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OREGON MINERAL PRODUCTION IN 1960

By
Ralph S. Mason*

Oregon's mineral industry produced its second highest value of raw minerals in 1960. Following a nation-wide economic trend during the year, the industry was off approximately $3 million from last year's record-breaking high of $49.8 million, according to preliminary estimates made by the U. S. Bureau of Mines. The heavy construction commodities, crushed stone and sand and gravel, reflected construction lag and were responsible for most of the change from last year. Metal mining, aside from nickel, was quiet. The state's only uranium mine and one of the two mercury producers shut down. Industrial mineral products showed both gains and losses as compared to the previous year. Cement production was up 12 percent while clays declined 15 percent and diatomite 3 percent. Pumice and volcanic cinders were up 9 percent and stone and sand and gravel were off 11 percent. Building stone activity was greatly increased over 1959.

Two major tests for oil were conducted during the year. Construction of a natural gas pipeline from Camas, Washington, to Eugene, Oregon, provided the area with an important raw material basic to many industrial operations. A second pipeline extending from Alberta, Canada, to California was started late in the year. The line will make natural gas available to such points as Bend, Klamath Falls, Medford, and the Rogue River Valley. Pacific Power and Light Company conducted by-product tests on its Eden Ridge coal in Coos County. Pacific has been exploring the feasibility of using the coal, which occurs in several nearly horizontal seams, in a mine-mouth steam plant for base-load power with a hydro facility on the South Fork of the Coquille River for supplying peaking capacity.

The electro-process metal industry in the state continued its rapid growth and integration. Increased primary aluminum production facilities were being constructed at an existing plant at The Dalles and plans for an additional aluminum smelter in the Northwest were announced. Production of ferro-nickel at the Riddle smelter exceeded that of any previous year. The state's refractory metals industry added greatly to its capacity to refine and fabricate a growing list of space-age metals, and one company installed a new research laboratory. Employment in the mining and metallurgical industries rose to a new high and revenue derived from mineral and oil and gas leases on public land in the state amounted to just under a quarter million dollars.

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Metals

Exotic metals

Nearly 900 employees are engaged in the production of exotic metals at two plants in Albany. These are Wah Chang Corporation and Oregon Metallurgical Corporation. Wah Chang, starting from scratch in 1956, now has a completely integrated processing plant for various reactive metals such as zirconium, hafnium, columbium, and tantalum. A 22-inch hot rolling mill and a 20-inch cold mill were added to the plant facilities during the year. The plant also is equipped with a 750-ton forging press, an electron-beam melting furnace, a rod mill, and a million-dollar foil mill. Some of the zirconium foil produced at the plant eventually ends up in photographers' flashbulbs. Most of Wah Chang's output is used in atomic reactors, space-age applications where resistance to heat plus lightness in weight is important, or in the chemical processing, electronics, or surgical fields. Wah Chang established a research center at its plant to investigate the many problems connected with the beneficiation, reduction, fabrication, and utilization of the new metals they handle. Stephen Yih, manager of Wah Chang's Albany operations, was elevated to the presidency of the firm January 1, 1961.

Oregon Metallurgical Corporation continued to expand and diversify. Titanium and zirconium ingot capacity was more than doubled during the year. Furnaces for melting refractory metals and increased production capacity for vanadium reduction were added to the plant. Development of spin-casting techniques for tungsten-base alloys and vacuum-arc melted castings of molybdenum and vanadium were also reported by the company.

Mercury

Most of the mercury produced in Oregon in 1960 came from the Bretz mine in southwestern Harney County, operated by the Arentz-Comstock Mining Venture of Salt Lake City, Utah. Installation of a furnace at the Mother Lode mine in the Ochoco district of Crook County was completed, and minor production was reported by its operator, Werdenhoff Mining Company of Seattle. The Quartz Mountain quicksilver deposit in western Lake County, which has been operated by Western Minerals Company of Lakeview for the past few years, terminated its lease to the property in December. A considerable yardage of crushed rock from the quarry was sold to the county for road metal during the year.

Exploration at two mercury prospects was carried on with the aid of federal Office of Minerals Exploration cooperative contracts. Work at the Oregon Cinnabar Mines, Inc., Big Muddy Cinnabar prospect in eastern Jefferson County was terminated before completion of the $48,000 project. Drilling was started late in the year by A. O. Bartell at the Nisbet mine in Clackamas County. Government cooperation in the $14,920 program was 50 percent. At year's end there were no new OME applications pending.

Cinnabar has been discovered on nine claims owned by Robert Hulin on Cave Creek, a tributary to Burnt River, in Baker County. Hulin made the original discovery in 1959.

David Chase, Medford, moved his 10-ton Gould rotary quicksilver furnace from the Bonita mine to the War Eagle property where the upper and lower workings were opened up. Small amounts of ore were mill tested during the year.

The Steelhead quicksilver mine, Jackson County, was drilled, and the management indicated that it would be put into operation at an unannounced date. The Bonanza mine, an important mercury producer for many years, closed down in October. The mine is located east of Sutherlin, Douglas County, and is owned by Bonanza Oil & Mine Corporation. Field work for the department's state-wide survey of all known mercury occurrences was finished, and preparation of the manuscript is nearly complete.

Nickel

Hanna Mining Company reported a record-breaking production of 22,228,720 pounds of nickel at its Riddle smelter in Douglas County. The nickel was reduced from 1.1 million tons of crude ore obtained from the open pit mine on Nickel Mountain above the smelter. Numerous minor technological improvements to the smelting operation contributed to the increased nickel production, which was almost one million pounds greater than in 1958, the previous highest year.

Uranium

Bear Creek Mining Corporation leased a uranium prospect on Bear Creek in Crook County from Sage Hollow Mining Corporation early in the year. The company opened a pit 60 feet deep and mined approximately 100 tons of ore. A total of 63 tons was shipped to the Lakeview Mining Company mill at Lakeview

during the summer. The property was returned to Sage Hollow late in the year.

Lakeview Mining Company abandoned the open-pit mining operation at the White King mine, Lake County, early in 1960 after switching over from an underground system to stripping late in 1959. The property was given back to the owners in August and leased in October by Vance Thornburg. Shipments from the Apex mine in Nevada were treated at the Lakeview mill, and 180 tons of ore from the Lucky Lass mine adjacent to the White King were also shipped to the mill. The Lakeview mill shut down in November after exhausting a stockpile of White King ore.

Lakeview Mining has a contract with the Atomic Energy Commission extending through November 30, 1963. There remained approximately 805,000 pounds of U_3O_8 to be delivered between July 1, 1960, and April 1, 1962, at a fixed unit price of $9.27 per pound for company-controlled ores. Post-1962 quantity contracted for is 766,000 pounds of U_3O_8 at a unit price of $8.00 per pound. Total cost of the remaining contract quantity from July 1, 1960, is approximately $13,600,000.

A detailed study of the uranium occurrences and regional geology in the Lakeview area was continued by the department during the year.

Copper

Two carloads of copper-bearing ore from the Copper Eagle (Brass Ledge) mine near Galice, Josephine County, were shipped to the Tacoma Smelter by Harry Comers of Grants Pass. A long-term study of the environment of copper mineralization in the state was initiated by the department. The project includes geologic mapping, petrography, and geochemical prospecting. A U. S. Geological Survey Open File Report, "A Preliminary Report on the Copper-Bearing Deposits of the Quartzburg District, Grant County, Oregon," was released and a copy placed in the department's Portland library.

Aluminum

Harvey Aluminum's reduction plant at The Dalles, originally designed for 54,000 tons of primary aluminum annually, produced nearly 60,000 tons during 1960. Additional smelting capacity under construction during the year will increase the plant capacity 25 percent when it is placed on stream early in 1961. Billet casting, heat treatment, and other facilities were also being installed.

Exploration for ferruginous bauxite in the Salem Hills area of Marion County and in Washington and Columbia counties was continued by a major aluminum company. Of particular interest to land owners in these areas was an article which appeared in the August issue of Engineering & Mining Journal describing the results of strip-mining bauxite in Hawaii. It was discovered that if the first foot of topsoil was removed and saved and then replaced after the ore had been mined, up to ten times as much grass could be grown. It was also found that the bare subsoil when properly prepared and fertilized made an excellent soil and produced much heavier crops than the original soil. The similarity between Hawaiian and Oregon bauxites makes the test results of far more than academic interest. Through the courtesy of the McGraw-Hill Publishing Company, the entire article "Mined Out Land Brought Back to Life", was reprinted in the September issue of the Ore.-Bin.

Gold

Approximately 70 percent of the gold produced in Oregon in 1960 came from small, seasonally active placers. In southwestern Oregon, 29 placers were in operation during the winter and spring. Equipment used included hydraulic giants, draglines, bulldozers, power shovels, front-end loaders, and one skin-diving outfit. An article, "Gold Placer Mining in Southwestern Oregon," appeared in the August Ore.-Bin.

Intermittent development and exploration work were carried on at several gold mines and prospects in southwestern Oregon, including the Eureka, Greenback, Reno, Snow Bird, Warner, and M. C.

The Star Mining Company, Haines, Baker County, completed a test run late in the year at its Chloride mine in the Rock Creek area. A truck-mounted mill on a large semi-trailer is a unique feature of the operation.

Some of the best fishing in eastern Oregon is in the old dredge ponds near John Day in Grant County and Sumpter in Baker County. The State Game Commission has stocked many of these ponds with legal-length fish of a type which thrives in that particular environment. The dredged ground also provides excellent though unlikely cover for deer. Hunters "in the know" have favored these areas for many years.

At the Buffalo mine in the Granite district of eastern Grant County work on driving a lower adit 250 feet below the present workings was continued. The adit is intended to tap several mineralized veins which

have been worked in the upper levels. Production at the Buffalo dates back to the turn of the century, and although records are incomplete, approximately $1 million in gold is estimated to have come from the mine.

Some of Oregon's Minerals at a Glance
(Preliminary figures)

	1959	1960
Clays	$ 308,000	$ 260,000
Gold	24,000	24,000
Mercury	278,000	100,000
Nickel	1/	1/
Pumice & volcanic cinder	1/	430,000
Sand and gravel	15,506,000	14,000,000
Silver	2/	2/
Stone	16,126,000	15,000,000
Undisclosed*	18,607,000	17,775,000
Total 3/	$49,842,000	$46,469,000

1/ Figure withheld to avoid disclosing individual company confidential data.
2/ Less than $500.
3/ Total adjusted to eliminate duplicating value of clays and stone; 1959 total revised.
* Asbestos, carbon dioxide, cement, copper (1960), diatomite, gem stones, iron ore 1959, lime, uranium, and figure indicated by footnote 1/.

The old Ibex mine in the Cracker Creek district, Baker County, was reopened and sampled by the Regal Mining Company, Ltd., of Vancouver, British Columbia. A sampling of the bedrock along the west bank of Pine Creek about 6 miles above Halfway in Baker County, was conducted by the McDonald brothers on ground owned by Milton Steinmetz. Kenneth Watkins of Emerald Empire Mines, Corvallis, shipped a truckload of gold ore from the Cinderella mine in the Blue River district of Lane County to the Tacoma Smelter in November. The ore came from a shallow trench along a newly discovered outcrop.

Considerable interest in gold was stimulated at the 1960 AIME Metals and Minerals Conference held in Portland in April. The all-day session was devoted to a thorough discussion of the role played by gold in the economy by a group of nationally recognized authorities. Copies of the papers and a transcript of the discussions were incorporated into a single publication, "Gold and Money Session", and distributed by the department.

Industrial Minerals

Building Stone

Production of Oregon building stones took a big step forward in 1960. No less than 19 quarries were in operation, some of them on a two-shift basis to keep up with the heavy demand. Production of stone was reported from 12 counties, and development work carried on during the summer by various individuals indicated that several other operations would be under way in 1961. A large percentage of the stone quarried in the state was shipped to out-of-state markets, with western Canada and southern California accounting for a considerable portion of the movement. Stones produced from Oregon quarries included dark red scoria from Tetherow Butte in Deschutes County, a nearly pure white rhyolite from Lake County, a gaily banded tuff from Wasco County, a bright green tuff from Crook County, and numerous others having a wide assortment of colors, textures, and markings. A field survey of more than 30 building stone quarries was made during the year by the department, the results of which are to be published in 1961.

Several quarries in the state produced aggregate for the popular built-up roofs. Opalite from a cinnabar mine in Lake County, white marble from a quarry in Josephine County, and brick-red scoria from a volcanic cone in the Bend area of central Oregon are representative of material sold for this purpose during the year. A new development in the construction of this type of roof was the use of a much wider range of sizes of the aggregate. Lumps measuring several inches across are used to "dress up" the base course of finer aggregate. Production of roof rock could expand considerably, since there are many rocks suitable for this purpose and they can often be produced from waste material resulting from the shaping of regular-sized blocks.

The Northwestern Granite Company plant at Haines, Baker County, was levelled by fire in July. Northwestern had produced monumental stone at this site for at least 50 years.

Sand and gravel

An estimated 15.5 million tons of sand and gravel were produced in the state last year. In recognition of the two-edged problem of the steadily increasing use of sand and gravel in construction in urban areas coupled with the rapid spread of urban areas over these deposits, the department began a long-range study of the Willamette Valley in 1960. In cooperation with the Mid-Willamette Valley Planning Commission, the

initial phases of the study were made in the Salem area. Factors such as sources of new material, rate of use, production costs, quantities available, and depletion rates of sources presently operated will be included in the study. When completed, the survey will have mapped the location of potential sources of supply and outlined some of the essential economic elements. This information will enable the Planning Commission to take steps well in advance to protect the deposits and urban areas from each other, recognizing that neither can exist alone.

Gem stones

An agate-cutting sawmill capable of slabbing logs of petrified wood 19½ inches thick and 8 feet long was built by Henry Bauman of Bend. The mill has two 24-inch, water-cooled saws mounted one above the other. Cutting rate depends on the hardness and thickness of the "wood" and ranges from 6 to 12 inches per hour. Crook County, which has been making a play for the rockhound over the past few years, reaped an estimated half million dollars in 1960, according to estimates by the Crook County Chamber of Commerce. The Chamber, in cooperation with local groups, has located numerous agate deposits, published maps, and given wide publicity to the wealth of gems to be found in the area.

Lightweight aggregates

Production of pumice by long-established operators in Deschutes County increased nearly 10 percent over the preceding year. A slight decrease in the production of expanded shale was reported by two plants in Washington County. Use of expanded shale as a pozzolanic additive for cements in the John Day Dam marked the first time that this material has been employed for other than lightweight aggregate production. The use of lightweight aggregates in pre-stressed concrete construction continued to expand, but regular sand and gravel aggregates also made inroads into the pre-stressed field. The recently developed "Lin Tee", which combines the functions of a beam and subfloor in one pre-stressed unit, was employed extensively by local structural engineers. The beams used either lightweight or regular aggregates.

Enough lightweight expanded-shale blocks were used in the Lloyd Center, a $90 million shopping area completed in Portland last fall, to build a wall 8 inches thick, 4 feet high, and 50 miles long.

Boron

Interest in the sodium borate deposits in the Alvord Lake area of Harney County was evidenced by the 45 apparently valid prospecting permits for sodium on file in the U. S. Land Office at Portland. Approximately 96,000 acres are covered by these leases. In addition, permits for nearly 12,000 acres were being applied for in Lake County, which adjoins Harney County on the west. Drilling was conducted by several firms in Harney County during the past several years. In 1960, Boron Incorporated drilled several deep holes east of Fields. A report on the geology and history of the Alvord Lake area was published in the October issue of the Ore.-Bin; it included analyses of seven boron samples collected from hot springs in the area.

