The Ore Bin

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The Ore Bin

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The ORE BIN
Volume 37, No. 10
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SOME RADIOCARBON DATES IN SURFICIAL DEPOSITS OF THE PORTLAND AREA

Paul E. Hammond
Department of Earth Sciences, Portland State University

Five samples of carbonized wood fragments were obtained from borehole drillings by local engineering firms. Two samples were obtained from a borehole located near the corner of S.W. Barnes and Miller Roads atop the West Hills. One sample was taken in silty clay at 730 feet (222.5 m) above sea level, giving an age of greater than 40,000 years. The second sample was taken from the same borehole in scoria of Boring Lava at 725 feet (221m) above sea level. The age is also greater than 40,000 years. These dates indicate that Boring Lava volcanism occurred here more than 40,000 years ago, and that at least part of the volcanic deposits in this area were covered by sediments more than 40,000 years ago.

The third sample was taken at 17 to 18.5 feet (5.2 to 5.6 m) below sea level in a borehole from a dock along the west bank of the Willamette River north of Linnton. The sample was in gray silt and gives an age of 4,800 $\pm$ 100 years ago.

The fourth and fifth samples were taken from another borehole nearby on the bank. The fourth, in similar gray silt, at 27 to 28$\frac{1}{2}$ feet (8.2 to 8.7 m) below sea level, gave an age of 5,420 $\pm$ 100 years ago. The fifth, of special interest because it was obtained from a thin layer of volcanic ash at 42 to 43$\frac{1}{2}$ feet (12.8 to 13.3 m) below sea level, gives an age of 6,490 $\pm$ 100 years ago. This layer of ash may be from the climactic eruption of Mount Mazama dated variously as about 7,000 years ago (Kittleman, 1973, p. 2950) or 6,600 years ago (Fryxell, 1965, p. 1288), but because the radiocarbon analysis obtained for this ash indicates a younger age of about 100 or more years, possible correlation of the ash layer with Mazama or other Cascade volcanic eruptions must await petrographic analysis.

The ages of the last three samples reveal the youthfulness of the sedimentary filling in the Portland basin. The deepest sample has the oldest age and the shallower samples have progressively younger ages, indicating a gradual filling of the basin. If the assumption is made that the sediments were deposited at a level near the average elevation of the stream surface and not in a deep pool within the stream channel, it can be surmised that

(1) the Portland basin has been subsiding during the past 5,000 or more years, (2) the sediments have been compacting, or (3) sea level has been rising during the same period of time, thus raising the level of the Columbia and Willamette Rivers in this area. If I assume that the ages of the samples represent sedimentary accumulation and/or subsidence, the average rate can be determined:

Elevations of samples	Ages (years)	Rate
17'-18.5' (5.2-5.6 m) below sea level	4,800±90	10' (3 m) per 620 years
27'-28.5' (8.2-8.7 m) below sea level	5,420±100	15' (4.6 m) per 1,070 years
42'-43.5' (12.8-13.3 m) below sea level	6,490±100	

Between the bottom two samples, 15 feet (4.6 m) of sediments accumulated in about 1,070 years, for an average of 0.17 inch (.43 cm) per year. Between the top two samples 10 feet (3 m) accumulated in about 620 years, for an average of 0.19 inch (0.49 cm) per year. Thus, until studies of the sediments can be made to determine their level of stream deposition, and additional dates on sediments at scattered locations at different depths can be obtained, the possible rate of accumulation and/or subsidence in the Portland basin could be about 0.18 inch (0.46 cm) per year.

Additional samples of both carbon material and basaltic rock obtained in boreholes are being requested by the Department of Earth Science, Portland State University.

Funding for dating the samples was provided by the Publication and Research Committee at Portland State University. The dating was determined at the Radiocarbon Dating Laboratory at the University of Washington. Samples were provided by Gennaro Avolio of CH_2M Hill and Dan Griswold of Foundation Sciences, who reviewed an early draft of this paper. Ken Robbins of Dames and Moore and Larry Kittleman of the University of Oregon are thanked for their discussions of the volcanic ash and its significance. A. W. Fairhall of the University of Washington is also thanked for the analyses and his review of the paper.

