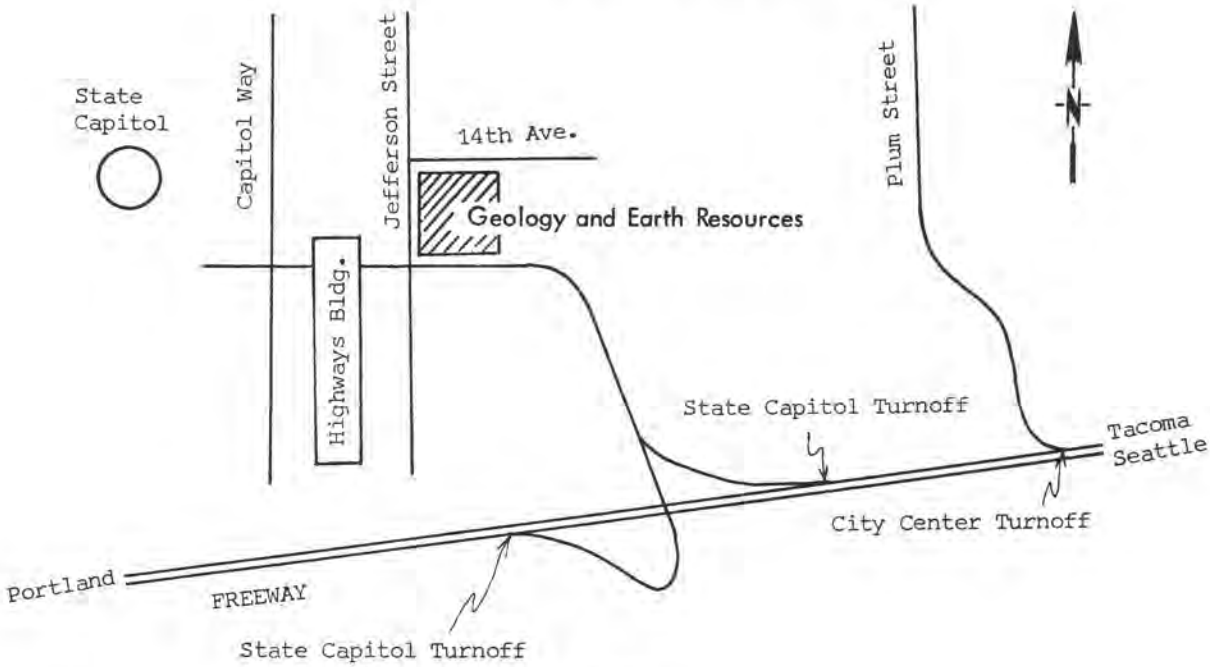

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COVER PHOTO

A sunny day in late summer provides an excellent opportunity to view active glacial processes on Mount Rainier before winter snows bury details, such as the crevasses in the Ingraham and Cowlitz glaciers.
Smith-Fiksdal photo.

EXPLORATION FOR URANIUM IN WASHINGTON DURING THE BICENTENNIAL YEAR

by

John M. Lucas

An article recently published in the Spokane Daily Chronicle listed the names of 29 companies known to be actively exploring or developing their land holdings in Pend Oreille, Stevens, Spokane, and to a lesser extent, Lincoln and Ferry Counties. Several companies, suspecting broad similarities between certain sedimentary formations of western Washington and uranium-producing formations of the Colorado Plateau, have expanded their exploration efforts west of the Cascade Mountains. In addition to the 29 companies known to be actively exploring for uranium in the state, there are perhaps an equal number of other organizations also doing exploration work.

The uranium deposit of Midnite Mines, Inc. on the Spokane Indian Reservation in Stevens County is still the only deposit from which uranium is currently being mined. The mine, located northwest of Wellpinit, is being developed, operated, and expanded by Dawn Mining Co., a consortium controlled jointly by Newmont Mining Co. (51 percent) and the Spokane-based Midnite Mines, Inc. Like many pioneer mines elsewhere, the property serves as the hub around which much of the competitive exploration activity begins or revolves. Most of the newly arrived companies, openly or otherwise, commence their exploration with a visit to the Spokane Indian Reservation and(or) the Midnite mine area, then spin-off from this center to explore lands, which in their individual opinions, exhibit conditions similar to those at the Midnite mine or other uranium-producing areas with which they may be familiar.