Natural gas

Oregon, long deprived of the benefits to be derived from natural gas, will shortly have it available in almost unlimited quantities. First distribution of natural gas in the state was in the Portland area, the Willamette Valley, and along the pipeline through northeastern Oregon. The gas came from the Four Corners area of the Southwest via the 22-inch El Paso Natural Gas Company line completed in 1956. The latest pipeline system was started in the last quarter of 1960 and when completed will extend from Alberta, Canada, to San Francisco and cross the state near Madras, Redmond, Bend, and Klamath Falls. The cities of Prineville and of Medford, Ashland, and other Rogue River valley points would also be served by the pipeline. (See map in August, 1960, Ore.-Bin.)

Diatomite

A. M. Matlock, Eugene, explored and stripped a diatomite deposit in the Silver Lake area of Lake County. Plans for the erection of a processing plant at Silver Lake early in 1961 were announced. The Dicalite Department of the Great Lakes Carbon Corporation continued operation of its quarry and processing plant at Lower Bridge in northern Deschutes County. Great Lakes acquired the property from the Dicalite Company in 1944. However, first production from the property dates back 40 years.

Perlite

The Paisley perlite deposit in central Lake County was explored by A. M. Matlock, who made plans for erecting a crushing and screening plant.

Bentonite

Central Oregon Bentonite Company produced 1500 tons of ground bentonite for sealing stock ponds and irrigation canals, as a binder for feed pellets, and for oil-well drilling muds and foundry-sand facings. The company quarry is located in the Camp Creek district, Crook County.

Silica

Bristol Silica Company was forced to abandon its plant at Rogue River, Jackson County, by the relocation of U. S. Highway 99. A new plant 3 miles west of Gold Hill was constructed, and operations were nearly back to normal at the end of the year. Activity at the Quartz Mountain silica deposit in Douglas County was confined to further sampling and exploration of the huge deposit located about 35 miles east of Roseburg. A report on the geology of the deposit was published in the November, 1960, Ore.-Bin.

Asbestos

Nicolet Asbestos Mines, Ltd., of Montreal, Canada, drilled the Foster asbestos property on Josephine Creek, Josephine County. The drilling failed to show the presence of sufficient ore for a commercial body.

Western Chemical & Manufacturing Company erected a small processing plant at the Oregon Asbestos mine near Mt. Vernon in Grant County. The property has produced intermittently since it was first developed in 1915.

Vinyl acetate

Pacific Carbide & Alloys Company went on stream with its vinyl acetate plant in North Portland in August. Annual capacity of the plant is five million pounds. Vinyl acetate is used in paints, phonograph records, acetates, floor tiles and other products. Acetylene gas from Pacific's carbide plant next door, plus acetic acid, are the raw materials used in the process.

Coal

Sixty tons of coal from Eden Ridge in southern Coos County were shipped to the Colorado School of Mines for testing in June. Pacific Power & Light Company has been exploring the feasibility of a mine-mouth steam generation plant to supply base-load power at Eden Ridge for several years. A relatively small high-head hydro plant using water impounded behind a dam on the upper South Coquille River is also being considered as an adjunct to supply peaking capability. Both the steam and hydro plants would be located in the same general area.

Soda ash

Studies to determine the feasibility of erecting a soda-ash processing plant at Alkali Lake in Lake County were made by A. M. Matlock and associates in 1960. The lake has been the subject of numerous investigations over the years. Solid masses of soda ash occur in crater-like "potholes" which cover a considerable area. The "lake" is actually a playa and is dry the greater part of each year.

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LEGISLATIVE COMMITTEES

Oregon Senate Natural Resources Committee: Andrew J. Naterlin, Chairman (Newport); Francis W. Ziegler, Vice Chairman (Corvallis); Vernon Cook (Troutdale); Loyd M. Key (Milton-Freewater); Walter C. Leth (Salem); E. D. Potts (Grants Pass); and Daniel A. Thiel (Astoria).

Oregon House Natural Resources Committee: Clinton P. Haight, Jr., Chairman (Baker); Sidney Leiken, Vice Chairman (Roseburg); Carl Back (Port Orford); Sidney Bazett (Grants Pass); Leon S. Davis (Hillsboro); Douglas E. Heider (Salem); Tom Monaghan (Milwaukie); Juanita N. Orr (Lake Grove); and Robert F. Smith (Burns).

U. S. Senate Committee on Interior and Insular Affairs: Anderson, Chairman (N. M.); Jackson (Wash.); Bible (Nev.); Carroll (Colo.); Church (Ida.); Gruening (Alas.); Moss (Utah); Long (Hawaii); Burdick (N. D.); Metcalf (Mont.); Hickey (Wyo.); Dworshak (Ida.); Kuchel (Calif.); Goldwater (Ariz.); Allott (Colo.); Fong (Hawaii); and Miller (Iowa).

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OIL AND GAS EXPLORATION IN 1960

By
V. C. Newton*

The department issued seven new drilling permits during the year to oil companies and individuals who were willing to venture "risk capital" to look for oil in Oregon. Three of the drillings were deep tests and four were shallow tests. As of December 31, 1960, Oregon was still a nonproducing state. However, one test is still being drilled (Humble Oil & Refining Company's "Leavitt, et al. No. 1") near Lakeview, and hopes are still high as long as the bit is turning.

Compared to past activity, this year has been above average for oil and gas exploration in Oregon. The total footage drilled was greater than in most years, and interest was expressed over widespread areas.

Eastern Oregon

Pan American Petroleum Company drilled a shallow gas test in Idaho just east of the Oregon border near the little town of Sheaville, Malheur County, Oregon. The well was abandoned at a depth of 1182 feet, and reportedly nothing of interest was found. The drilling was encouraging to Oregon, however, as it indicated a continuing interest in gas prospects of the continental Tertiary sediments in the Snake River downwarp of northern Malheur County.

Central Oregon

At year's end, Humble Oil & Refining Company was still actively exploring production possibilities of Mesozoic-Paleozoic marine sediments believed to lie beneath the Tertiary volcanics in central Oregon. Drilling in this region is deep and expensive and requires detailed geologic investigations over a wide area before the geology can be extrapolated from beneath the volcanic cover.

Western Oregon

More drilling was done in the Tertiary marine basin of western Oregon than anywhere else in the state. Ross Mitchell & Associates, a local group, explored for shallow production south of the city of Dallas, Polk County, in the summer months without success. Numerous showings of gas in water wells and old test drillings have spurred "wildcatters" to continue to search the area. Reserve Oil & Gas Company, San Francisco, drilled a fairly deep test north of Dallas in May and was apparently discouraged after finding the sedimentary section thinner than expected.

Footage Chart by Years

Year	Total Footage Drilled
1956	9,458'
1957	29,024
1958	17,113
1959	5,192
1960	22,802

The Shell Oil Company offered to lease the entire submerged lands of the state in November, setting off a great deal of controversy concerning offshore development of oil and gas. Subsequently, the state's Attorney General ruled that there were no provisions in Oregon law for leasing these lands. Governor Mark O. Hatfield instructed that legislation be prepared for introduction in the present session of the Legislature to allow for offshore leasing. Shell's definite offer to spend money to explore offshore has called industry's attention to a whole new area in Oregon for investigation. The large area included in this first proposal may indicate that the odds against finding commercial quantities of oil or gas are believed to be high.

*Petroleum Engineer, State of Oregon Department of Geology and Mineral Industries

Forecast

The department still takes the optimistic view on Oregon's oil and gas prospects even though drilling in the sedimentary marine basins has not been especially encouraging. Minor shows of petroleum have been encountered in recent drillings, and porous sand bodies have been found in the Tertiary marine sediments of northwestern Oregon. Holes drilled so far in the Mesozoic-Paleozoic marine basins in central Oregon have shown that several thousand feet of unmetamorphosed section exist and could have productive horizons. Not nearly enough geology or drilling have been done in the state to rule out the possibilities for commercial accumulations of oil and gas.

Private industry has proved time and again the existence of commercial oil fields in areas considered to have few possibilities. It is to industry's credit, moreover, that new oil reserves beyond the expectancy predicted by the "experts" have been maintained. As long as the incentive to look for oil is continued, Oregon has hope.

Oil and Gas Permits Issued in 1960

Permit No.	Company	Lease Name	County	Location	Depth	Status
38	Reserve Oil & Gas Co.	Roy-L&G Bruer No. 1	Polk	NE¼ sec. 31 T. 6 S., R. 4 W.	5,549'	Abandoned 7- 6-60
39	Ross Mitchell & Associates	Bliven No. 2	Polk	SE¼ sec. 10 T. 8 S., R. 5 W.	430'	Abandoned 7-12-60
40	John T. Miller	Sullenger No. 1	Polk	NE¼ sec. 18 T. 8 S., R. 5 W.	710'	Abandoned 6-28-60
41	Ross Mitchell & Associates	Bliven No. 3	Polk	SE¼ sec. 10 T. 8 S., R. 5 W.	580'	Abandoned 7-13-60
42	Humble Oil & Refining Co.	Thomas Creek Unit, Block III, No. 1	Lake	NE¼ sec. 18 T. 36 S., R. 18 E.	12,093'	Abandoned 10-25-60
43	Ross Mitchell & Associates	Bliven-Adams No. 4	Polk	NW¼ sec. 15 T. 8 S., R. 5 W.	340'	Abandoned 7-27-60
44	Humble Oil & Refining Co.	Leavitt et al. No. 1	Lake	NE¼ sec. 2 T. 40 S., R. 20 E.	3,100'	Drilling

Suspended Wells Abandoned

Permit No.	Company	Lease Name	County	Location	Depth	Date
1	W. F. Kernin	D. Coon No. 1	Douglas	Sec. 30 T. 28 S., R. 6 W.	152'	6-17-60
8	Riddle Gas & Oil Producers	Dayton No. 1	Douglas	Sec. 34 T. 30 S., R. 6 W.	1,370'	8-23-60
33	Riddle Gas & Oil Producers	Aikins No. 1	Douglas	Sec. 30 T. 27 S., R. 6 W.	480'	8-29-60
34	Linn County Oil Development Co.	Barr No. 1	Linn	Sec. 32 T. 11 S., R. 1 W.	4,529'	9-13-60
36	Oregon Oil & Gas Co.	Roberts No. 1	Lincoln	Sec. 25 T. 10 S., R. 8 W.	2,630'	6-17-60
- -	Northwestern Oils, Inc.	Morrow No. 1	Jefferson	Sec. 18 T. 12 S., R. 15 E.	3,300'	12-19-60

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MINERAL POLICY PROPOSAL INTRODUCED

Senators Allott (Colo.), Bennett (Utah), and Bartlett (Alaska) have co-sponsored a bill (S.210) which would declare it to be the continuing policy of the federal government " to foster and encourage (1) the development of an economically sound and stable domestic mining and minerals industry, (2) the orderly development of domestic mineral resources and reserves necessary to assure satisfaction of industrial and security needs, and (3) mining, mineral, and metallurgical research to promote the wise and efficient use of our mineral resources."

The bill would require the Secretary of Interior to carry out this policy "in such programs as may be authorized by law." He would also be required to report annually to Congress on the state of the domestic mining and minerals industry and submit recommendations for legislation to carry out this policy. A similar measure was introduced in the last Congress and passed the Senate but was not acted upon by the House.

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OREGON ACADEMY OF SCIENCE TO MEET IN PORTLAND

The 19th annual meeting of the Oregon Academy of Science will be held in Portland at the University of Oregon Medical School, 3181 S. W. Jackson Park Road, on Saturday, February 25, 1961. The Geology-Geography Section, with Herbert G. Schlicker as chairman, will hold morning and afternoon sessions at 10:15 A.M. and 2:30 P.M. respectively. Ten papers covering a broad range of geological subjects will be presented. Department staff members presenting papers are Len Ramp, Richard Bowen, Norman Wagner, and Howard Brooks. In the evening Dr. Ewart M. Baldwin will give an illustrated talk on East Pakistan at Portland State College, Room 53 State Hall, at 7:30 P.M.

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NEW MERCURY REDUCTION PLANTS

San Francisco (McGraw-Hill News Bureau): Two large mercury reduction plants designed by Gordon I. Gould Co., San Francisco, will go onstream later this year in Spain and Yugoslavia. Both are rotary kiln-type plants.

The Yugoslavian plant is now being constructed in Italy, and will go into service at the Idrija Mine. It will have a capacity of 250 metric tons of ore per day, and will feature the largest single mercury furnace ever built, according to the designer.

A similar but smaller plant is being built at La Esperanza Mine near Mieres, in northern Spain, for Astur-Belga De Minas, S. A. It will have a capacity of 150 mtpd.

The Gould firm in recent years has designed complete mercury plants for use in Italy, The Philippines, and Japan. Gould notes that in recent years a majority of its mercury plant design work has been done for foreign customers, because a poor price-cost relationship and lower-grade ores at home are retarding U. S. mercury development. (From E&MJ Metal & Mineral Markets, January 26, 1961.)

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BUREAU OF MINES ISSUES NEW INDEX

Recently made available by the U. S. Bureau of Mines is List of Publications Issued by the Bureau of Mines from July 1, 1910, to January 1, 1960, with Subject and Author Index, by Hazel J. Stratton. This valuable and much-needed index supersedes all previous indexes of the Bureau's publications. The 826-page paperbound book is priced at $4.25 and may be purchased from the Superintendent of Documents, Washington 25, D. C.