References

Fryxell, Roald, 1965, Mazama and Glacier Peak volcanic ash (layers): relative ages: Science, v. 147, p. 1288-1290.

Kittleman, L. R., 1973, Mineralogy, correlation, and grain-size distributions of Mazama tephra and other post-glacial pyroclastic layers, Pacific Northwest: Geol. Soc. America Bull., v. 84, p. 2957-2980.

* * * * *

FIBERS FROM BASALT

Basalt covering large areas of Washington, Oregon, and Idaho could provide the raw material for a profitable new Northwest industry, according to Dr. Richard Dailey, Associate Professor of Economics and Director of the University of Idaho's Center of Business Development and Research. His findings are based on cooperative research between the University and Washington State University. Basalt fibers can be manufactured economically, Dr. Dailey states, and are superior in many applications to more conventional materials, such as glass fiber, rock wool, or asbestos.

Experiments showed that the fibers form easily in a temperature range of 1300° to 1370°C. The finest fibers had a silk-like sheen and were golden brown, soft, and flexible enough to be spun and woven into fabrics. European and Russian reports show that basalt fiber products can almost entirely replace glass fiber and asbestos products.

Dailey believes that the basalt fibers could wholesale for less than 20 cents per pound. By comparison, textile glass fibers average 44 cents per pound, wool glass fibers run 29 cents and various types of asbestos fibers range from 12 to 51 cents. Further research at the two schools will be directed toward applications of the basalt fibers.

A copy of the report "Economic Criteria for Producing Basalt Fibers in the Pacific Northwest," by Dean Wullenwaber and Richard T. Dailey may be consulted in the Oregon Department of Geology and Mineral Industries library in Portland.

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OIL AND GAS WELL RECORDS RELEASED

The Department released to open file on September 1, 1975 all the well records on the Standard Oil Company "Blue Mountain Unit No. 1." The hole was drilled in the summer of 1973 to a total depth of 8,414 feet. The well was located in the NW¼SW¼ sec. 34, T. 37 S., R. 41 E., Malheur County, approximately 30 miles north of McDermitt, Nevada and 4 miles west of U.S. Highway 95.

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GEOTHERMAL WELL RECORDS TO BE RELEASED

The Department will release to open file on November 15, 1975 all well records on the Gulf Oil Company Favell-Utley No. 1 geothermal drilling in Lake County. The hole was drilled in the NW¼NE¼ sec. 17, T. 39 S., R. 20 E., approximately 1½ miles south of Hunters Hot Spring. Total depth reached in the drilling was 5,440 feet.

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OUR MINERAL SUPPLY IN JEOPARDY

The mineral account in America's land bank is in danger of becoming overdrawn, according to a study on withdrawals of Federal land from mining and mineral leasing just completed by two Interior Department employes.

The study is a bombshell, although it was completed by the two volunteer researchers on their own time and effort over an 18-month period and is strictly their own independent survey. [See table on opposite page.] It is not backed officially or unofficially by the Interior Department.

Gary Bennethum, staff assistant to the Assistant Secretary of Interior for Land and Water Resources, and L. Courtland Lee, a geologist in the Division of Mineral Resources of the Bureau of Land Management, have made an in-depth survey of withdrawals vis-a-vis mining and mineral leasing laws.

Their conclusions are that:

The Federal agencies have "firmly withdrawn nearly 400 million acres from the operation of the (1872 Hardrock) Mining Law and over 500 million acres" of Federal land from the mineral leasing laws. "In addition, over 100 million acres for the mining law and 70 million acres for the mineral leasing laws are encumbered or are being managed in such a way as to constitute a de facto withdrawal from minerals development."

"In 1968 only about 17 percent of the 742.3 million acres of public domain was withdrawn from operation of the 1872 Mining Law" which is applicable to public domain lands which never passed out of Federal ownership. "In 1974 approximately 53 percent of our original assets were withdrawn from the mining law. An additional 14 percent was included in de facto withdrawals....In 1974 the total acreage completely or partially withdrawn from the mining law amounted to 67 percent, or two-thirds of all public lands. What is perhaps even more alarming is the fact that this situation has occurred without the knowledge of the government."