The ore deposits at the Midnite are essentially tabular or lens-shaped bodies of uranium-bearing minerals developed at or along the contact between the Precambrian metasedimentary Togo Formation and Cretaceous(?) granitic rocks of the Loon Lake batholith. The principal ore minerals are pitchblende and coffinite, with abundant pyrite and marcasite. Autunite is the principal near-surface secondary ore mineral; the fluorescent property of this mineral under ultraviolet light led to the original discovery of the deposit in 1954 by prospectors plying their trade by night with the aid of a portable black light.

The ore deposits are believed by some investigators to have originated as a result of the leaching of primary uranium minerals from the adjacent Loon Lake granitics and their subsequent redeposition along the intrusive-metasedimentary contact. Redeposition of these minerals at the contact could have been promoted by a variety of factors, including changes in porosity and permeability, ground-water levels, and chemical environment. The thickest and richest deposits appear to be confined to troughs or depressions, as well as sheared or schistose zones at the contact. These features have apparently served as natural traps capturing dissolved uranium moving in solution from its points of origin.

Others who have studied these deposits contend that the ore may have originated as the direct result of hydrothermal processes related to the intrusion of the older surrounding rocks by various phases of the Loon Lake batholith, later modified and enriched by the action of ground water.

Western Nuclear's Sherwood mine, which contains substantial uranium reserves, is located about 8 miles south of the Midnite property. Though this mine is still in the process of development, it ranks as the second major uranium deposit in the state. The uranium mineralization at the Sherwood mine is quite unlike the mineralization so far discovered at the Midnite. The mineralization, consisting of autunite, occurs in a cobble conglomerate at the base of the Tertiary

Gerome Andesite, a series of volcanic flows, breccias, tuffs, and interbedded sedimentary rocks that unconformably overlie the same intrusive batholith against which the Midnite ores are found. The Gerome Andesite with its mineralized sediments is thought to occupy a shallow northwest-trending trough in the underlying batholith. The uranium deposit, however, is not developed at the granite contact. Here, as at the Midnite, the source of the uranium mineralization is uncertain

Whatever the origins of the original deposits were, it seems certain that the uranium mineralization at both of these deposits, as well as at prospects elsewhere in northeastern Washington, is in some way directly related to one or more of the various plutonic phases of the extensive Kaniksu, Colville, and Loon Lake batholiths. Secondary enrichment modified and controlled to a certain extent by local faulting and lithology along the intrusive contacts has also played an important role in producing a minable product at both the Midnite and Sherwood mines. Hopefully, continued exploration will reveal other equally rich deposits of this vital commodity.

Guided by the basic concepts outlined above, combined with the aid of advanced ground and(or) airborne radiometric techniques including Track Etch and alpha- and gamma-ray spectrometry, numerous companies and individuals have zeroed-in on batholiths of the eastern Okanogan Highlands physiographic province, especially those areas where the batholiths contact the county rock.

All of this interest has led to a considerable increase in mineral leasing on private, state, and federal lands. A spokesman for the 150,000-acre Spokane Indian Reservation, within which the Midnite and Sherwood mines are located, recently estimated that prospecting or development permits covering roughly 99 percent of their reservation lands have been issued. In excess of 130,000 acres or nearly 60 percent of the available state lands in northeastern Washington have been acquired specifically for uranium prospecting. In addition to holding large areas of state and private lands, the companies have also staked claims on a considerable area of public lands within the Colville and Kaniksu National Forests.

The possibility of ultimately applying newly developed techniques of in-situ or heap leaching to some of the lower-grade deposits seems to have captured the interest of some of the companies. With these new techniques obviously in mind, a number of companies are rumored to be searching for previously unrecognized porphyry-type uranium deposits that may be amenable to this recovery process. A 500-ppm uranium threshold over a large area seems to constitute a minimum target. It is not known whether or not this sort of deposit has actually been discovered within the state.