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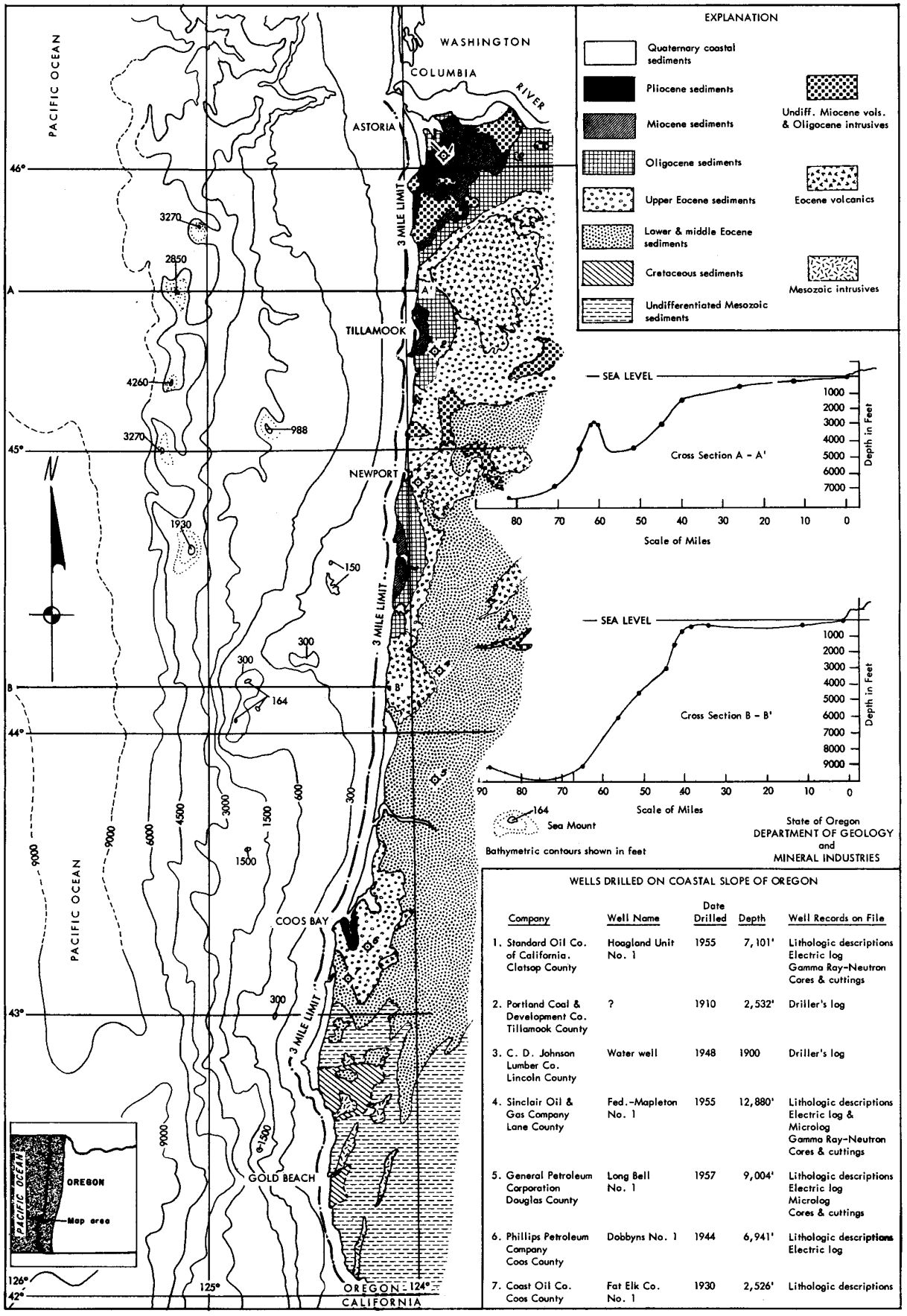
SUBMARINE TOPOGRAPHY AND COASTAL GEOLOGY OF OREGON



EXPLANATION

- Quaternary coastal sediments
- Pliocene sediments
- Miocene sediments
- Oligocene sediments
- Upper Eocene sediments
- Lower & middle Eocene sediments
- Cretaceous sediments
- Undifferentiated Mesozoic sediments
- Undiff. Miocene vols. & Oligocene intrusives
- Eocene volcanics
- Mesozoic intrusives

164 Sea Mount

Bathymetric contours shown in feet

State of Oregon
DEPARTMENT OF GEOLOGY
and
MINERAL INDUSTRIES

WELLS DRILLED ON COASTAL SLOPE OF OREGON

	Company	Well Name	Date Drilled	Depth	Well Records on File
1.	Standard Oil Co. of California. Clatsop County	Hoagland Unit No. 1	1955	7,101'	Lithologic descriptions Electric log Gamma Ray-Neutron Cores & cuttings
2.	Portland Coal & Development Co. Tillamook County	?	1910	2,532'	Driller's log
3.	C. D. Johnson Lumber Co. Lincoln County	Water well	1948	1900	Driller's log
4.	Sinclair Oil & Gas Company Lane County	Fed.-Mapleton No. 1	1955	12,880'	Lithologic descriptions Electric log & Microlog Gamma Ray-Neutron Cores & cuttings
5.	General Petroleum Corporation Douglas County	Long Bell No. 1	1957	9,004'	Lithologic descriptions Electric log Microlog Cores & cuttings
6.	Phillips Petroleum Company Coos County	Dobbyns No. 1	1944	6,941'	Lithologic descriptions Electric log
7.	Coast Oil Co. Coos County	Fat Elk Co. No. 1	1930	2,526'	Lithologic descriptions

DATA ON OREGON'S OFFSHORE

A map of Oregon's coastal and offshore lands is presented here in response to the interest shown in this subject in recent months. The generalized geology on the map has been compiled from published material and from unpublished work for the State Geologic Map. The bathymetric contours and the two cross-sections are based on the International Map of the World. The drilling information is from the department records, and only those wells considered significant are mentioned. Additional drilling records are available from the department.

Accompanying the map are references on Oregon geology and a list of nautical charts. Most of the detailed geologic maps may be purchased from the U. S. Geological Survey. Unpublished theses are on file in the department's offices and at the universities or colleges where they were submitted for advanced degrees. Charts may be obtained from the U. S. Coast and Geodetic Survey or local marine outfitting establishments.

All lands within the 3-mile limit belong to the State of Oregon. A recent opinion by the Attorney General ruled that the state has no authority to lease such lands. However, legislation which will give the State Land Board the authority to lease is being prepared for presentation at the current session of the legislature. Lands beyond the 3-mile limit belong to the federal government and are leased through the U. S. Bureau of Land Management.

As yet 600 feet (100 fathoms) is the maximum water depth in which a drilling has been made. Offshore drilling is done by one of three methods: (1) by directional drilling from the shore, (2) by means of towers or man-made islands in shallow water, or (3) by specially constructed drilling ships in deeper water. At the present time wells are being drilled off the shores of Texas, California, and Louisiana.

NAUTICAL CHARTS ALONG OREGON COAST

C & GS Chart No.	Title	Scale	Price
5052	San Francisco to Cape Flattery (A Sailing chart showing generalized shoreline, soundings, and topography.)	1:1,200,000	$ 1.00
5021	Monterey Bay to Coos Bay	1:811,980	1.00
5022	Cape Blanco to Cape Flattery (Sailing charts with more detail on shoreline, soundings, and coastal topography.)	1:736,560	1.00
5702	Trinidad Head to Cape Blanco	1:196,948	1.00
5802	Cape Blanco to Yaquina Head	1:191,730	1.00
5902	Yaquina Head to Columbia River (General charts for coastwise navigation. Considerable detail on shoreline and off-shore topography.)	1:185,238	1.00

Harbor charts at various scales larger than the above are available of the following areas: Columbia River, Nehalem River, Tillamook Bay, Netarts Bay, Depoe Bay, Yaquina Bay, Siuslaw River, Umpqua River, Coos Bay, Coquille River, Port Orford to Cape Blanco, Cape Sebastian to Humbug Mountain, and Pyramid Point to Cape Sebastian.

Charts may be obtained at the following places:

Astoria: Englund Marine Supply, Foot of 15th St.
Coos Bay: Independent Stevedore Co., Inc.
Newport: Englund Marine Supply Co., 252 Bay Blvd.
North Bend: Oregon Pacific Co., Inc.

Portland:
U. S. Coast and Geodetic Survey District Office
314 U. S. Court House, 620 S. W. Main St.
Frank H. Parks, 213 S. W. Washington St.
Portland Instrument Co., 334 S. W. 5th Ave.

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DATING OREGON'S GEOLOGIC PAST

By
Richard G. Bowen*

Introduction

Dating of the geologic past is done by two basic methods: geological, which gives relative age, and radiometric, which gives absolute age.

Relative age determinations attempt to fit a rock into the geologic column by using such field information as stratigraphic position, index fossils and unconformities. By this method the time classification of rocks, called the geologic column, developed from a dual system of Primary (rocks considered to be part of the original crust) and Secondary (rocks derived from the erosion of the Primary rocks) into the complex classification shown on the accompanying Geologic Time Chart. These methods are relative, showing time has passed and change has taken place from one geological bench mark to another. The number of years elapsing between these bench marks has been subject to varying interpretation depending upon the criteria used by the investigator.

Absolute age, on the other hand, is the number of years that have elapsed since the rock was formed. An example of a method of determining absolute age familiar to all is counting the annual rings of a tree. Similar to this are the layers of annual deposition of sediment in lakes, called varves, which are especially useful in tracing the wasting and retreat of the continental glaciers. In terms of geologic time, however, the period of time involved and the incidents that can be dated by tree rings and varves are very limited. Absolute age determinations as they are used today are dependent upon the measurable decay of radioactive minerals.

Early radiometric work was limited to uranium-bearing igneous rocks, mainly of pre-Cambrian age, but more recent work has been extended to sedimentary and metamorphic rocks and to rocks as young as two million years.

Uranium methods

Radioactive age dating became possible with the discovery of radioactivity by the French physicist Antoine Becquerel in 1896. Shortly after Becquerel's discovery, physicists demonstrated the constancy of radioactive decay of uranium and showed that lead and helium are always the product of this decay. By knowing the annual decay rate and the ratio of uranium (called the parent) to the lead or helium (called the daughter) it is possible to compute the original uranium content and thus the total age of the rock. It soon became apparent to workers in this field that they were getting divergent ages from different uranium-bearing minerals in the same rock. Most of this error, it was discovered, resulted from the inclusion of primary lead at the time of the

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mineral's crystallization. As a result the chemical analysis showed too much lead and made the rock appear much older than it actually was. With refinements in technique this method has once again become useful so that it is possible to determine the amount of radiogenic lead and its ratio to other forms of lead. It is an extremely involved procedure, however, and is used mostly as a check on other methods.

Most uranium-lead geochronological work today is done by the lead-alpha method. This method involved the selection and separation of a radioactive mineral (zircon has proved to be the most satisfactory) that because of the size of its crystal lattice excludes primary lead from its structure during formation. The mineral is separated from the rock then analyzed for its content of uranium and lead. The age can then be determined by equating the ratio of lead to uranium times the rate of formation of the lead. When used on older rocks the lead-alpha method has proven satisfactory, because the ratio of radiogenic lead to uranium in the zircon is low. When the ratio is low a small error in weighing the lead or uranium has only a small effect on total age. However, on younger rocks where only minute quantities of radiogenic lead have been produced since the crystallization of the zircon, its ratio to uranium is high. Here a small error makes a large difference in the age determined. For this reason the accuracy of this method begins to decrease rapidly in rocks younger than Cretaceous, and it has not been successful on rocks much younger than Oligocene.

Potassium method

The potassium method uses an isotope of a more common element than the other systems, thereby greatly increasing its utility. Potassium is one of the most abundant elements and is a principal constituent of orthoclase and mica, both common rock-forming minerals. One isotope of potassium, K^{40}, is radioactive and decays to A^{40} (argon of mass number 40).

By knowing the amount of potassium^{40} and argon^{40} in the mineral and the rate of argon^{40} formation, it is possible by calculations similar to those used for the lead-uranium ratio, to determine the age of the sample. This method has several important advantages over the lead-alpha and other methods using uranium. The most important is the relatively greater abundance of potassium-bearing minerals. The uranium methods are in general restricted to igneous rocks, but the K^{40} - A^{40} method may be used on igneous, sedimentary, and metamorphic rocks with equal facility.

The K^{40} - A^{40} method has not completely replaced the uranium-lead methods because of the more highly refined techniques and complex equipment needed. It is rapidly supplanting it, however, particularly in younger rocks, and has been successful in dating materials as young as two million years.

Carbon and other methods

The 1960 Nobel prize winner, Dr. Willard F. Libby, received the chemistry award for developing radiocarbon dating. Radioactive carbon (carbon of isotope number 14) is formed in the uppermost layers of the atmosphere by the nuclear reaction of cosmic-ray neutrons and nitrogen atoms. It then disintegrates by the emission of beta particles. The newly-born radiocarbon in the atmosphere reacts, within minutes or hours, with oxygen and forms carbon dioxide. The radioactive carbon dioxide, by atmospheric circulation, is brought to the surface of the earth where it is absorbed by plants. Animals eat the plants or other animals living off the plants, and consequently distribute C^{14} in all living matter.

Because of the continuing interchange of carbon dioxide by living matter, the radioactivity stays constant during life. Upon the cessation of life, the carbon dioxide interchange stops and the radioactivity of the carbon begins to diminish. The radioactivity of the fresh C^{14} is 15.3

AGE DETERMINATIONS FROM OREGON

Rock Type and Location	Method	Stratigraphic Position	Age in Years From Present	Reference
Log in lava flow, west of Parkdale, Hood River County	C^{14}	Recent	240	Waters (1958)
Stumps buried by pumice from Newberry volcano, Deschutes County	C^{14}	Recent	2020	Brogan (1952)
Stumps buried by pumice deposits from Mt. Mazama, Deschutes County	C^{14}	Recent	6500	Williams (1953)
Sandals buried under ash fall from Newberry volcano, Fort Rock Cave, Lake County	C^{14}	Recent	9050	Brogan (1952)
Diorite, "Hall's" Diorite, eight miles above Detroit Dam, Marion County	lead-alpha	Early Miocene	23 million years	Jaffe (1959)
Vitric tuff, John Day Formation near Mitchell, Wheeler County				
Bed 165' above base	K^{40}-A^{40}	Oligocene	31.3 million years	Hay (1960)
Bed 1110' above base	K^{40}-A^{40}	Oligocene	24.4 million years	Hay (1960)
Biotite granite, "Nimrod" granite, below Nimrod, Lane County	lead-alpha	Oligocene	37 million years	Jaffe (1959)
Quartz diorite, Bald Mountain batholith, Baker County	lead-alpha	Early Cretaceous	99 million years	Thayer (1961)
Granodiorite, Grouse Creek, Jackson County	lead-alpha	Jurassic or Cretaceous	103 million years	Jaffe (1959)

GEOLOGIC TIME CHART

AGE DIVISIONS			DOMINANT LIFE		TIME			
ERA	PERIOD	EPOCH	ANIMAL	PLANT	DURATION IN MILLIONS OF YEARS: ERA	DURATION IN MILLIONS OF YEARS: PERIOD	DURATION IN MILLIONS OF YEARS: EPOCH	BEGINNING MILLIONS OF YEARS AGO *
CENOZOIC	QUATERNARY	RECENT	MAN		63.011	1.011	0.011	0.011
		PLEISTOCENE					1	1
	TERTIARY	PLIOCENE	MAMMALS, BONY FISH, BIRDS, SHELL FISH, ARTHROPODS	FLOWERING TREES AND SHRUBS		62	12	13
		MIOCENE					12	25
		OLIGOCENE					11	36
		EOCENE					22	58
		PALEOCENE**					5	63
MESOZOIC	CRETACEOUS		REPTILES	CONIFERS, CYCADS, GINGKOS, FERNS	167	72		135
	JURASSIC					46		181
	TRIASSIC					49		230
PALEOZOIC	PERMIAN		AMPHIBIANS, INSECTS	SCALE TREES, CORDAITES, TREE FERNS, CALAMITES	370	50		280
	PENNSYLVANIAN (CARBONIFEROUS)					40		320
	MISSISSIPPIAN (CARBONIFEROUS)					25		345
	DEVONIAN**		SHARKS	PRIMITIVE SCALE TREES AND TREE FERNS		60		405
	SILURIAN**		LUNGFISH	PSILOPHYTES		20		425
	ORDOVICIAN**		CORALS, BRACHIOPODS			75		500
	CAMBRIAN**		ECHINODERMS, TRILOBITES	FUNGI, ALGAE		100		600
PRE-CAMBRIAN	GRENVILLE OROGENY**		BEGINNING OF PRIMITIVE PLANT AND ANIMAL LIFE		4000			1000
	OLDEST KNOWN ROCKS IN NORTH AMERICA**							2600
	OLDEST KNOWN ROCKS (MURMANSK AREA)**							3400
	PROBABLE AGE OF THE EARTH							4600