Even more Federal land has been withdrawn from mineral leasing. "In 1968 about 17 percent of the 924.2 million acres" of Federal land "theoretically available was withdrawn from the leasing laws. Another 63 million acres were encumbered by existing leases, mostly for oil and gas development....Between 1968 and 1974 the situation for mineral leasing changed dramatically. Surface managing agencies developed and implemented land-use planning systems. Also significant new legislation was enacted which severely impacted the availability of lands for mineral leasing. The result is that as of 1974, 64 percent of Federal lands had been withdrawn from our mineral leasing account. Another 9 percent was restricted by already existing leases." So, overall, 73 percent of all Federal land was totally or partially withdrawn from operation of the mineral leasing laws by 1974.

"One of the major reasons this situation has occurred is the lack of any mechanism for assessing the cumulative impact of thousands of discrete or separate withdrawal actions. Each interest group working to have more land withdrawn does not consider the cumulative impact of its and other groups'

Federal Lands Excluded from Mineral Exploration and Development, 1974 (in millions of acres)

Under 1872 Hard-Rock Mining Law	
Alaska Native Claims Act	249.6
U.S. Forest Service roadless areas	55.9
Military	41.3
State selections, pending state selections, and unperfected entries	25.6
BLM roadless study areas	19.2
Wildlife refuges	15.3
Power site withdrawals	15.2
National Park System	14.6
National Wilderness System	10.7
Reclamation	5.7
BLM primitive areas (all types)	5.6
Utility corridors	5.35
Indian purposes	4.2
U.S. Forest Service proposed wilderness	3.8
Oil shale withdrawals	3.7
Alaska wildlife ranges	3.3
Proposed withdrawals	2.6
Recreation	1.9
Atomic Energy Commission	1.4
BLM Classification Act	0.7
Wild and Scenic Rivers	0.5
Small Tract Act	0.5
Natural areas	0.3
Miscellaneous	7.6
Total closed to mining under 1872 law	495.
Total theoretically open*	247.

Under mineral leasing laws	
Alaska Native Claims Act	249.6
U.S. Forest Service roadless areas	55.9
Military	48.1
Wildlife refuges	28.1
State selections, pending state selections, and unperfected entries	25.6
National Park System	24.6
BLM roadless study areas	19.2
Power site withdrawals	15.2
National Wilderness System	11.6
BLM primitive areas (all types)	5.6
Utility corridor in Alaska	5.3
U.S. Forest Service primitive areas	3.8
Oil shale	3.7
Proposed withdrawals	1.2
TVA acquired land	0.9
Indian purposes	0.8
Atomic Energy Commission	0.7
Wild and Scenic Rivers	0.5
Oil reserve buffer zone	0.1
Miscellaneous	26.
Closed to leasing, subtotal	526.
Acreage already under lease	73.8
Total closed to new leasing	599.8
Total theoretically open**	224.4

*Includes land under lease and 10 million mining claims
**Coal leasing now suspended on Federal lands

successful efforts....Since the size of the total (mineral) account has been assumed to be limitless and since no overall accounting is kept, withdrawals have been encouraged with little regard for their cumulative effect."

"We think some attention will have to be paid to the trend toward accelerated withdrawals because it seriously erodes the long-range mineral position of this country. It affects our economy, our ability to protect jobs, and it is forcing American industry to look elsewhere for minerals. It makes us vulnerable to mineral cartels like the OPEC oil cartel."

(From Western Resources Wrap-up, Series XI, No. 35, Aug. 28, 1975)

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BLM RESUMES ACTION ON OIL AND GAS LEASE APPLICATIONS

Funds have been allocated this fiscal year for the Bureau of Land Management to start processing the backlog of oil and gas leasing applications in Oregon and Washington that have been on file since November 1971.