A number of the major energy and mineral companies have been exploring the northeastern part of the state for several years; however, it has only been within the last year or so (since the radical increase of uranium prices) that the general public has become aware of their presence. Some of the companies or landholders that may be classed as old timers include Midnite Mines, Western Nuclear, Evergreen Minerals, Painted Desert Oil and Uranium, Atomic Silver and Uranium, and Solar Silver. A sizeable number of claims or prospects dating back to the uranium boom of the 50's have been maintained over the intervening years by various companies and individuals; many of these properties now serve as nuclei around which some of the more recent arrivals have assembled their land holdings.

Major out-of-state companies that are known to have been active in the northeast part of the state for a period of several years or more include Exxon, U.S. Steel, Reserve Oil and Minerals Corp., Burlington Northern and Westinghouse (BurWest), Kerr-McGee, Westinghouse (Wyoming Minerals), Pechiney Ugine Kuhlmann Development (P.U.K.), and General Electric (Utah International).

Exxon, which controls quite a large area of land in Stevens and Pend Oreille Counties, recently completed a core drilling program several miles north-

west of the Midnite mine; drilling and investigation is continuing on another prospect area west of Tiger in Pend Oreille County. U.S. Steel is actively exploring their large land holdings in Stevens County, northeast of Colville between Old Dominion Mountain and Twin Lakes. Inspiration Development, St. Joe American Corp., and several other companies are also believed to have interests or claims in this same general area.

Kerr-McGee is said to have numerous claims in Pend Oreille County midway between Usk and Chewelah, as well as some area west of the Columbia River in Ferry County.

Pechiney (P.U.K.) of France has been very active lately in northeastern Washington. They control several large tracts of land in Pend Oreille County on both sides of the Pend Oreille River and just recently completed drilling a number of holes in the South Skookum Lake area. The largest corporate landholder in both Stevens and Pend Oreille counties is reported to be Reserve Oil and Minerals. This company was quite active in 1975.

Continental Oil Co. recently expanded the size of their exploration staff to nearly two dozen members, apparently to expedite coverage of their lands in northeastern Washington.

Other domestic companies rumored or known to be interested or involved in Washington uranium are Getty Oil, International Minerals and Chemicals, Kennecott Exploration, Minerals Exploration (Union Oil), Rocky Mountain Energy (Union Pacific), Teton Exploration (United Nuclear), Union Carbide, Gulf Minerals, Dennison Mines, and Wold Nuclear.

In addition to Pechiney, quite a few other foreign companies are interested in or exploring in northeastern Washington, and westward into Ferry and possibly Okanogan Counties. Some of these companies are A.G.I.P. (Italian), Urania Investment (French), Rio Amex (British), Uranertz and Urangazelshaft (German), Sumimoto and Mitsubishi (Japanese), and Colt Resources and Teck Corporation (Canadian).

Other company names that popped up here and there during my investigation include Mineral Associates Inc., Metaline Mining and Leasing, Helena Silver, Empire Exploration, Champion Gold and Silver, and Producers Land Corp.

In Ferry County west of the Columbia River, several individuals and companies have been tying-up and investigating the pegmatitic uranium deposits in various areas around Sherman Pass and Nancy Creek. These deposits are mostly very low-grade; however, with the increasing value of uranium, the day they become minable may not be too far away.

In conclusion, we hope that the steady growth of uranium exploration in Washington State will ultimately help to bolster the world's uncertain supplies of this fuel. Additional benefits may perhaps be derived from both the increased awareness of exploration by the general public and a better understanding of the state's geology through exploration, which may in turn lead to the discovery of deposits of other minerals vital to the economic health of both the state and the nation.

AEG MEETING HELD

The September 10th dinner meeting of the Washington State section of the Association of Engineering Geologists was held in Seattle.

A "standing room only" crowd enthusiastically greeted Howard Coombs as he related highlights of 40 years as an engineering geologist. While serving as educator, professor, and geology department chairman at the University of Washington, Howard was also called upon as an expert engineering geological consultant for numerous projects throughout the Pacific Northwest, including most of the major hydroelectric dams in our state.