*ADAPTED FROM KULP, 1961

**ROCKS OF THIS AGE NOT KNOWN TO EXIST IN OREGON

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

GENERALIZED GEOLOGIC TIME CHART FOR OREGON

Era	Period	Epoch	PRINCIPAL GEOLOGIC EVENTS	Age * (in millions of years)
CENOZOIC	QUATERNARY	RECENT	Glaciers in mountains receding. Crater Lake and Newberry Craters formed by collapse of volcanic cones. Minor lava flows near Mt. Hood, at McKenzie Pass, Cow Lakes, and in central Oregon.	.011
		PLEISTOCENE	Greatly enlarged glaciers in mountains. Eruption of numerous volcanoes along crest of Cascades and in central Oregon. Large lakes in south-central part of State. Mastodons and giant beavers in Willamette Valley; camels and horses in Fossil Lake area.	1
	TERTIARY	PLIOCENE	First eruptions of lava cones at crest of Cascade Range. Extensive outpouring of lava in south-central Oregon. Horses, rhinos, camels, antelope, bear, mastodons living in John Day country. Large areas of grasslands due to drier climate east of High Cascade Range. Warm temperate climate west of Cascades initiates period of laterization.	13
		MIOCENE	Thick layers of lava extruded over much of State (middle and upper Miocene). Seas invade coastal areas; mollusks, fish, whales, sea lions. Oreodonts, rodents, 3-toed horses, giant pigs, rhinos, tiny camels, wolves, and saber-tooth cats living in John Day country. General mild humid climate with extensive forests of Metasequoia. Last emplacement of granitic plutons in the State (Cascade Range) with accompanying mineralization. Cascade and Coast ranges begin uplift. Beginning of drier climate in eastern Oregon.	25
		OLIGOCENE	Willamette Valley and parts of Coast Range covered by warm seas. Inhabited by abundant and varied mollusks. Warm temperate flora growing in both eastern and western Oregon, with Metasequoia, maple, sycamore, ginkgo, and katsura trees plentiful. Three-toed horses, camels, giant pigs, saber-toothed cats, oreodonts, tapirs in John Day country. Cascade Range too low to affect climate of eastern Oregon.	36
		EOCENE	Coos Bay coal forming in coastal swamps. Coast Range begins to rise in south. Sub-tropical forests with palms, figs, avocados, pecans, and walnuts in central Oregon. Four-toed horses, rhinos, tapirs, crocodiles in Clarno area. Numerous volcanoes in area of the Cascades ending marine invasion into central and eastern Oregon. Western Oregon covered for long periods by arm of ocean, locally many mollusks.	63
MESOZOIC	CRETACEOUS		Most of State covered by warm seas. Ammonites, trigonia, and other mollusks abundant in Medford and Mitchell areas. Tree ferns growing near Austin in Grant County. Formation of principal metalliferous deposits in State following batholithic intrusions.	135
	JURASSIC		Oregon largely covered by seas. Brachiopods, mollusks, and ammonites abundant. Some marine reptiles. Ferns, cycads, ginkgoes, and conifers growing on land areas. Period of serpentine intrusions with formation of chromite deposits followed by granitic intrusions in Klamath Mountains, Blue Mountains, and possibly Wallowa Mountains.	180
	TRIASSIC		Most of Oregon covered by warm seas. Sponges, corals, ammonites, gastropods, and nautiloids. Volcanoes active and widespread especially in northeastern and southwestern Oregon.	230
PALEOZOIC	PERMIAN		Warm seas cover much of State. Limestone reefs forming. Fusilinids common. Vulcanism in northeastern part of State.	280
	CARBONIFEROUS		Much of State covered by warm seas containing brachiopods and corals. Ferns and calamites growing on land areas. Rocks now exposed in Suplee area.	345
	PRE-CARBONIFEROUS		"Pre-Carboniferous" includes the vast stretch of geologic time extending back to the oldest rocks found on the earth. Rocks of this age are not well known in Oregon because of covering by younger sediments and volcanics. Old schistose metamorphic rocks in southwest Oregon are probably of early Paleozoic age. Some limestones in central Oregon may be as old as Devonian.	3400

*From Kulp 1961

disintegrations per minute per gram of carbon. This wanes at a constant rate, and by 5,600 years the activity is 7.15 dpm/g, and at the end of 11,200 years the activity is 3.57 dpm/g. Thus the half life of C^{14} is 5,600 years. This method has become widely used in anthropological and archeological research in addition to geological studies. Although it is most successful when measuring between 1,000 and 20,000 years, refinements in techniques and instrumentation will extend its future usefulness to about 60,000 years.

Other methods based on atomic disintegration have been proposed or are being developed. One that is particularly desirable, since it would bridge the gap between the K^{40} and the C^{14} datings is beryllium^{10}. Its half life is 2.5 million years, about the right magnitude to date events in the Pleistocene and late Pliocene.

Radioactive dating and the geologic time scale

For some years now, studies have been under way to correlate absolute dating with the geologic time scale. The earlier work was limited to igneous rocks, and the most accurate results came from intrusive rocks of early Paleozoic age or older. One reason for the better results on the older rocks was the small relative error. From the time a magma was intruded to the time it cooled and precipitated the various uranium-bearing minerals, some millions of years might elapse. Where the age of the rock was determined to be 600 million years or older, as in Pre-Cambrian rocks, the time of precipitation of the minerals to be dated could extend over 5 or 10 million years and still give results of less than 2 percent variation, well within the limits of acceptable error. In younger igneous intrusions this method was not successful. An experimental error of 5 to 10 million years, the time for cooling, in a rock only 20 million years old was too great to be acceptable.

After the development of the potassium method, it was found that glauconite, a potassium-bearing mineral that formed during the deposition of sediments, could be used to determine the ages of the enclosing sediments. By this method, absolute ages could be determined for fossil-bearing, geologically-dated rocks.

The geologic time scale has been revised recently by several workers, including Holmes and Kulp. The latest revision of Kulp appears on two geologic time charts accompanying this article. In addition, there is a list of rocks in Oregon that have been radiometrically dated.

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STATE LEGISLATIVE NEWS

The following bills of direct interest to the mining industry are now being considered in the Oregon Legislature:

SB 227 would abolish the Department of Geology and Mineral Industries and its Governing Board and establish a Mineral Resources Division and an advisory Mineral Resources Board within a Department of Natural Resources. Referred to the Committee on State and Federal Affairs and later referred to the Committee on Ways and Means.

HB 1136 would give authority for all boards, departments and commissions owning or controlling state lands to lease the lands for mineral development and amend existing laws to allow for hard rock mineral leases and oil and gas leases to be on the same land and to validate existing state leases. Two hearings have been held by the Committee on Natural Resources and a third is scheduled. This bill is intended to clarify state leasing laws.

HB 1316 would grant easements and licenses across the shore of the Pacific Ocean between high and low tides. This would allow for pipe lines and the like to be put under the ocean beach which is now declared a state highway and to be nonviolate. Passed by the House February 8. Now in Senate Committee on State and Federal Affairs.

HB 1394 would establish a research program to determine damage done to cherries by exposure to fluorine gases from aluminum reduction plants. Now in Committee on Ways and Means.

HB 1416 would provide that mineral exploration and mineral development on reforested lands would not be permitted. Hearings have not been set up by Committee on Natural Resources as yet.

HB 1532 would allow the State Land Board, upon consultation with the Department of Geology and Mineral Industries, to lease offshore lands for oil and gas explorations. Sets up procedures for: (1) notification of intention to lease, (2) leasing, (3) establishing size of lease parcels, (4) rent required, and (5) royalty on production. Provides that consideration be given when preparing lease whether operations would "(1) Be detrimental to the health, safety, comfort, convenience or welfare of persons residing, owning real property, or working in the neighborhood of the leased area; (2) Interfere with shoreline recreational or residential areas to an extent that would render such areas unfit for recreational or residential uses or for park purposes; (3) Destroy, impair, or interfere with the esthetic and scenic value of such recreational, residential, or park areas; or (4) Create any fire hazard, smoke, smog or dust nuisance, or pollution of waters surrounding or adjoining the leased areas." Prohibits pollution and contamination of the ocean and impairment and interference with bathing, fishing, or navigation.

HB 1568 would establish provisions for compulsory unitization either upon motion of the Board or upon application of any interested person. This bill is copied from the Interstate Oil Compact Commission's model law on compulsory unitization and prior to introduction was circulated widely throughout the oil industry. Introduced at the request of the Department.

To be introduced soon: A bill setting up rules and regulations for locating placer mining claims. (Oregon has no specific laws at present for locating placer claims.)

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FEDERAL LEGISLATION

Bills introduced in the House and the Senate through February 15 of interest to the mining industry are listed below in summary form. This information has been compiled from the American Mining Congress Bulletin Service. If further information is desired, it is suggested that you obtain copies of the bills from your Congressional delegation.

Lands

S 174 National Wilderness Preservation System - Anderson (New Mexico) and 13 others. Senator Clinton N. Anderson, Chairman of the Senate Interior Committee, has announced that public hearings will be held on this bill February 27-28, in Washington, D. C. This bill would establish a multimillion acre National Wilderness Preservation System composed in large part of national forest and public domain lands now subject to the general mining laws. Under the proposed legislation, the mining laws would no longer be applicable to the wilderness lands; the President would be given discretionary authority to permit mining in specific areas under such regulation as he may deem desirable. The mining and oil, forestry, grazing, and ranching industries have expressed vigorous opposition to any legislation which would hinder multiple use development of the natural resources on the public domain. Persons wishing to express views should write their Congressional delegation immediately.

Similar bill - HR 293 by Baldwin (California) and many others.

HR 2960 Limit access over national forest lands - Ullman (Oregon). Would direct the Secretary of Agriculture to "(1) grant easements for specified periods of time or otherwise in, upon, across, and over lands administered by the Forest Service for rights-of-way for roads upon such terms and conditions as he may deem are in the public interest; and (2) enter into agreements to exchange hauling rights or rights-of-way and easements for roads with those who own, control, or use lands intermingled with or adjacent to lands administered by the Forest Service and where mutual needs for access exist and not withstanding any other provisions of law, to condition the grant of any right-of-way or permission to cross Forest Service lands upon the granting to the United States of rights or permission to cross lands owned, controlled, or used by the applicant to the extent the Secretary deems necessary and to make or receive reasonable compensation for such rights or permission: Provided, That no such conditions shall be imposed upon persons residing within or adjacent to lands administered by the Forest Service seeking rights of ingress and egress to their homes."

Identical bill S 501 - Morse (Oregon) and 15 others.

HR 3342 Public land withdrawals - Rivers (Alaska). Would amend sections 1 and 2 of the Public Lands Withdrawal Act to extend their application to ". . . any department or agency of the government." The withdrawal limitation presently applies only to the Department of Defense for defense purposes.

HR 4060 Land withdrawals for nondefense purposes - Aspinall (Colorado). Would provide that withdrawals, reservations or restrictions of 5,000 acres or more of public lands for any government agency or department shall not become effective until at least 60 days after the proposed withdrawal has been submitted to the committees on Interior and Insular Affairs of the Senate and House.

Gold

HR 26 Provide for coinage of $5.00 and $10.00 gold pieces - Kearns (Pennsylvania).

HR 333 Free market for gold - Chenoweth (Colorado). Similar bill, HR 981 - Johnson (California).

HR 334 Authorize $35 per ounce subsidy for domestically mined gold - Chenoweth (Colorado). Similar bill, HR 1991 - Baring (Nevada).

HR 391 Establish gold standard and redeemable currency - Hiestand (California).

HR 2573 Authorize payment of $70 per ounce for domestically mined gold - Rivers (Alaska). Similar bill, HR 2212 - Baring (Nevada).

HR 3636 Gold depletion increase - Berry (South Dakota). Would provide a 23 percent rate of depletion for gold produced from domestic deposits.

HJ Res 185 Incentive payments to domestic gold producers - Johnson (California). Amount of incentive payment to be allowed by the Secretary of Interior but in no case would exceed $35 an ounce. No incentive payments could be made during any period in which the U. S. Government gold reserves equal or exceed 23 billion dollars. Identical to SJ Res 44 by Engle (California), Case (South Dakota), Kuchel (California).

Lead-zinc

HR 84 Federal subsidies to small lead-zinc producers - Edmondson (Oklahoma). Would direct the Secretary of Interior to establish a program of stabilization payments to small domestic producers of lead and zinc ores and concentrates. Payments to eligible producers would be at a rate to provide the equivalent of the difference between what they actually receive and what they would have received at market prices of 17 cents and 14½ cents per pound for lead and zinc, respectively. Would define a "small domestic producer" as one who, during the 12 months preceding the period for which he seeks subsidy payments, has not produced or sold ores or concentrates the recoverable content of which is more than 2,000 tons of lead and/or 2,000 tons of zinc for each single operating unit, with the further provisions that "a domestic producer shall be treated as a small domestic producer with respect to one, but only one, operating unit in any one state or mining district." Similar bills, HR 163 - Thompson (Wisconsin); HR 2505 - Montoya (New Mexico); HR 2874 - Baring (Nevada); HR 4003 - Pfost (Idaho); S 115 Kerr and Monroney (Oklahoma), Schoeppel (Kansas), Bible and Cannon (Nevada), Church (Idaho), and Metcalf (Montana).

HR 3416 Provides limited subsidies and import taxes on lead and zinc - Aspinall (Colorado). Would (1) authorize the Secretary of Interior to make limited stabilization payments to domestic lead-zinc miners; (2) create in the United States Treasury a Lead and Zinc Stabilization Payments Fund into which would be paid receipts from lead-zinc import taxes imposed by the bill; and (3) replace current tariff duties on lead and zinc with a system of import taxes. Identical bills, HR 3425 - Baring (Nevada); HR 3447 - King (Utah); HR 3461 - Peterson (Utah); HR 3471 - Ullman (Oregon).

Policy

S 210 Establish national mining and minerals policy - Allott (Colorado), Bennett (Utah), and Bartlett (Alaska). Would declare it the continuing policy of the Federal Government "to foster and encourage (1) the development of an economically sound and stable domestic mining and minerals industry, (2) the orderly development of domestic mineral resources and reserves necessary to assure satisfaction of industrial and security needs, and (3) mining, mineral, and metallurgical research to promote the wise and efficient use of our mineral resources."

S 239 National policy on utilization of natural resources - Engle (California) and 30 others. Would require the President to transmit annually to Congress a Resources and Conservation Report setting forth "(1) the condition of the soil, water, air, forest, grazing, mineral, wildlife, recreational, and other natural resources with particular reference to attainment of multiple purpose use; (2) current and foreseeable trends in management and utilization of the aforesaid natural resources; (3) the adequacy of available natural resources for fulfilling human and economic requirements of the nation; (4) a review of the conservation programs and activities of the Federal Government, the state and local governments, and nongovernmental entities and individuals with particular reference to their effect on full conservation, development, and utilization of the

natural resources; (5) a program for carrying out the policy . . . together with such recommendations for legislation as he may deem necessary or desirable." Similar bill, HR 3436 - Dingell (Michigan).

HR 2875 Comprehensive program for a healthy mining industry - Baring (Nevada). Would state that "Congress has determined that it is essential that the United States be as nearly self sufficient as is reasonably economically possible in all useful minerals and metals as well as those classified by the Government as strategic and critical, since dependence upon foreign sources invites possible national suicide."

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OREGON MAN NAMED BLM DIRECTOR

Interior Secretary Stewart L. Udall has announced the appointment of Karl S. Landstrom, a native of Lebanon, Ore., as Director of the Bureau of Land Management. He succeeds Edward Woozley of Malad, Idaho, who had headed the Bureau for nearly eight years. Landstrom, a career civil servant, has had nearly 25 years of experience in the natural resource field. He joined the Bureau of Land Management in 1949, as Regional Chief of Lands and Minerals in Portland, and in recent years had been a member of the staff of the House Interior Committee.

The secretary's announcement said that Landstrom's "experience and understanding of public land management will assure development of progressive policies and programs in concert with the resource conservation goals of the Kennedy Administration." (American Mining Congress Bulletin Service, 2-3-61.)