Standard BLM procedure is to conduct an environmental analysis prior to the issuance of a lease and attach as conditions of the lease detailed stipulations to insure the protection of the environment. In addition, before operations commence, detailed plans must be submitted by the lessee and approved.

An environmental assessment recently was completed by the Salem BLM district for the Columbia planning unit, almost all of which is located in Columbia County. As a result of this assessment, the District Manager recommended that, with the stipulated safeguards, leasing should proceed in this planning unit. Issuance of Federal leases should encourage Reichhold Energy Corp. to drill its acreage in Columbia County this year.

* * * * *

ORE BIN INDEX REVISED AND ENLARGED

A 50-page author and subject index for The ORE BIN covering the period 1950 through 1974 has been published by the Department as Miscellaneous Paper 13, Revised. The new index includes the work done for the original 1950-1969 version plus additional entries from that period and the more recent literature since 1969. The new edition was prepared by Nora T. Mussotto and edited by Carol S. Brookhyser.

"Index to The ORE BIN, 1950-1974," Miscellaneous Paper 13, Rev., is for sale by the Department at its Portland, Baker, and Grants Pass offices for $1.50.

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Bull. 57 - Lunar Field Conference Guidebook, 1965 — 3.50 _____

Field trips outlined to 1) Devils Hill, Broken Top and Lava Butte; 2) Newberry Volcano; 3) Hole-in-the-Ground and Fort Rock; 4) Belknap Crater, Yapoah Crater, and Collier Cone; 5) Crater Lake

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GEOLOGY AND MARINE ARCHAEOLOGY

James S. White
Oregon Department of Fish and Wildlife

A recent article in Cosmopolitan magazine described treasure diving as a combination of history, meteorology, shipbuilding, metallurgy, sociology, weapons, and chemistry. They forgot geology. In History Under the Sea, the Smithsonian's publication on marine archaeology, Mendel Peterson discusses digging out an underwater wreck, removing the "overburden," including the ballast. Again geology is forgotten.

Why geology? As a means of tracing the vessel. When sailing ships (and others) were built, rocks were placed in the bilge area to weight and hold the ship upright. Ships without heavy cargo needed more weight, ships with freight to haul had less ballast. So - ships were initially ballasted with local rocks, then in their travels some stones were dropped off, some gained. In other words, ballast rock in the worm-eaten, rotted hull can give the investigator clues to where the ship was built and where it went, just as dirt and lint in trouser cuffs and in shoes give crime-lab detectives clues to where the suspect has been.

As an example, the lumber schooners that plied the Pacific Coast in the late 19th century were largely ballasted with local basalt, normally quarried from a convenient location. A wreck at Seabeck, Washington and another in Gig Harbor, Washington were ballasted with quarried basalt, easy enough for a geologist to recognize.

But why do we need a geologist? Because both of these wrecks are nearly devoid of remaining wood - a mere hundred years (more or less, depending on the type of wood) of teredos and rot have completely removed it. The iron work is also completely oxidized, not enough iron remaining to activate a metal detector. Brass pins and spikes may remain, but they were not generally used before 1850. Nothing comparable, however, happens to the rock ballast.

Another wreck lies on the bottom near Manzanita, Oregon. Of this one, about all that remains is the pattern of ballast rock. Unlike the old schooners' ballast, this ship's rocks are rounded, picked up from some beach or river bed. This was ballasting practice prior to about 1820, when it seems to have been abandoned in favor of quarried rock whose square corners helped to prevent shifting in rough seas.

Geology establishes that the Manzanita wreck is not a local vessel, for the ballast* found low in the pile (and thus most likely original ballast,

*Some of the ballast rocks are on display in the museum of the Dept. of Geology and Mineral Industries, 10th floor, State Office Building, Portland.

Some ballast rocks from the Manzanita wreck.

since to remove all ballast is to invite capsizing) includes quantities of gneiss and quartzite, both uncommon in the port areas of western United States but common rocks of Europe. Other rocks unfamiliar to our Pacific shores but possibly from Mexico, such as dacite, suggest a stop along the way.