Professor Coombs' slide presentation chronicled a richly stimulating and rewarding career in earth

science. He continues his vital role in northwest geology, even though formally retired from the university. Howard has just recently been chosen as a member of an expert federal team picked to investigate and determine the cause of the Teton dam failure.

GUIDEBOOK TO MINING SITES NOW AVAILABLE

The U.S. Bureau of Mines has published a 70-page guidebook on mines of the past and present in the Pacific Coast states (Alaska, California, Hawaii, Oregon, and Washington) to aid students and tourists interested in mining.

Many historic and modern sites associated with minerals and mineral production are well illustrated. The sites are readily accessible by public roads; their locations are shown on the accompanying state maps.

Because of the gold-mining production history of Alaska and California, most of the booklet is devoted to these states. However, the section on Washington includes the early-day gold mining districts, the lead-zinc area, and the strip mine that now produces coal for the steam-electric plant at Centralia, as well as other mining areas.

"Mining and Mineral Operations in the Pacific States: A Visitor Guide" can be purchased for $2.15 a copy from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. It is available for reference use in the Division of Geology and Earth Resources library.

"FORD ELECTED PRESIDENT"

The National Association of State Land Reclamationists held their annual meeting on September 13-15 in Marquette Michigan. The association's goal is to help members accomplish effective rehabilitation of mined lands and to share the experience of the reclamation experts.

Donald M. Ford, assistant supervisor of the Division of Geology and Earth Resources, heads Washington State's land reclamation program. He served as vice president of the national association last year; this year he was elected president for 1977. Ford said, "The location of next year's meeting has not been determined at this time. We are now considering bids from three states—Illinois, Washington, and West Virginia. Thirteen states are now members of the association and we are encouraging other states to join."

NORTHWEST MINING ASSOCIATION CONVENTION COMING UP

"Gold and Silver Deposits in the Pacific Northwest" will be the theme for the 82nd Annual Convention of NWMA to be held at the Davenport Hotel in Spokane on December 3-4, 1976.

Speeches and discussions during the Technical Sessions will include: Source of supply, markets, and uses of gold, silver, and platinum-group metals; precious metal mining; problems and solutions to industrial waste disposal; smelting and environmental considerations; and gold, silver, and platinum-group deposits in the Northwest.

A pre-convention Short Course on Mineral Industry Costs (Nov. 30-Dec. 2) sponsored jointly by the University of Idaho and NWMA, will update the costs of exploration, development, and operating.

For information on registration contact the Northwest Mining Association, W. 1020 Riverside Ave., Spokane, WA 99201 (509 624-1158).

Communication is the essence of science -- Sir Francis Klick

[Co-discoverer of the structure of DNA, 1953]

STATE GEOLOGIC PUBLICATIONS AVAILABLE IN SPOKANE

Geologic reports published by the Division of Geology and Earth Resources may be purchased across the counter at Northwest Mining Association, West 1020 Riverside Ave., Spokane, Washington. The reports are available both across the counter and by mail order at the Division of Geology and Earth Resources in Olympia.

U.S. GEOLOGICAL SURVEY OPEN-FILE REPORTS

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

Collection, chemical analysis, and evaluation of coal samples in 1975, by V. E. Swanson and others, 503 p. Open-file Report 76-468. [Washington sample descriptions and analyses, p. 480-485.]

Minor and trace elements in coal—A selected bibliography of reports . . . January 1976, by the U.S. Geological Survey, 16 p. Open-file Report 76-481.

Potential hazards from future eruptions of Mount St. Helens volcano, Washington, by D. R. Crandell and D. R. Mullineaux, 25 p. Open-file Report 76-491.

Geology of the Deep Creek area, Washington, and its regional significance, by R. G. Yates, 435 p. Open-file Report 76-537

Geophysical survey of uranium mineralization in alaskitic rocks, eastern Washington, by V. J. Flanigan, 25 p. Open-file Report 76-679.