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NORTHWESTERN MINING COUNCIL HOLDS ANNUAL ELECTION

The Northwestern Mining Council, Inc., of Medford, Oregon, held its annual election on February 2, 1961. Officers for the coming year are as follows: W. H. Holloway, re-elected as President; Mrs. Truman Bishop, Vice President; Mrs. R. A. Mitchell, Secretary; Mrs. Glenn Hall, Correspondence Secretary; R. A. Mitchell, Treasurer. New directors are Glenn Hall and Fred Adams, while directors already in office are George Brewer and Claud Stevens.

* * * * *

TUNGSTEN CASTS MADE AT ALBANY

The first castings of pure tungsten metal ever made in the United States, if not in the world, were accomplished last month by Oregon Metallurgical Corporation of Albany, Oregon. Company President Stephen M. Shelton reports that tungsten, with a melting point of 6,170° F. -- the highest melting point of any metal, was hitherto considered prohibitive of casting. Oregon Metallurgical succeeded in producing two castings, each consisting of a missile nozzle containing 240 pounds of tungsten. The nozzles, which were made for the U. S. Government, must undergo severe tests to prove whether they are able to withstand tremendous blasts of heat. (Abstracted from The Oregonian, 1-27-61.)

* * * * *

OREGON SECTION, AIME, ELECTS NEW OFFICERS

The Oregon Section of the AIME elected the following as its officers for 1961 at its regular meeting in January: S. L. Sampson (Electric Steel Foundry), Chairman; Gordon E. White (Reynolds Metals Company, Troutdale), Vice-Chairman; and Charles McVicker (E. J. Bartells Company), Secretary-Treasurer.

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* *

GEOLOGY OF THE HUMBUG MOUNTAIN STATE PARK AREA

By
J. G. Koch, W. R. Kaiser, and R. H. Dott, Jr.*

INTRODUCTION

The Humbug Mountain area was visited in 1955 by Dott while in the employ of Humble Oil & Refining Company. The presence of a diorite pluton and unmetamorphosed strata containing diorite and phyllite pebbles together with moderate numbers of Cretaceous fossils offered great promise for accurate geologic dating of mountain building, intrusion of diorite, and regional metamorphism in southwestern Oregon. The geology also seemed to provide an opportunity for establishing detailed coastal Cretaceous stratigraphy. Work renewed in 1959 has verified these beliefs, although structural complications are far greater than anticipated. These investigations, the first since J.S. Diller's (1903) description and mapping of the Port Orford quadrangle, are part of a long-range study of the sedimentation in and stratigraphic history of the Klamath mobile belt during its most active periods of post-Paleozoic deformation.

This preliminary summary of the geology of the Humbug Mountain State Park area is based upon investigations made during two field seasons by Koch, one by Kaiser, and parts of three seasons by Dott. Koch has completed a Master's dissertation on the immediate park area (Koch, 1960) and now is extending his studies of late Mesozoic strata southward and eastward. Kaiser currently is investigating in detail the metamorphic and igneous rocks east of the park. Their work, as well as that of other University of Wisconsin students farther south along the coast, is under the general direction of Dott. He also has investigated areas northward as far as Coos Bay. Financial support from the Wisconsin Alumni Research Foundation and the Oregon Department of Geology and Mineral Resources is gratefully acknowledged.

PREVIOUS WORK

Diller (1903) was the first geologist to describe the area in detail. His application of the name Myrtle formation (Diller, 1898, p. 1) to most of the sedimentary rocks was unfortunate in that these are of mixed ages and lithologies. Imlay, et al. (1959), recently recognized the Myrtle as a group in the Roseburg region (80 miles northeast of Port Orford), the type Myrtle area. Two new formations of latest Jurassic and earliest Cretaceous age, respectively, have been designated there. Because of the distance from that area and rather different lithologic characteristics, no formal stratigraphic terminology is being endorsed herein for coastal sequences of similar age. Ages suggested by previous workers for metamorphic and igneous rocks in the Humbug Mountain area are regarded with reservations.

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STRATIGRAPHY

Metamorphic and Igneous Rocks

Characteristics

Rocks assigned to the pre-Cretaceous include metasediments, phyllites, greenstones, and basic to intermediate igneous varieties, chiefly diorite. Their general distribution appears on the accompanying map.

Metasedimentary rocks: The metasediments contain 85 to 90 percent quartz and are characteristically banded. Bands range from 1/4 to one inch in thickness, and they show fine-scale ripple bedding and graded bedding. In thin section one sees incipient growth of mica, a few quartz grains with sutured boundaries, and poorly preserved foraminifera. Among all the sedimentary rocks in the area, these banded metasediments are the most distinctive. They are similar in practically all respects with sediments of the Galice formation observed by the writers along Grave Creek in the Galice quadrangle, 50 miles east of Port Orford (see Wells and Walker, 1953).

Colebrooke schist: Low-grade metamorphic rocks referred to the pre-Cretaceous Colebrooke schist by Diller (1903) are chiefly quartz-mica phyllite. A significant amount of carbonaceous material is also present. The phyllite locally has chevron folds on both a megascopic and microscopic scale.

Greenstones: The most complex group of rocks are those described under the general heading of greenstones. These are greenish, altered basic igneous rocks. The color is principally due to three minerals - chlorite, epidote, and hornblende. Because of the high degree of alteration, it can not be said with certainty whether these are altered intrusive or extrusive rocks. No definite amygdaloidal, pillow, or other volcanic structures were observed except in one example associated with Upper Jurassic strata along the Rogue River, south of the present map area. Basic igneous rocks, other than greenstone, are diabasic in texture and of gabbroic composition. These are found in scattered localities along the Elk River and elsewhere.

Diorite and metasedimentary rocks: The most common igneous rock is diorite that shows local variations toward a more basic composition. It occurs in a small intrusive pluton, here designated the Pearse Peak diorite. The best exposures are along the Elk River, just north of Pearse Peak. The diorite contains andesine with well-developed zoning, hornblende, quartz (5 to 10 per cent), and biotite, with alkali feldspar, sphene, and magnetite as accessories. It has a granitic texture. The presence of sphene, euhedral mineral grains, and well-developed zoning of the plagioclase all point to a magmatic origin.

Age and Sedimentary Relationships

The stratigraphic position of the Pearse Peak diorite is considered as Upper Jurassic. Dikes and sills of the diorite intrude banded metasediments on the east and west sides of the pluton, for example, at Purple Mountain Creek (NE$\frac{1}{4}$ sec. 23, T. 33 S., R. 14 W., near its junction with the Elk River) and on Beartrap Creek (SW$\frac{1}{4}$ sec. 32, T. 33 S., R. 14 W.). At both localities foraminiferal-bearing banded metasedimentary rocks were collected near the contacts. The foraminifera have been identified by Professor R. L. Batten of the University of Wisconsin (personal communication) as belonging to the families Buliminidae, Heterohelicidae, Lagenidae, Polymorphinidae, and Rotaliidea, and they are of probable Late Jurassic or Cretaceous age. A Late Jurassic age seems more likely because the metamorphic-igneous complex is unconformably overlain by Early Cretaceous (Valanginian) conglomerate containing diorite and metasedimentary pebbles. Furthermore, there is the striking similarity of the banded metasediments to the early Late Jurassic (Oxfordian-Kimmeridgian) Galice formation (Wells and Walker, 1953). It is also unlikely that the foraminifera could be older than Late Jurassic (personal communication, R. L. Batten). The Pearse Peak diorite, therefore, is regarded as post-early Late Jurassic and pre-Early Cretaceous (Valanginian). (It is hoped that a radio-active date by the potassium-argon method can be

established, but no biotite that has escaped chloritization has been found.

The history of the phyllite is poorly documented. The presence of phyllite fragments in Lower Cretaceous conglomerate near the head of Brush Creek (sec. 4, T. 34 S., R. 14 W.) and at the mouth of Mussel Creek (sec. 19, T. 34 S., R. 14 W., just south of the map area) indicates a pre-Early Cretaceous (Valanginian) age. Wells (1955) mapped the Colebrooke schist as a metamorphosed phase of the Late Jurassic (Oxfordian-Kimmeridgian?) Rogue formation. The typical Rogue (Wells and Walker, 1953), where seen by the writers inland on the Rogue River below Grave Creek bridge, consists of fine- to coarse-grained sediments rich in volcanic detritus, tuffs, agglomerates, flow breccias, flows, and their metamorphic equivalents. The mineralogy of the Colebrooke does not suggest a close similarity. Extremely high quartz content plus carbonaceous material suggest a more normal sedimentary rock as the parent, for example, the Galice formation. Foliation transecting relict bedding also was found in the phyllite; however, in most cases the bedding has been destroyed. Perhaps the banded metasedimentary rocks are the parent, for the mineralogy and scale of compositional layering or banding are compatible with that of the phyllite. Chemical analyses of both lithologies should aid in identifying the parent of the phyllite.

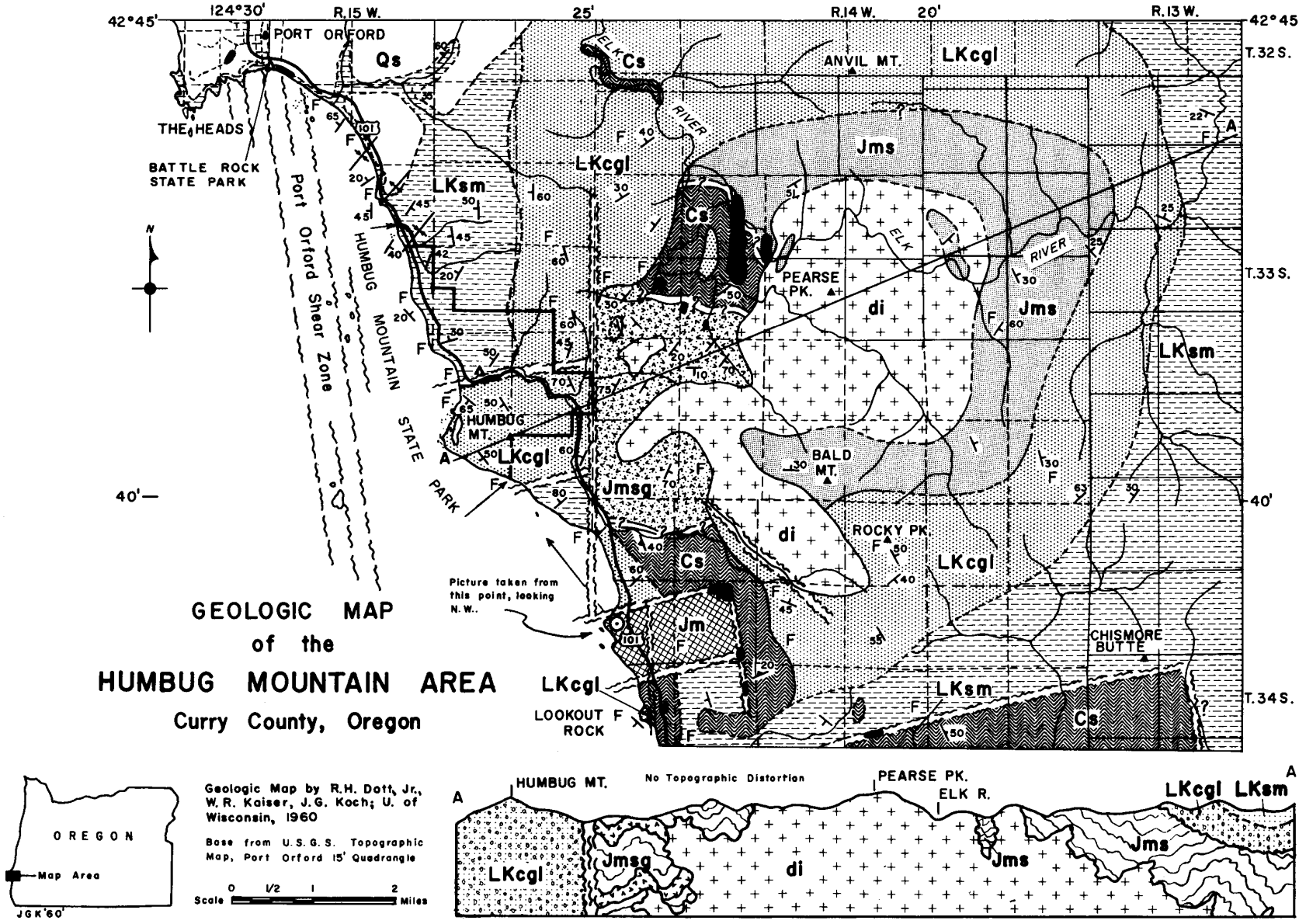
A pre-Cretaceous age for most, if not all, of the greenstone is suggested by abundant fragments of this lithology in the Lower Cretaceous conglomerate. Study of inclusions found in the diorite to ascertain whether they are basic rock may be helpful in further restricting the age of the greenstones and other basic rocks exposed near the Elk River. But greenstone masses along the coast in areas of Cretaceous outcrops cannot be dated adequately. Diller (1903) believed that these (e.g., Silver Butte, just north of Port Orford) were Cretaceous? volcanic necks. This area lies in what now is regarded as the Port Orford shear zone ~~(fig. 1)~~, and it is entirely possible that these masses are in-faulted pre-Cretaceous bodies. Intensely sheared greenstones as well as serpentinites are present due west, but not east, of the diorite pluton. A possible explanation of this relationship, in view of the general northeast strike and southeast dip of the banded metasediments, is that faulting on the west has brought up basic rocks, now greenstones, that were stratigraphically below or low within this sequence. Because of the easterly dip, the greenstones would be buried more deeply on the east, thus explaining why they are not exposed east of the pluton (~~figs. 1 and 2~~). Faulting may also explain the greenstones scattered locally within the phyllite. If basic igneous rocks were interbedded in the phyllite, they probably were better able to withstand dynamic metamorphism because of their relatively greater competence. The fact that many of the greenstones also are associated intimately with banded metasediments makes it important to determine if they are extrusive or intrusive. At present the writers have insufficient petrographic data to give a definite answer. If they are extrusive, we would consider them as interbedded within the banded metasediment sequence and its possible phyllitic phase.

The serpentinites present yet another problem of stratigraphic relationships. Faulting, undoubtedly a significant factor in regard to their present positions, greatly hinders any age assignment for these rocks. Furthermore, serpentinite fragments are apparently absent from the Lower Cretaceous conglomerates.

Sedimentary Rocks

Upper Jurassic (Portlandian) Sedimentary Rocks

An unmetamorphosed sequence of sediments containing the late Jurassic (Portlandian) pelecypod Buchia piochii (Gabb) was found north of Gold Beach during 1960 (south of the map area of the present report). These are somewhat similar lithologically to the Early Cretaceous sediments. Pillow basalts exposed along the Rogue River about five miles above its mouth may be interbedded with Upper Jurassic strata, but no other known volcanics have been seen associated with them. Detailed petrologic distinctions between the Upper Jurassic and Lower Cretaceous sediments have not been established, but obvious differences exist between conglomerates in the two sequences.


42°45'
124°30'
R.15 W.
25'
R.14 W.
20'
R.13 W.
42°45
T.32 S.
T.33 S.
40'
T.34 S.
PORT ORFORD
THE HEADS
BATTLE ROCK STATE PARK
Port Orford Shear Zone
HUMBUG MOUNTAIN STATE PARK
HUMBUG MT.
ELK RIVER
ANVIL MT.
PEARSE PK.
BALD MT.
ROCKY PK.
CHISMORE BUTTE
LOOKOUT ROCK
Picture taken from this point, looking N.W.
Qs
Cs
LKcgl
LKsm
Jms
Jmsg
Jm
di
GEOLOGIC MAP
of the
HUMBUG MOUNTAIN AREA
Curry County, Oregon
OREGON
Map Area
JGK'60
Geologic Map by R.H. Dott, Jr., W.R. Kaiser, J.G. Koch; U. of Wisconsin, 1960
Base from U.S.G.S. Topographic Map, Port Orford 15' Quadrangle
Scale 0 1/2 1 2 Miles
No Topographic Distortion
A
A'

HUMBUG MOUNTAIN, in the background, is composed of Lower Cretaceous conglomerate. The foreground is of the same material. The light-colored area between is a down-faulted block of younger Cretaceous sandstone and mudstone.