Eventually the excavation of the Manzanita site may reveal glassware, dishes, or other traceable artifacts. However, geology has paved the way by establishing that the pattern of rocks in the form of a ship is not a natural phenomenon and that the origin of the wreck is of sufficient interest to warrant further study.

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BLANKS IN YOUR ORE BIN?

Should you receive an ORE BIN copy with any blank pages, please let us know - a new copy will be sent immediately.

OPIE DILLDOCK IS BACK

A geographic feature in the Cascade Mountains of Oregon has now been officially named Opie Dilldock Pass in honor of the popular newspaper cartoon character of the early 1900's, the U.S. Board on Geographic Names announced.

Donald J. Orth, a geographic names expert with the U.S. Geological Survey, and executive secretary of the Board's Domestic Names Committee, said that final approval of the name for use on all Federal maps and other publications ends a long period of confusion concerning the name of the Pass.

"Over the years," Orth said, "the name of the Pass has been spelled several different ways on State and Federal maps and reports. Adding to the difficulties, the source of the name has been variously attributed to the 'opodeldoc' liniment of a 14th century alchemist, to a more recent camphor and soap liniment known as 'Knight's Opedildock,' and to the legend of an early explorer named Obie Dilldock who allegedly was buried near the Pass."

"Last December," Orth said, "the Oregon Geographic Names Board officially adopted Opie Dilldock, the cartoon character, as the original source and proper spelling for State use. At the same time, the Oregon Board asked the U.S. Board to adopt the same usage for Federal publications. At its July meeting, Opie Dilldock was one of 110 names formally adopted for use on Federal maps and other publications."

Part of the Oregon Skyline Trail, Opie Dilldock Pass is located in the Willamette National Forest of central Oregon, about 15 miles southwest of Sisters, Oregon, and provides passage for hikers between a jumbled lava rock field and the Three Sisters mountain range.

The comic strip "Old Opie Dilldock," the work of Frank M. Howarth, was syndicated by the Chicago Tribune from 1907 to 1914.

"Opie Dilldock," said Orth, "was noted for telling tall tales that had him escaping from nearly impossible situations in the nick of time. Perhaps the U.S. Forest Service rangers who named the Pass in 1932 felt that the small passageway through the lava rock field provided a typical last-minute escape route from a tight situation."

First created in 1890, the interagency Board on Geographic Names shares responsibility with the Secretary of the Department of the Interior to establish and maintain uniform geographic name usage throughout the Federal Government. The Board serves as the central authority for geographic name proposals and inquiries and develops procedures to be followed in standardizing domestic and foreign names as well as underseas and extraterrestrial feature names. The Board generally does not propose name changes, usually following a policy of recognizing present-day local usage or preference. The U.S. Geological Survey, the nation's largest civilian mapping agency, provides staff support for the Board's Domestic Names Committee.

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EVERY OREGONIAN'S SHARE OF AGGREGATE

Ralph S. Mason

Joe Pungle, his wife, and two children woke up one morning to find a 69-ton pile of sand and gravel and stone dumped on their driveway. On top of the pile was a note which read: "Dear Joe, here is your fair share of the aggregates which were produced in Oregon this year."

While Joe and his family were pondering what to do with this small mountain of industrial mineral, a truck from the State Highway Department drove up. Somebody had goofed, the driver said; he was to pick up that portion of the load which actually should have been delivered to the State Highway job a mile away. Right behind the Highway truck came two more, one from the County Road Department and one from the City Streets Division. Both claimed their fair share and drove off.

Breakfast for the Pungles was a shambles. Seven contractors, ranging from a local stonemason to a general contractor, dropped by with their pick-ups and hauled away various amounts of aggregate destined for a driveway, a patio, a fireplace, some concrete block, a landfill, a landscape job, and sidewalk repair.

By this time the pile had shrunk considerably. After a man from a local stoneyard took a load of cobbles and an employee from the railroad picked up some engine sand needed to keep the locomotive wheels from spinning on slippery rails, the pile was nearly gone.

About this time Mrs. Pungle selected several nice rounded stones for her aquarium, and a workman from a foundry drove up and took two barrels-ful of sandblast sand. This left only a few shovelsful of coarse sand, which Joe swept up carefully and put in a bucket for use on his driveway some icy morning.