DIVISION RELEASES OPEN-FILE MAPS

The Division of Geology and Earth Resources has placed the following maps on open file; they may be inspected in the division reference library:

Preliminary geologic map of the La Connor quadrangle in Skagit County, Washington, by E. R. Artim and J. M. Wunder. Scale - 1:24,000.

Preliminary geologic map of the Utsalady quadrangle, Skagit and Snohomish Counties, Washington, by J. M. Wunder. Scale - 1:24,000.

Surficial geology of northeast Tacoma, Pierce County, Washington, by Mackey Smith. Scale - 1:24,000.

Preliminary geologic map of the Brinnon area, Jefferson County Washington, by R. J. Carson. Scale - 1:24,000.

Relative compressibility of the Brinnon area, Jefferson County, Washington, by R. J. Carson. Scale - 1:24,000.

Waste-disposal planning, Brinnon area, Jefferson County, Washington, by R. J. Carson. Scale 1:24,000.

Preliminary geologic map of north-central Mason County, Washington, by R. J. Carson. Scale 1:62,500.

PRICE INCREASES FOR USGS TOPO MAPS

Prices for 7.5- and 15-minute standard topographic quadrangle maps have increased to $1.25 each. This same price hike also applies to 7.5-minute orthophotoquads and orthophotomaps, which are aerial photographs in map form or maps with backgrounds made from aerial photos. The 7.5-minute maps have a

scale of 1:24,000; the 15-minute maps are at a scale of 1:62,500.

The standard 1:250,000 scale (1 inch represents 4 miles) and the standard 1:1,000,000 (1 inch represents 16 miles) topo maps are now $2 each.

The USGS maps are sold directly by the Survey and also by many private dealers. Indexes to the topo maps and an information booklet on topographic maps and symbols are available upon request from the USGS Distribution offices at 1200 S. Eads St., Arlington, VA, 22202; Federal Center, Box 25286, Denver, CO, 80225; and 310 First Ave., Fairbanks, AK, 99701.

RECENT U.S. GEOLOGIC REPORTS ON AREAS IN WASHINGTON

Bortleson, G. C.; Foxworthy, B. L., 1975, Relative susceptibility of lakes to water-quality degredation in the southern Hood Canal area, Washington: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-853-B.

Cady, W. M., 1974, Volcanic rocks of the Olympic Peninsula, Washington. In Northwest Science Association Annual Meeting, 47th, Vancouver, B.C., May 1974, Program and Abstracts, p. 26.

Cady, W. M., 1975, Tectonic setting of the Tertiary volcanic rocks of the Olympic Peninsula, Washington: U.S. Geological Survey Journal of Research, v. 3, no. 5, p. 573-582.

Clifton, H. E.; Phillips, R. L., 1976, Pleistocene estuaries on the southern Washington coast [abstract]: Geological Society of America Abstracts with Programs, v. 8, no. 3, p. 362.

Crandell, Dwight R., 1976, Preliminary assessment of potential hazards from future volcanic eruptions in Washington: U.S. Geological Survey Miscellaneous Field Studies Map MF-774, map and text on one sheet, scale 1:1,000,000.

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Forn, C. L.; Whittington, C. L; McDanal, S. K., 1975, Magnetic tape containing spectrographic and chemical analyses of stream sediments and rocks from the Alpine Lakes study area and additions, Washington: U.S. Department of Commerce, National Technical Information Service, PB-240-487/AS, p. 2 + tape.

Frank, David; Post, Austin, 1976, Documentation of thermal changes by photographs of snow and ice features at Mount Baker, Washington [abstract]: EOS, Transactions of the American Geophysical Union, v. 57, no. 2, p. 87.

Helz, R. T.; Swanson, D. A., 1976, Analysis and interpretation of chemical trends in the youngest unit of Yakima basalt, central Columbia Plateau, Washington [abstract]: Geological Society of America Abstracts with Programs, v. 8, no. 3, p. 380.

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Miller, F. K.; Engels, J. C., 1975, Distribution and trends of discordant ages of the plutonic rocks of northeastern Washington and northern Idaho: Geological Society of America Bulletin, v. 86, no. 4, p. 517-528.