EXPLANATION

PLIO-PLEISTOCENE

Qs — ELEVATED MARINE TERRACE DEPOSITS, SOME EXPOSURES OF PLIOCENE SEDIMENTS.

ANGULAR UNCONFORMITY

LOWER CRETACEOUS

LKsm — CHIEFLY GRADED SANDSTONES AND MUDSTONES

LKcgl — CHIEFLY MASSIVE CONGLOMERATE

ANGULAR UNCONFORMITY

JURASSIC ?

di — DIORITE

sp — SERPENTINITE

Jm — MIXED ROCKS; SEDIMENTS, METASEDIMENTS, SCHIST, GREENSTONES.

Jms — METASEDIMENTS WITH FORAMINIFERA, Jms; ALSO WITH GREENSTONES, Jmsg.

Jmsg

Cs — COLEBROOKE SCHIST; QUARTZ-MICA, GRAPHITIC PHYLLITE TO SCHIST WITH GREENSTONES, UNDIFF.

30 — STRIKE AND DIP OF BEDS

40 — STRIKE AND DIP OF FOLIATION

CONTACT

INDEFINITE CONTACT

POSSIBLE LATERAL GRADATION

SHEAR ZONE

F — FOSSIL LOCALITY

MOUNTAIN PEAKS

STATE PARK CAMPING OR PICNIC AREAS

BOUNDARIES OF HUMBUG MOUNTAIN STATE PARK

Upper Jurassic conglomerates are dominantly of argillite, quartz, and chert fragments that are all less than four inches in average diameter. In contrast, Lower Cretaceous conglomerates contain numerous phyllite, metasediment, greenstone, diorite and other igneous rock clasts, and are generally coarser, having individual fragments to one foot or more in diameter, and more poorly sorted.

Where one sequence is exposed the other is absent. Thus their inter-relationship remains unknown, neither supporting nor denying the possible presence in this area of an unconformity between the Upper Jurassic and Lower Cretaceous strata such as that suggested in the Roseburg area by Imlay, et al. (1959). Although the sequence appears to be equivalent at least in part to the Riddle formation of Imlay, et al. (1959), it is deemed presently inadvisable to apply that term in this area.

Lower Cretaceous (Valanginian) Sedimentary Rocks

A dominantly coarse-grained clastic Lower Cretaceous sequence rests with marked unconformity on pre-Cretaceous rocks exposed along the Elk River (SW¼ sec. 8, T. 33 S., R. 14 W.). This sequence, temporally equivalent to part of the Days Creek formation (Imlay, et al., 1959), has been subdivided into two mappable units by Koch (1960), a lower massive conglomerate unit overlain gradationally by a dark-gray sandstone-mudstone unit. Humbug Mountain consists of southwest-dipping massive conglomerate, whereas north of it the sandstone-mudstone unit is exposed and dips westward. Their relative stratigraphic positions are revealed north of the Humbug Mountain camp ground where the coarse unit appears to dip west beneath the other in an unfaulted relationship. The Lower Cretaceous sequence is believed to be at least 9,000 feet thick. Fragments of pre-Cretaceous rocks are abundant in the conglomerates, and the graywacke sandstones also consist predominantly of lithic fragments. Buchia crassicolis (Keyserling) and other early Cretaceous (Valanginian) fossils have been found at several places (see map), notably near the junction of Butler Creek and the Elk River (NE¼ sec. 17, T. 33 S., R. 13 W.).

A study of these strata and their sedimentary structures by Koch (1960) indicates that the Lower Cretaceous is a geosynclinal sequence reflecting the denudation of nearby, easterly source areas. Active erosion and rapid deposition of gravels in close proximity to a very rugged, perhaps faulted, shoreline occurred during the early part of the sedimentary cycle. As erosion and marine transgression proceeded, turbidity current deposition apparently was favored as is evidenced by abundant graded bedding in sandstones and granule to pebble conglomerates. Flute, groove and load casts, contorted bedding, and other sedimentary structures, together with mascerated plant debris mixed with displaced shallow-water pelecypods also typify this sequence. Finer and finer sediments were deposited as the sea progressively transgressed the waning source areas. Absence of contemporaneous extrusive igneous material from the sequence is significant, indicating at least a temporary volcanically-quiescent period. Tectonic instability was extreme, nonetheless, judging from the character and thickness of the Lower Cretaceous sediments and the fact that subsequent faulting and folding have deformed them severely.

Upper Cretaceous Sedimentary Rocks

Upper Cretaceous foraminifera have been identified in rocks exposed along the coast several miles north of Port Orford, but their relationship to older rocks in that area has not been established. They are rather similar lithologically and structurally to Upper Cretaceous deposits about 30 miles south of Port Orford, in the Pistol River and Cape Sebastian area (Popenoe, et al., 1960). The latter area is under study by John K. Howard, graduate student at the University of Wisconsin.

Plio-Pleistocene Sediments

Unconformably overlying the Lower Cretaceous north of Humbug Mountain are Plio-Pleistocene sediments, the most prominent of which are marine terrace deposits of tan sand and gravel. An

exposure of fossiliferous sediments, tentatively regarded as the Pliocene Empire formation, was found at the mouth of Hubbard Creek, about one mile southeast of Port Orford. Fossils there include large, coarse-ribbed Pecten and other molluscs, as well as coaly material. A thin terrace veneer of Plio-Pleistocene sediments is also visible approximately 300 feet up on the west or seaward face of Humbug Mountain, just above the sea cliffs.

GEOLOGIC STRUCTURE

Faults of various trends, including almost due north and due east shear zones, have sliced the area into a number of discrete blocks (figs. 1 and 2). The dominant trend, and also the one that has apparently the most intensive deformation, is northerly. Some of the shear zones are at least half a mile wide. Such zones are characterized by intensely sheared rocks, calcite and quartz veining, and commonly by greenstones and ultramafic rocks of indefinite affinities. Also typical of the shear zones are landslides and valleys, for example, the Brush Creek valley at the Humbug Mountain camp ground. Due south of Port Orford, serpentinite masses of indefinite age and origin are present within the Port Orford shear zone. This zone is believed to be coincident offshore with the greenstone islands and to pass west of Humbug Mountain. It apparently re-enters the coast south of the map area. Movement along this and the other shear zones is unclear and requires further study. Their pattern and magnitude of deformation are quite similar to the fault systems of northern California. Distinct contrasts are the more regular northeast-trending structural pattern in the interior Klamath-Siskiyou province farther east (Wells, 1955) and the less intense deformation of Tertiary rocks in the Coast Range farther north.

In general, poor exposures and widespread shearing mask that area's fold patterns. Small folds present in beach exposures north of Humbug Mountain trend northeast, but these may be only the result of movement along the Port Orford shear zone. Mapping, however, does indicate a north to northeast trend in the inland portions of the Lower Cretaceous, a trend somewhat similar to the general northeast structural pattern of most of southwest Oregon. Structures within the pre-Lower Cretaceous, besides those due to shearing, are but imperfectly recognized, as are possible northeast trends in the metasediments.

HISTORICAL SUMMARY

The Humbug Mountain area was subjected to the same severe mountain-building forces that pervaded the whole Klamath region during late Mesozoic time, and presumably earlier as well. The Pearse Peak diorite, a product of this activity, is the most westerly body of like composition in the whole Klamath province. It is notable in that its age can be fixed rather precisely as intra-Late Jurassic or classic Nevadan. Dioritic plutons of this age have proved to be rare indeed, and, in general, these are confined to the westerly side of the Pacific Coast batholithic belt. By far the bulk of the batholiths are of Cretaceous age. Very soon after the diorite was intruded and the most intense deformation had ceased, at least by Early Cretaceous time, the Pearse Peak diorite and surrounding metamorphic and igneous rocks were being eroded in a very rugged terrain, providing abundant coarse gravels to the sea. Topographic conditions then changed, however, and deposition gave way to sandstones and mudstones apparently deposited considerably by turbidity currents.

After Early Cretaceous and until relatively recent time, there was renewed mountain building characterized chiefly by long-continued intense shearing along great fault zones. Broad vertical warping that has taken place still more recently is evidenced by elevated flat-topped and wave-notched sea stacks and by marine terraces veneered with conspicuous tan sands and gravels exposed along Highway 101 between Humbug Mountain and Port Orford.

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UNDERWATER WELL COMPLETION

The petroleum industry's first underwater well completion was announced early in November by Peruvian Pacific Petroleum Company. The wellhead of the pioneer project is located under 130 feet of water on the ocean floor about a mile off the coast of northern Peru. Oil now is flowing from the well to a tank farm ashore through a string of 3-inch-diameter aluminum pipes anchored to the ocean bottom. Success of the technique used could eliminate the need for costly platforms in offshore oilfield development. The unique ocean-floor well utilized a Peruvian Pacific-Richfield Oil Corporation "Christmas tree" made of aluminum piping that is expected to minimize operating and maintenance difficulties at the 130-foot depth of the wellhead. The flow line from well to shore is actually a bundle of aluminum pipes made up of 50-foot lengths welded on shore into two continuous 3250-foot segments. These were then plugged and the lines launched parallel to the shoreline and (pulled through 90 degrees of arc without the use of a pipe-laying barge) floated into position. (From Compressed Air Magazine, January, 1961)

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MINERALOGIST MAGAZINE UNDER NEW OWNERSHIP

The Mineraolgist Magazine, which for over 30 years was owned and managed by the Dake family of Portland, with Dr. H. C. Dake as editor, transferred ownership in September, 1960.

New owner and publisher is Don MacLachlan of Mentone, California, editor of the magazine Gems and Minerals. Mr. MacLachlan states that the editorial policy of The Mineralogist has been altered to make it primarily a magazine for mineral collectors and that very little gem or gem-cutting material will be included, because this type of information is now covered adequately by other periodicals.

The Dakes will continue to handle the publication and distribution of their many popular and helpful booklets on prospecting and gem cutting from their home in Portland.

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STATE LEGISLATIVE NEWS

The following bills of direct interest to the mining industry have been introduced since the report made in the February Ore.-Bin:

House Bill 1668: Introduced by Representatives Haight, Eymann, Kelsay, and Leiken: establishes regulations for perfection of placer mining claims upon the public domain of the United States. Sec. 1 defines "legal subdivision" as a subdivision of a state survey or of a United States survey which has been extended over the geographic area to be described. Sec. 2 requires that location notice shall contain the name of the claim, name of the individuals locating claim, date of location, and description of area to be located. Sec. 3 requires that boundaries of claim be marked within 30 days after posting of location notice. Sec. 4 requires that within 60 days after posting of location notice an open cut be made of not less than five cubic yards in volume and exposing the placer deposit. Sec. 5 requires that within 60 days from posting of location notice the claim shall be filed for record with the County Recorder of Conveyances. Sec. 6 states that all locations or attempted locations of placer mining claims made after the effective date of the act that do not comply with the provisions of secs. 1-5 are void.

House Joint Memorial 11 - Introduced by Representatives Haight, Eymann, Kelsay, Leiken, and Senator Flegel: states the importance of Oregon's mineral resources to the state and nation and the need for maintaining a healthy mineral industry and calls upon the federal government to foster and encourage the development of an economically sound and stable domestic mining and mineral industry, the orderly development of domestic mineral resources and reserves necessary to assure satisfaction of industrial security needs, and research to promote the wise and efficient use of our mineral resources. Recommends that this policy be implemented by more effective enforcement of anti-dumping laws and the imposition of adequate duties on metals and mineral imports.

House Joint Memorial 12 - Introduced by Representative Cannon: urges Congress to decline passage of Senate Bill 174 (the National Wilderness Bill), decline passage of any legislation which would encourage extension of or increase the rigidity of regulation of existing wilderness, wild, or primitive areas, and decline passage of any legislation which would set aside any area of federally owned land for limited and restricted use.

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UNDERSECRETARY FOR MINERALS APPOINTED

On February 14, President Kennedy announced the appointment of John M. Kelly of Roswell, New Mexico, as Assistant Secretary of the Interior for Mineral Resources.

Kelly, a native of Chelsea, Mass., is a mining and petroleum engineer. As assistant secretary, he will discharge the duties of Secretary Udall in the field of natural resource development. He will also be responsible for the activities of the Bureau of Mines, the Geological Survey, the Oil Import Administration, the Office of Mineral Exploration, the Office of Minerals Mobilization, the Office of Coal Research, the Office of Oil and Gas, and the Office of Geography.

For the past 25 years Kelly has been active in the field of petroleum conservation, and at the time of his appointment, was the president of his own oil-producing firm in New Mexico. He is a graduate of the New Mexico School of Mines with bachelor of science degrees in mining engineering and petroleum engineering. (American Mining Congress Bulletin Service, Feb. 18, 1961).

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MINERALS CONFERENCE TO BE HELD AT SPOKANE

The Pacific Northwest Metals and Minerals Conference for 1961 will be held at the Davenport Hotel in Spokane on April 13, 14, and 15. W. D. Nesbeitt, Spokane, is chairman of the conference.

The meeting will be sponsored jointly by the Columbia Section of AIME and the Spokane Section of the American Society for Metals. Scheduled for April 13 and 14 are 11 technical sessions on mining, geology, industrial minerals, minerals beneficiation, geophysics, and primary and secondary metal working. A panel discussion "Gold and the Monetary System" will be held Thursday evening, April 13. The program will include two luncheons with speakers and a buffet dinner. Field trips will be made on Saturday, April 15.

Some of the papers to be presented at the two-day sessions are as follows:

"Cement Operation in the Pacific Northwest" by Lawrence C. Miller, Portland Cement Association, Spokane, Washington.

"Precast and Prestressed Concrete" by J. Gordon Fenton, Central Pre-Mix Concrete Company, Spokane, Washington.

"An Airborne Magnetometer and Scintillometor Survey in Ferry and Okanogan Counties, Washington" by Marshall T. Huntting, Washington State, Division of Mines and Geology, Olympia, Washington.

"Iron Ore Occurrences in Idaho" by David W. Young, Idaho Bureau of Mines and Geology, Moscow, Idaho.

"Engineering Geologic Studies as an Aid in Urban Development" by Herbert G. Schlicker, State of Oregon Department of Geology and Mineral Industries, Portland, Oregon.

"Sawtooth Mountains Aquamarine and Other Beryllium Deposits in Idaho" by Eldon C. Pattee, U. S. Bureau of Mines, Spokane, Washington.

"Stratigraphy of the Belt Series, Northwest Montana" by Willis M. Johns, Montana Bureau of Mines and Geology, Butte, Montana.

"Electron Beam Zone Refining of Tungsten" by Lloyd Bazant, U. S. Bureau of Mines, Albany, Oregon.

"Geology of the Hunters Quadrangle and Vicinity, Washington" by Arthur B. Campbell, U. S. Geological Survey, Denver, Colorado.

"Geochemical Studies in Pend Oreille County, Washington" by James W. Crosby 111 and Richard E. Cavin, Division of Industrial Research, Washington State University, Pullman.

"Permian Limestones in Northeastern Washington" by Joseph W. Mills, Department of Geology, Washington State University, Pullman, Washington.