The driveway was now clear, and as Joe Pungle drove to work, he understood for the first time the many uses of plain old sand and gravel and common rock. He even waved at the driver of a gravel truck he passed on the new concrete overpass.

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ALLEN GOES TO NEVADA BUREAU OF MINES

John Eliot Allen, former head of Department of Earth Sciences at Portland State University and more recently Professor Emeritus at that University, has joined the staff of the Nevada Bureau of Mines and Geology, University of Nevada, Reno, where he will serve as Geologist on Special Projects.

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LET'S GET INTO THE SWING

The men who drill for oil and natural gas from offshore platforms don't go to work on the 8:10. Instead, many of them swing up on baskets from bobbing crew boats, for seven days at a stretch. This, of course, helps the rest of us get to work in more conventional ways - by trains, buses and cars.

Unfortunately, given America's critical need for domestically produced oil and natural gas, there isn't enough offshore drilling going on. Federal and State authorities have dragged their feet on offering new acreage for exploration. As a result, offshore production is confined essentially to the Gulf of Mexico, a small area off the West Coast, and a small area off Alaska. There hasn't been a single well drilled off the U.S. Atlantic Coast.

America's Outer Continental Shelf, lying up to 600 feet beneath the sea, is an area of huge oil and gas potential. Covering 875,000 square miles, it is equal in size to all the states east of the Mississippi. While the whole shelf is not prospective petroleum acreage, the U.S. Geological Survey estimates undiscovered offshore oil reserves to be 65 to 130 billion barrels; the gas, 395 to 790 trillion cubic feet. Even Mobil's somewhat more conservative estimates indicate there's half as much oil and gas under the shelf as the U.S. has produced in its entire history, on and offshore.

Estimates are only educated guesses, of course, until there's actual drilling. But experience in the Gulf of Mexico encourages optimism. Offshore production, mostly in the Gulf, now accounts for some 16 percent of all U.S. oil production - about 1.8 million barrels a day - and for nearly 20 percent of the natural gas produced in this country.

Yet despite the promise of the offshore areas, only about 2 percent of the shelf has been leased by Washington for exploration.

More offshore drilling opportunities must be provided. And soon. For lead times in offshore petroleum development are long. From the time an offshore lease sale is announced, it can take four to seven years to find a field, delineate it, and bring it into commercial production, even in the relatively familiar waters of the Gulf. In new areas, such as the Atlantic, this process may take even longer.

America cannot afford further delay in developing this potential energy resource.

(reprinted from YEA '75, Mobil Oil Corp.)

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NORTHWEST MINING ASSOCIATION TO MEET IN DECEMBER

The Northwest Mining Association will hold its 81st annual convention December 5-7 at the Davenport Hotel in Spokane. The Association encompasses Alaska, Idaho, Montana, Oregon, Washington, the provinces of British Columbia, Alberta, and the Yukon and Northwest Territories.

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NATION'S GEOTHERMAL RESOURCES ASSESSED

"Assessment of Geothermal Resources of the United States - 1975," edited by D. G. White and D. L. Williams, and published as U.S.G.S. Circular 726, may be obtained free upon request from the U.S. Geological Survey, Branch of Distribution, 1200 South Eads Street, Arlington, VA 22202.

The report shows that natural heat is contained in rocks beneath the surface of all 50 states, and that huge quantities exist in "hot spots" in the western states and in some parts of the Gulf Coast. According to Dr. V. E. McKelvey, U.S.G.S. Director, the assessment shows that geothermal energy is an extremely important alternative energy source and that its potential is large enough to justify exploration, technological research, and development.

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REVISED U.S. COAL RESOURCES REPORTED

Coal resources of 1,731 billion tons are known and 2,237 billion tons are believed to be present in the United States, according to U.S.G.S. Bulletin 1412, "Coal Resources of the United States, January 1, 1974," by Paul Averitt. The Bulletin is for sale for $1.60 from U.S.G.S. Branch of Distribution, 1200 South Eads St., Arlington, VA 22202.