Mullineaux, D. R.; Hyde, J. H.; Rubin, Meyer, 1975, Widespread late glacial and postglacial tephra deposits from Mount St. Helens volcano, Washington: U.S. Geological Survey Journal of Research, v. 3, no. 3, p. 329-335.

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Nash, J. T.; Lehrman, N. J., 1975, Geology of the Midnite uranium mine, Stevens County, Washington—a preliminary report: U.S. Geological Survey Open-file Report 75-402.

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Robbins, S. L.; Burt, R. J.; Gregg, D. O., 1975, Gravity and aeromagnetic study of part of the Yakima River basin, Washington: U.S. Geological Survey Professional Paper 726-E.

Sato, Motoaki, Malone, S. D., Moxham, R. M.; McLane, J. E., 1976, Monitoring of fumarolic gas at Sherman Crater, Mount Baker, Washington [abstract]: EOS, Transactions of the American Geophysical Union, v. 57, no. 2, p. 88-89.

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In addition to these reports, summaries of significant results of most current projects are contained in U.S. Geological Survey Professional Paper 975.

UNITED STATES ENERGY OPTIONS RUNNING OUT

According to Dr. Thomas Falkie, Director, U.S. Bureau of Mines, this country does not have that many optional energy sources to choose from for purposes of domestic development.

Speaking at an energy seminar in Colorado recently, Falkie explained that most of the current attempts to shift energy development to different resources are predicted on false reasoning; reasoning that maintains the United States has numerous other energy options from which to choose.

"This is no longer true," asserted Falkie. "We can only count on the resources we have, and the largest is coal."

Falkie noted that there have been "repeated attempts to push energy developments 'elsewhere', and these attempts are tending to force the country into a no-growth posture." He also was concerned that such a posture could adversely affect the country's national security.

Dr. Falkie felt that there were abundant known coal resources in the territorial United States to be tapped. He said a national lack of determination to use America's extensive resources was the cause of the uncertain outlook and present stumbling blocks to increased coal output.

Outlining a number of problem areas impeding expanded coal production and consumption, Falkie considered "the most serious and immediate problems affecting long-term coal availability to be the uncertainty stemming from unresolved clean-air issues, pending environmental legislation, and the continuing threat of intervention by preservationists who resist the development of coal resources and the siting of coal-burning facilities."

Dr. Falkie felt that "the long-term capability of the United States to determine its own future is at stake." "If we are to have adequate energy" he said, "we must burn more coal."

Ellis Vonheeder

YOUR STATE GEOLOGIST REPORTS

I attended the Department of the Interior hearing in Salt Lake City on September 8 and 9, 1976. The purpose of the hearing was to provide input from the public into the study that is being made on land withdrawals by the Department of the Interior's Mineral

Lands Availability Task Force. The objectives of the task force are to: (a) determine how much land has been withdrawn from mineral entry, (b) review present policy dealing with land withdrawals, and (c) investigate alternatives to the present policy.

Two full days of testimony included speakers representing industry, environmental groups, states, counties, cities, and individuals. The overwhelming consensus expressed was that too much federal land has been withdrawn from mineral entry. Speaker after speaker warned that we are looking down the gun barrel so far as mineral resources availability are concerned and that continued withdrawals will most certainly result in adverse economic consequences. There were many suggestions made about what should be done; simplistically summed up, the conclusions were: No more land should be withdrawn, and currently withdrawn areas (with some exceptions) should be opened to mineral entry.

There was very little acrimony displayed by those giving testimony, and none by the members of the task force. The members appeared honestly interested in defining the problems and looking for answers. So far as the hearings were concerned, they were interesting and informative—what will happen as a result of the hearings is another question. Just how much the Department of the Interior can do to cure the problems is questionable. So much of the land has been withdrawn by congressional action; I am sure there is little the Interior can do to change this. Also, the Forest Service was not represented at the hearings (I understand they were invited), so I doubt that we can hope to see much change in the Forest Service policy. The ball is now in the court of the task force—when they return it, we will know how we stand.

Ted Livingston

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