"Progress Report on the Washington State Geologic Map" by Wayne Moon, Washington State Division of Mines and Geology.

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QUICKSILVER INSTITUTE ELECTS OFFICERS

At the annual meeting of the American Quicksilver Institute, S. H. Williston was elected president, C. Hyde Lewis, vice-president, and S. R. Smith, James Bradley, and C. O. Reed, directors.

Within the past year the number of active quicksilver mines in the United States has dropped by 30 percent because of the lowest price in ten years. As a result, exploration and development for new mines has slowed considerably and current operating mines have had to increase their cut-off grade of ore to remain in operation. This has reduced materially the proven reserves of the industry.

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DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
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Telephone: CApitol 6-2161, Ext. 488

Field Offices

2033 First Street
Baker

239 S. E. "H" Street
Grants Pass

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SKIN DIVING FOR GOLD IN OREGON*

Introduction

The combination of leisure time, the lure of gold lying hidden in the riffles of a stream, and inexpensive diving equipment has inevitably produced a large demand for information on diving for placer gold. This article has been prepared to assist and inform the prospective skin diver who wants to try his luck looking for gold in Oregon. Most of the information on methods and equipment has been abstracted from the very comprehensive article by W. B. Clark, "Skin diving for gold in California", which appeared in the June, 1960, issue of Mineral Information Service of the California Division of Mines. Additional references to articles concerned with placer gold mining appear at the end of the article. Information may also be obtained from the two field offices of the department, which are located in the main placer gold areas in the state at Baker and Grants Pass, also at the head office in Portland.

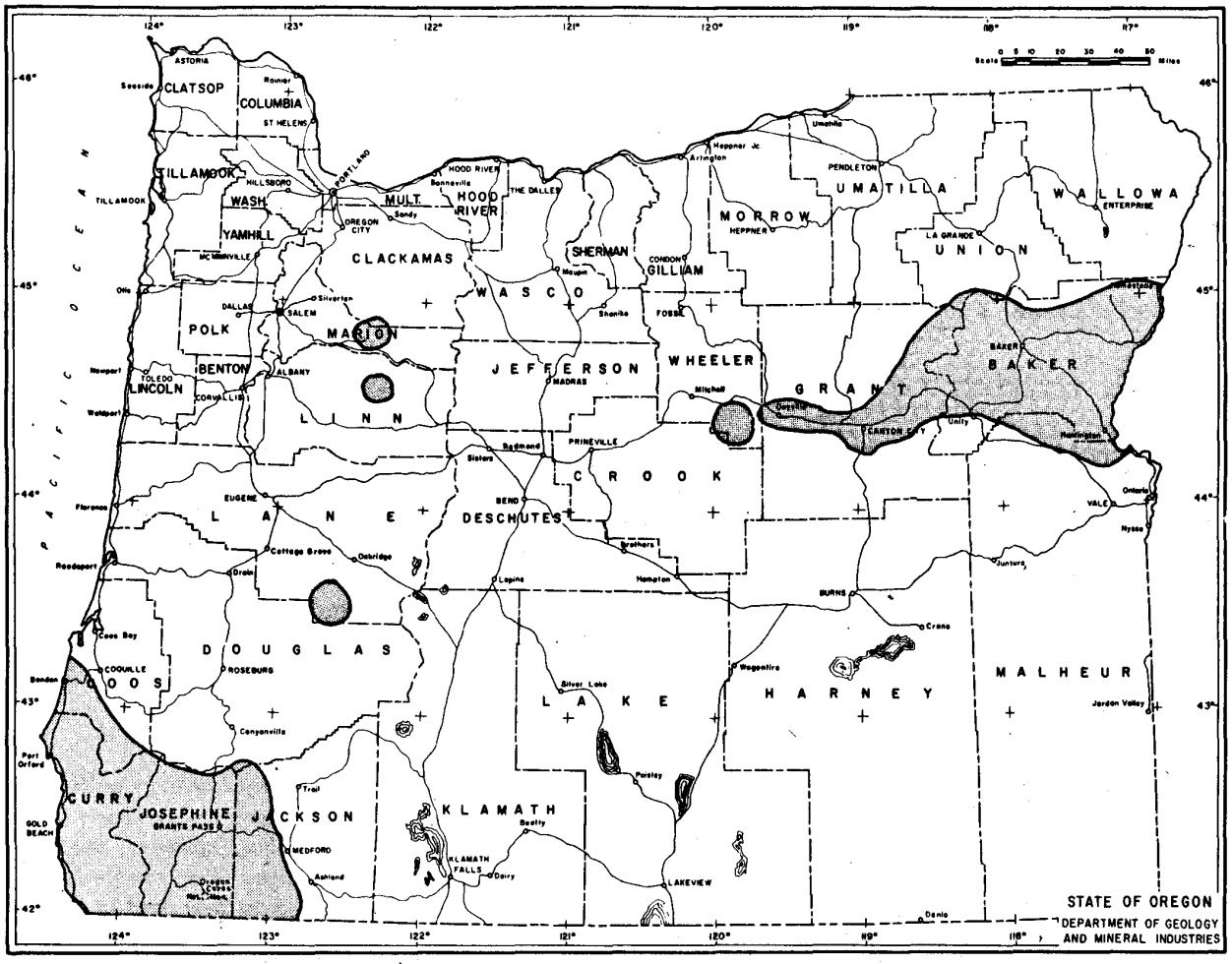
History and economics

It should be emphasized that from a purely economic standpoint the chances of recovering significant amounts of gold by skin diving are poor. Occasional "finds" of very rich material tend to overshadow the meager returns obtained by the majority of the prospectors. From a recreational angle, however, the rewards are great since the activity includes generous portions of outdoor living in areas often remote from civilization and work in the murky depths of a stream with equipment far removed from that used in daily life. Add to this the ever-present possibility that there may be gold in the next panful, and the attraction of skin diving for gold becomes clear.

Historically, the recovery of placer gold in Oregon began in July, 1850, with the discovery at the confluence of Josephine Creek and the Illinois River in Josephine County (Spreen, 1939). The deposits found in Rich Gulch near Jacksonville in January of 1852 touched off the first of a long series of "rushes" to various parts of the state. Placer gold has been mined continuously in Oregon ever since. Gold which had been accumulating in the streams for thousands of years was soon mostly gone. Low-grade areas were temporarily ignored in favor of richer claims. Later on the poorer sections of the streams were worked with more elaborate and efficient equipment. Today the skin diver must concentrate on those places that were either too small for large-scale operations or were inaccessible because of depth of water. A careful study should be made of an area before deciding where to prospect, since much time and money can be wasted in searching in areas which have been worked thoroughly already.

Over the years the placer miner has progressed from the simple gold pan, which was entirely adequate for the very rich stream placers first discovered, to the long tom, the rocker, the hydraulic giant with greatly enlarged and extended sluices, the connected bucket dredge, the "doodlebug" or portable washing plant fed by an independent power shovel or dragline, to a wide variety of earth-moving and gold-recovery devices nearly all of which are easily transportable and designed to work small, irregular areas. Skin-diving equipment has been used in the state only recently but has been gaining rapidly in popularity. Many attempts have been made to recover stream gold with small floating suction pumps and hoses operated from the surface, but these have not been successful, mainly because of inability to control and direct the suction nozzle properly. The use of skin-diving equipment, which permits use of underwater gold-saving devices, should increase the efficiency of this phase of the operation.

*Compiled by Ralph S. Mason, Mining Engineer, State of Oregon Dept. of Geology and Mineral Industries.



Generalized Map of Placer Mining Areas in Oregon

Possible placer gold areas in Oregon

Placer gold has been reported from many streams in Oregon but, generally speaking, the gold-bearing streams that have been important producers in the past are concentrated in two widely separated areas in the northeastern and southwestern corners of the state. The accompanying map shows these two principal areas as well as four smaller localities which have been moderately productive over the years. Streams draining the Bohemia district in southern Lane County, particularly Sharps, Martin, and Steamboat creeks, have been moderately productive. The Little North Fork of the Santiam River above Elkhorn in Marion County, Quartzville Creek in the vicinity of Quartzville in Linn County, and Spanish Gulch near Antone in Wheeler County have seen placering activity.

The skin diver can obtain much useful information about the various areas in which he wishes to prospect from topographic maps issued by the United States Geological Survey. Such maps on a scale of one inch to the mile are available for all of southwestern Oregon. For eastern Oregon, topographic maps cover part of the area, although some of them are on a scale of one-half inch to the mile.

Many of Oregon's gold-bearing streams are too small for serious skin diving during the summer months. There are occasional pools where diving gear could be used, however, and prospectors equipped with face masks and snorkels could explore the shallow streams that are too deep to wade but too shallow to dive in.

Prospecting and mining methods

Once a stream has been selected for prospecting by skin diving methods it is important to recognize the most favorable places for the occurrence of gold. Mineral Information Service explains the procedures as follows:

... The first step involves a careful examination of the streams and the terrain adjacent to them. Natural features that should be noted are the topography, nature of the bedrock including joint and crevice systems, stream currents, bends in the stream, and visible underwater features such as crevices, large boulders, or any other type of barrier. The deposition of gold is the result of the action of flowing water coupled with the shape of the stream channel and stream bed which have acted as natural traps. The processes involved in the action of flowing water are extremely complex as they are dependent upon a number of variable factors, the most important of which are (1) shape of the channel, (2) volume of water and (3) the slope of the stream channel.

Wherever the natural features or a change in the volume of water flowing have caused a sudden decrease in stream velocity, conditions are favorable for gold prospecting. A decrease in velocity lowers the carrying power of the stream which begins to deposit its load. The heaviest particles including gold will be dropped first. Thus concentration of gold can be expected where the stream widens, near quiet pools below rapids, or along bends in the channel. In a straight channel the current is swifter near the middle than near the sides, and swifter above mid-depth than below. At bends the transportation and deposition of gold become extremely complicated. Velocities within the stream change so that the greatest velocity is near the outer or concave bank.

Next, examine the stream bank for gold between the high water mark and the water level. Material in narrow cracks and crevices should be removed with the crevicing tool and panned. Material from the downstream side of half-buried obstructions also should be examined. In addition, fine roots, moss, or other vegetal material near the water should be examined as they will commonly trap fine particles of gold. If gold or "colors" are found in the pan, that area of the stream is a good place to prospect further.

Initial underwater exploration in the stream should be done with the snorkel. This avoids the large amount of work involved in carrying and setting up mining equipment in case the stream proves to be unfavorable. The initial underwater trip is to determine the configuration, location of natural gold traps, and the nature of currents. Deep narrow crevices and cracks, especially those that occur in steeply dipping rocks whose strike or trend is perpendicular to the stream flow, are particularly favorable for the occurrence of gold. A series of parallel deep narrow cracks are especially good as they form natural riffles. Such traps are most likely to be found in gneiss and heavily jointed granitic and volcanic rocks. In some cases long trough-like crevices that are parallel to the stream flow act as natural sluice boxes. Natural irregularities at the bottom act as riffles or pockets to catch the gold. Sometimes deep potholes are good gold traps. Potholes have been scoured out in the bedrock by gravels being spun around by eddying currents. They are most common below falls and rapids and most abundant in crystalline limestone and granitic rocks. However, the scouring action also may tend to grind up and dissipate the gold. The downstream side of large boulders or any type of obstruction may be favorable sites since the eddying motion on the downstream side facilitates the deposition of gold.

The gold is almost always concentrated near and at the bottom of such natural traps. It occurs as flat or rounded grains and flakes ranging from microscopic size to nuggets several inches across. The coarser gold usually is found at the greatest depths. Because many of the streams have been mined in past years and the gold usually was recovered by amalgamation with mercury, some of the gold found at the present time may have been partially amalgamated with mercury and be nearly white in color. Native mercury occasionally is found also at the bottom of such streams. The gold is always associated with black sands that are composed chiefly of magnetite and smaller amounts of ilmenite, zircon, and garnet. Usually small amounts of pyrite or "fool's gold" are present in black sand. Small grayish-white grains and nuggets of platinum may be present but usually only in very small amounts. Also present in some of the stream beds are lead shot, old nails, small bits of scrap iron, and occasionally old coins, etc. The presence of metal should be carefully noted when prospecting. The gold-bearing black sands are near or at the bottom of the natural traps and usually are covered by accumulated sands, gravels, cobbles, boulders, and wood fragments. Sometimes the overburden itself will contain values. The particles of gold found in the streams originally came from veins, mineralized zones, and older placer deposits from which they were released by weathering and disintegration of the rock.

When prospecting a crevice underwater, the loose overburden can be partially removed by "fanning" it with cupped hands, and the heavier gold-bearing black sands at the bottom can be removed with the crevicing tool. The gold sniffer is especially valuable here. Efforts should be made to determine the exact spot for mining operations. There is no magic formula to determine the presence of gold. The finding of gold is partly luck and partly intelligent prospecting and painstaking observation. A knowledge of the gold-bearing regions in the state is extremely important.

After the area to be mined has been selected, the equipment is carried down to the stream and set up. The jet dredge is operated by a two man team. The "dredge" man stands and holds the dredge while it sucks up material. In order to stand upright the dredge man will need 40 to 50 pounds of weight on his belt and he also will carry weights on his feet. The second man, known as the "pick-up" man, lies nearly flat on his stomach and guides the dredge intake. He usually carries about 30 pounds of weights. In addition he removes rocks too large for the intake and uses the tools to help clean out the crevices. He also moves rocks downstream and away from the mining operation, usually in a pail or large can. When mining an area, the work should progress upstream so that the divers will not be working in their own discarded tailings. Jet dredges are particularly good for removing overburden while at the same time recovering any contained values. A 6-inch dredge can handle between 12 and 16 cubic yards per hour. If a considerable amount of overburden must be removed in order to mine the bedrock, great care must be exercised to see that the walls of the excavation are not too steep because of the danger of caving. The dredge man should act as a lookout when working in these excavations.

The jet dredge should be held nearly horizontal when mining so that the gold will stay in the riffles. When the riffles are full, the dredge is upended, turned over, and the riffle box emptied into a special container for concentrates. This can be done either under water or on shore. At the end of the day the jet dredge concentrates are cleaned up with the miner's pan.

Experience and equipment needed

Mr. Clark, in his article in the Mineral Information Service on skin diving in California, discusses safety measures and equipment needed, which factors are also pertinent to Oregon conditions.

Certain safety rules and precautions must be observed when diving for gold, and such factors must have first consideration. A person should never dive alone. He should have sufficient diving experience so that he can handle himself in the various situations and hazards that are encountered in mountain streams. He should have a thorough understanding of the use and the limitations of his equipment. Hazards that may be encountered include swift and treacherous currents, snags, floating debris, shifting rocks, and chilling water temperatures. In addition many of the places where skin diving for gold is done are in isolated areas far from help.

Usually there are no decompression problems because diving depths rarely exceed 30 feet, and no time limit exists for diving at these shallow depths. However, dives of any duration below 30 feet require careful planning and time allowances for decompression. For example, it is necessary to allow 13 minutes at 20 feet and 16 minutes at 10 feet for decompression after 2 hours of work at 70 feet. A person lacking experience should attend a diving school. These schools offer instruction in diving and breathing techniques, care and use of equipment, emergency procedures, and first aid. A first-aid kit should be taken on any diving trip.

Because of the great amount of exertion in skin diving for gold and the chilling water temperatures, the diver should be in reasonably good health. Those who suffer from chronic bronchitis, asthma, cardiac conditions, ear trouble or have a perforated ear drum should refrain from diving. Persons with colds or sinus trouble, should not dive until they have recovered their health. Ear plugs should never be used while diving with SCUBA. The diver should adhere to a high protein diet and avoid heavy gas-forming food and alcoholic beverages. Cuts and bruises should receive proper treatment....