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A PIPELINE AND ARCHAEOLOGY

The trans-Alaska pipeline being built to bring oil 800 miles across Alaska is the springboard of a major archaeological project that would not have been possible, or at least not as intensive, without the massive construction project. The route of the pipeline, from the North Slope to the southern ice-free port of Valdez, is an ideal area for a major "dig" because it cuts right across the suspected route of ancient man's migration to the New World. Cooperation between pipeliners and archaeologists has resulted in an agreement whereby the archaeologists get first crack at the land along the right-of-way, with major digging being done by construction crews. The pipeline crews also undergo periodic briefings by the scientists on what to look for and how it applies to their work. In two summers' time, nearly 300 important prehistoric sites and more than 20,000 relics have been discovered. By normal procedures, the amount of work accomplished would have taken at least 5 full years. One important theory coming from the project's results is that American Indians and Eskimos may be descended from common ancestors, rather than from separate cultures, as was previously believed.

(Reprinted from Compressed Air, copyright 1975)

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AVAILABLE PUBLICATIONS

(Please include remittance with order; postage free. All sales are final - no returns. Upon request, a complete list of Department publications, including out-of-print, will be mailed.)

BULLETINS

26. Soil: Its origin, destruction, preservation, 1944: Twenhofel. $0.45
33. Bibliography (1st suppl.) geology and mineral resources of Oregon, 1947: Allen . 1.00
35. Geology of Dallas and Valsetz quadrangles, Oregon, rev. 1964: Baldwin . . . 3.00
36. Papers on Tertiary foraminifera: Cushman, Stewart & Stewart. vol. 2- 1.25
39. Geology and mineralization of Morning mine region, 1948: Allen and Thayer . . 1.00
44. Bibliography (2nd suppl.) geology and mineral resources of Oregon, 1953: Steere. 1.00
46. Ferruginous bauxite deposits, Salem Hills, 1956: Corcoran and Libbey 1.25
49. Lode mines, Granite mining district, Grant County, Oregon, 1959: Koch . . . 1.00
52. Chromite in southwestern Oregon, 1961: Ramp 5.00
53. Bibliography (3rd suppl.) geology and mineral resources of Oregon, 1962: Steere, Owen 3.00
57. Lunar Geological Field Conf. guidebook, 1965: Peterson and Groh, editors . . 3.50
60. Engineering geology of Tualatin Valley region, 1967: Schlicker and Deacon . . 7.50
61. Gold and silver in Oregon, 1968: Brooks and Ramp 7.50
62. Andesite Conference Guidebook, 1968: Dole 3.50
64. Geology, mineral, and water resources of Oregon, 1969 . . . . . 3.00
65. Proceedings of the Andesite Conference, 1969: McBirney, editor (photocopy) . . 10.00
66. Geology and mineral resources of Klamath and Lake Counties, 1970. . . . . 6.50
67. Bibliography (4th suppl.) geology and mineral industries, 1970: Roberts . . . 3.00
68. Seventeenth biennial report of the Department, 1968-1970 . . . . . 1.00
69. Geology of the southwestern Oregon Coast, 1971: Dott 4.00
70. Geologic formations of western Oregon, 1971: Beaulieu 2.00
71. Geology of selected lava tubes in the Bend area, 1971: Greeley 2.50
72. Geology of Mitchell quadrangle, Wheeler County, 1972: Oles and Enlows . . 3.00
73. Geologic formations of eastern Oregon, 1972: Beaulieu 2.00
75. Geology, mineral resources of Douglas County, 1972: Ramp 3.00
76. Eighteenth biennial report of the Department, 1970-1972 . . . . . 1.00
77. Geologic field trips in northern Oregon and southern Washington, 1973. . . . 5.00
78. Bibliography (5th suppl.) geology and mineral industries, 1973: Roberts and others 3.00
79. Environmental geology inland Tillamook Clatsop Counties, 1973: Beaulieu. . . 7.00
80. Geology and mineral resources of Coos County, 1973: Baldwin and others . . . 6.00
81. Environmental geology of Lincoln County, 1973: Schlicker and others 9.00
82. Geol. Hazards of Bull Run Watershed, Mult. Clackamas Counties, 1974: Beaulieu 6.50
83. Eocene stratigraphy of southwestern Oregon, 1974: Baldwin 4.00
84. Environmental geology of western Linn Co., 1974: Beaulieu and others. . . . 12.00
85. Environmental geology of coastal Lane Co., 1974: Schlicker and others . . . 12.00
86. Nineteenth biennial report of the Department, 1972-1974 . . . . . 1.00
87. Environmental geology of western Coos and Douglas Counties, Oregon, 1975 . . in press
88. Geology and mineral resources of upper Chetco River drainage, 1975: Ramp . . in press

GEOLOGIC MAPS

Geologic map of Oregon west of 121st meridian, 1961: Wells and Peck $2.00; mailed - 2.50
Geologic map of Oregon (12" x 9"), 1969: Walker and King 0.25
Geologic map of Albany quadrangle, Oregon, 1953: Allison (from Bulletin 37) . . . 1.00
Geologic map of Galice quadrangle, Oregon, 1953: Wells and Walker 1.50
Geologic map of Lebanon quadrangle, Oregon, 1956: Allison and Felts 1.50
Geologic map of Bend quadrangle, and portion of High Cascade Mtns., 1957: Williams 1.50
GMS-1: Geologic map of the Sparta quadrangle, Oregon, 1962: Prostka 2.00
GMS-2: Geologic map, Mitchell Butte quadrangle, Oregon: 1962 . . . . . 2.00
GMS-3: Preliminary geologic map, Durkee quadrangle, Oregon, 1967: Prostka . . 2.00
GMS-4: Gravity maps, Oregon onshore & offshore; [set only]: at counter $3.00, mailed 3.50
GMS-5: Geology of the Powers quadrangle, 1971: Baldwin and Hess 2.00
GMS-6: Preliminary report, geology of part of Snake River Canyon, 1974: Vallier. . 6.50

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Dec. 1976 ☐
Other:

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Available Publications, Continued:

SHORT PAPERS

18. Radioactive minerals prospectors should know, 1955: White and Schafer	$0.30
19. Brick and tile industry in Oregon, 1949: Allen and Mason	0.20
21. Lightweight aggregate industry in Oregon, 1951: Mason	0.25
24. The Almeda mine, Josephine County, Oregon, 1967: Libbey	3.00

MISCELLANEOUS PAPERS

1. Description of some Oregon rocks and minerals, 1950: Dole	1.00
2. Oregon mineral deposits map (22 x 34 inches) and key (reprinted 1973):	1.00
4. Rules and regulations for conservation of oil and natural gas (rev. 1962)	1.00
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6. Oil and gas exploration in Oregon, rev. 1965: Stewart and Newton	3.00
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16. Mosaic of Oregon from ERTS-1 imagery, 1973:	2.50
18. Proceedings of Citizens' Forum on potential future sources of energy, 1975	2.00

OIL AND GAS INVESTIGATIONS

1. Petroleum geology, western Snake River basin, 1963: Newton and Corcoran	3.50
2. Subsurface geology, lower Columbia and Willamette basins, 1969: Newton	3.50
3. Prelim. identifications of foraminifera, General Petroleum Long Bell No. 1 well	2.00
4. Prelim. identifications of foraminifera, E. M. Warren Coos Co. 1-7 well: Rau	2.00

MISCELLANEOUS PUBLICATIONS

Landforms of Oregon: a physiographic sketch (17" x 22"), 1941	0.25
Mining claims (State laws governing quartz and placer claims)	0.50
Oregon base map (22" x 30")	0.50
Geologic time chart for Oregon, 1961	free
Postcard - geology of Oregon, in color — 10¢ each; 3 - 25¢; 7 - 50¢; 15	1.00
The ORE BIN - Annual subscription ($8.00 for 3 yrs.)	3.00
Available back issues, each — 25¢; mailed	0.35
Accumulated index - see Misc. Paper 13	