The equipment used in skin diving for gold varies considerably. The occasional or beginning underwater miner may be equipped with only a snorkel and miner's pan while others have compressors, floating suction dredges, or underwater gold recovering equipment. The outlay for equipment ranges from less than $50 to as much as several thousand dollars. Because it is usually necessary to hike over steep trails or climb down steep banks to reach the streams, durable lightweight equipment that can be carried by two men is most satisfactory.

Several experienced skin divers have recommended the following as the minimum equipment necessary for the beginner in skin diving for gold: snorkel, face mask, weighted belt, fins, gold pan, and crevicing tool. Although a diving suit is not absolutely necessary, the low water temperatures of most streams make it difficult to do much work without one.

There are two types of rubber diving suits: the "dry" and "wet" suits. Dry suits prevent the water from having any contact with the body as all points are sealed. These usually are used only in extremely cold water. Wet suits are the most popular. They are close fitting but allow a little water to penetrate which is warmed by the body and serves as an insulating layer between the suits and the body. Gloves commonly are worn, the most practical being those with separate thumbs and forefingers. Fins are worn when prospecting where a large area is to be covered and much movement is required. Canvas shoes are usually worn when standing or working in a small area. The amount of weight required varies with the individual and should be sufficient to keep him on the bottom. All weighted belts have quick releases so they can be discarded in cases of emergency.

The more experienced and serious divers use self-contained underwater breathing apparatus or SCUBA. This consists essentially of a mouthpiece for breathing, an air regulator, and an air supply. The regulator, on the diver's back, automatically feeds the air to the diver and releases air only as needed at a pressure identical to that of the surrounding water. The source of air supply is a high-pressure cylinder carried on the diver's back.

When a more permanent air supply is desired, an air hose is connected with a low-pressure air compressor on the surface. The air compressor and air lines connected to the diver are collectively known as a "hookah". Hookahs are used in the majority of underwater mining operations. Diaphragm-type compressors are used and are usually operated by a 1½-2 horsepower, 1-cylinder, self-lubricating, portable motor using regular gasoline. These supply air to two divers, the normal amount of air required for two divers being 4 cubic feet per minute. Fuel consumption is about 1 gallon per horsepower per 8 hours.

Piston-type air compressors such as those used for pneumatic tools should never be used as a source of air in diving because of the danger of poisoning from oil fumes. The compressor discharges to a 1- to 1½-cubic foot floating receiver or reserve tank that is connected to the diver's air line. The reserve tank allows the air to cool and acts as a receiver for the air supply. This is a safety measure in case the compressor motor stops suddenly; the diver's air isn't cut off immediately, and he has time to surface. The rubber air hose is ¼- to 3/8-inch in diameter. The compressor is either on shore, or mounted on a float which follows the divers around as they work under water....

One of the more popular and successful items of equipment is an underwater gold saver known as a jet dredge or a "sucker". This is a pipe-like device curved at one end. Most models are 6 to 8 feet long and weigh around 20 pounds. The nozzle ranges from 2 to 12 inches in diameter. The jet dredge is made of galvanized sheet metal or occasionally of plastic or spun glass. The curved end is the nozzle or intake and is composed of stainless steel or some other abrasion-resistant material. At its upper end the head is connected with a valve to a hose that in turn is connected to a motor-driven water pump at the surface. Water under pressure is fed through the hose to the head. As the water is injected, a vacuum is created at the mouth which sucks in and blows out toward the discharge end.

The lighter material is ejected from the discharge end, but the heavier material drops into a small riffle box near the discharge end. Riffle boxes are 6 to 12 inches long, and the riffles are 1 to 2 inches deep. The water pump motor is gasoline driven and ranges from 6 to 10 horsepower. Water hoses range 1½ to 2½ inches in diameter depending upon the size of the sucker. The hose is usually made of flexible heavy rubber. Some skin diving operations are conducted from

Local Suppliers and Diving Schools

EQUIPMENT SUPPLIERS (LOCAL):

Amerman's Divers' Supplies
7312 S. E. 82nd Avenue
Portland, Oregon

Atomic Sales
1218 "M" Street
Sweet Home, Oregon

Cameo Swimming Pools, Inc
9415 S. W. Canyon Road
Portland, Oregon

Diver's Air & Equipment Company
4867 N. E. Union Avenue
Portland, Oregon

Foster Sporting Goods
Foster Road at S. E. 79th Avenue
Portland, Oregon

Freeway Sporting Goods, Inc.
N. E. 81st Avenue at Halsey
Portland, Oregon

Gold Coast Diver's Supply
P. O. Box 418
Barview, Oregon

Lowell's Skin Diving Supplies
3139 Pacific
Forest Grove, Oregon

Marine Mining & Manufacturing, Inc.
1115 Molalla Avenue
Oregon City, Oregon

Pollocks Marina
70 Highway 99
Grants Pass, Oregon

Reese Marine Center
200 North Main Street
Phoenix, Oregon

Sauter Spray Eauipment Company
2903 S. E. Milwaukie Avenue
Portland, Oregon

EQUIPMENT SUPPLIERS (OUT OF STATE):

Aqua Shop
1317 - 20th Street
Sacramento, California

Gold Divers
3534 W. Rosecrans Avenue
Hawthorne, California

Fuller's Diver's Supply
415 Garden Highway
Yuba City, California

Lawrence Phillips
5937 Walnut Drive
Eureka, California

Lusk Dredge Company
P. O. Box 17
North San Juan, California

Powermite Drill & Tool Company
P. O. Box 1131
Ontario, California

Surf Shop
2686 Great Highway
San Francisco, California

The Nugget Farm
5213 Green Valley Road
Placerville, California

SCHOOLS:

Pacific College of Sport Diving
3727 S. E. Kelly
Portland 2, Oregon

small floating dredges equipped with suction pumps and sluices.

A very useful device for prospecting and especially for those who do not have dredge equipment is a large syringe known as a gold sniffer. This can be made from a grease gun, the best type being that which unscrews on the front or nozzle end. Some are made of transparent plastic. Crevicing tools include large spoons, knives, screw drivers, crowbars, and special types now on the market. Other useful equipment includes small bags attached to the diver's belts for nuggets, prospector's pick, hand magnifying glass for inspecting small gold particles, tweezers, gold scales, and bottles or vials for storing the gold.

Rules and regulations

The skin diver looking for gold should acquaint himself with the many rules and regulations concerned with placer mineral rights, prospecting and mining operations, and ownership and sales of gold. The Fifty-first Legislative Assembly has just passed a placer mining law which is abstracted below:

....Any individual, a citizen of the United States, or one who has declared his intention to become such, who discovers a placer deposit of minerals upon the unappropriated public domain of the United States within this state, which minerals are subject to location under the mineral and mining laws of the United States, may locate a placer claim thereon by posting in a conspicuous place thereon a notice of such discovery and location. The notice shall contain:

(1) The name of the claim.
(2) The name of the individual or individuals locating the claim.
(3) The date of the location of the claim.
(4) The number of feet or acres claimed, together with a description, either by legal subdivisions, if practicable, or if not, then by reference to some natural object or permanent monument in the vicinity of the claim, which will identify the claim located.

....Unless the claim for placer deposit...is located by legal subdivisions, the surface boundaries of the claim must be marked so that the same may be readily traced. Such boundaries shall be marked within 30 days after the posting of the notice...by substantial posts or other monuments of the same size, materials and dimensions as in the case of quartz claims. The boundaries of the claim shall be marked at each corner or angle, and, when any side or end of the claim extends for more than 1,320 feet without a corner or angle, then at intervals of not less than 1,320 feet along such side or end.

....Where the claim for placer deposit...is taken by legal subdivisions, no other reference in the notice of claim required to be posted and filed...than to the legal subdivisions shall be required and the boundaries of a claim so located and described need not be staked or monumented. The description by legal subdivisions in the notice...shall be deemed the equivalent of marking the surface boundaries of the claim.

....Within 60 days after the date of the posting of the notice of location,...the individual locating the claim shall cause to be excavated an open cut upon the claim, removing from the cut not less than five cubic yards of material, and, if practicable, exposing thereby the placer deposit described by such notice. The individual locating the claim, the individual making the cut or any person who worked upon the excavation who has knowledge of the facts relating thereto, shall make and attach to the copy of the notice...an affidavit showing compliance with the provisions of this section.

....The individual locating a placer deposit shall, within 60 days from the posting of the location notice upon the claim, file for record with the recorder of conveyances, if there is one, otherwise with the clerk of the county where the claim is situated, a copy of the notice posted by him upon the claim, together with the affidavit of excavation....The fee for filing such location notice shall be the same as required by ORS 517.030 for recording location notices of mineral-bearing rock claims. The recorder or clerk, as the case may be, shall immediately record the location notice and affidavit annexed thereto in a book kept by him for that purpose. No placer location notices shall be entitled to record or be recorded until the work required...has been done and the affidavit in proof thereof is attached to the notice to be recorded.

In many instances the determination of the status of the stream bed is difficult. The following information supplied by the Lands Officer of the Bureau of Land Management may be helpful in this respect:

Beds of navigable waters are subject to laws of the State in which they are situated and they are, therefore, not subject to location under the United States mining laws. Title to the beds of meandered nonnavigable streams is in the riparian owner. The beds of unmeandered nonnavigable streams are subject to location under the United States mining laws if they are unoccupied, as are also the beds of meandered nonnavigable streams where the abutting upland is still owned by the United States.

Where the abutting lands of meandered nonnavigable streams or lakes have been withdrawn for power site purposes, and those abutting lands are owned by the United States, the bed of the stream or lake and abutting uplands are open for location under the United States mining laws, and have been open since August 11, 1955. There are, however, special requirements about which the locator of such claim should know before beginning mining operations on such a location, otherwise, he may find that his mining operation is in trespass.

Further references are in 43 Code of Federal Regulations 185.172 - .186, published in Bureau of Land Management Department of Interior Circular 2007.

The title to the beds of all navigable streams within the state is vested in the State of Oregon and is under the administration of the State Land Board. In addition, the title to the beds of all streams, either navigable or nonnavigable, affected by the ebb and flow of the tide is vested in the state. Prospectors interested in such lands should write to the State Land Board in the State Capitol Building, Salem, for leasing information.

Since a considerable proportion of the beds of gold-bearing streams in the state are already held by mining claimants, it becomes important for the prospector, even if he wants to do "just a little skin diving", to ascertain carefully what the ownership is. Local inquiry will help in this respect since residents living in the immediate area are usually well informed about claims nearby. Unpatented mining claims in good standing are fairly easy to identify because of the annual labor which must be performed on them. An examination of the mining records in the court house of the county in which the claim is located should also show a recording of an annual "Proof of Labor" affidavit for each claim held. Patented claims are usually on the county tax rolls, and information as to their location is generally available from the county assessor's office. Information on patented claims can also be obtained from the U. S. Bureau of Land Management, 809 N. E. 6th Avenue, Portland 12, Oregon.

In some instances it might be possible for the casual "week end" skin diver to make an informal arrangement with a claim owner to do some prospecting on his claim. It is not mandatory for a skin diver to locate a claim on unappropriated or "open" ground, but failure to do this might result in location of the ground by a second party. Certain state and federal agencies have regulatory powers in connection with water and fish life in Oregon streams. In most cases the activities of the skin diver will in no way affect the stream, and restrictive regulations would not apply. It is conceivable that some fairly intensive placering methods employed in connection with skin diving might be contrary to existing rules and regulations. Operations which seriously disturb the bed of a stream, muddy the water, or introduce toxic materials would be objectionable. Agencies having regulatory powers include the State Fish Commission, State Game Commission, State Sanitary Authority, and the U. S. Fish and Wildlife Service.

Markets for placer gold - regulations

Natural gold may be held, bought, sold, and transported within the United States without the necessity of obtaining a government license. Natural gold is defined by the Treasury as gold recovered from natural sources that has not been melted, smelted, or refined or otherwise treated by heating or by a chemical or electrical process. Thus the only gold which would come under the Treasury definition and which may be bought and sold in this country without any strings attached is metallic gold obtained from a natural source by mechanical means only -- that is, by such methods as sorting, washing, sluicing, screening, and tabling.

Gold obtained in the form of sponge, which results from retorting gold amalgamated with mercury, may be held and transported without a license by the person retorting the amalgam, provided that the person shall hold at any one time an amount not in excess of 200 troy ounces of fine gold. The person holding such gold may dispose of it only to the United States mint or to a person holding the proper government license. Care should be taken during the retorting not to melt the sponge, since this would remove it from the natural gold classification. Also, extreme care should be taken to breathe none of the fumes coming from retorting of amalgam, because mercury vapors are highly toxic.

IS IT GOLD?	PHYSICAL PROPERTIES OF GOLD
The positive identification of placer gold is of prime importance to a prospector. Gold is a heavy mineral and will hang back in a pan. Shiny flakes of mica, often mistaken for gold, are easily washed away. Flour gold may also be lost, particularly if any greasy film is present on the water. Gold is soft, and may be cut or flattened easily with a knife blade. Placer gold is usually yellow but may not shine like polished jeweler's gold. Gold is commonly mistaken for either mica or pyrite, neither of which leaves a golden trace on a streak plate. Pyrite is brittle, has a black streak and is attacked by nitric acid. Gold is soluble only in aqua regia.	Specific gravity: 15 - 19 Hardness: 2.5 - 3.0 Malleable and ductile Color: pale to silvery yellow Streak: pale yellow Lustre: metallic

Prospectors wishing to sell placer gold may take it to the following places: the Grants Pass branch of The United States National Bank of Portland buys small quantities of placer gold outright. The First National Bank of Oregon, Grants Pass Branch, and the Southern Oregon State Bank will ship gold to the mint on consignment. A small service charge is made for handling and shipping. The Baker and Medford branches of the United States National Bank will also accept gold for shipment to the mint. Palmer Brothers Jewelry Store in Baker has a gold purchasing and melting license and will buy placer gold outright. In the Portland area, small quantities of placer gold are purchased by the Montana Assay Office, 610 S. W. Second Ave., or by licensed "gold buyers". Prospectors having several ounces of gold to sell at one time should send it directly to the United States Mint, U. S. Mint Building, San Francisco, California.

Much confusion exists about the system of weights and measures used for gold. There are two methods for reporting the purity of gold. Gold used for industry and in the arts is commonly alloyed with other metals to impart certain special characteristics, and the proportion is expressed in karats. Pure gold is 24 karat, while metal containing 50 percent by weight in gold would be 12 karat. For monetary purposes a different system with a fineness number is used. Pure gold under this system is said to be "1000 fine", which would be equivalent to 24 karat gold. Both placer and lode gold contain certain percentages of alloying metals, usually silver, and the fineness is determined by means of the standard fire assay. The fineness of placer gold varies widely from place to place in the state, but an overall average would be about 850 to 900.

Precious metals are weighed with the troy system rather than the familiar avoirdupois. A troy ounce weighs 31.103 grams, while an avoirdupois ounce weighs 28.349 grams. A troy pennyweight is one-twentieth of a troy ounce.

The government-controlled price for gold is $35 per troy ounce 1000 fine. Since newly mined and untreated gold always contains a certain amount of silver and other impurities, the full price is never paid. In actual practice, small lots of placer gold sold to buyers other than the mint are discounted about one-third. Fair-sized nuggets are often sold to collectors and others for prices considerably above the intrinsic value of the contained gold.

Prospectors working streams in southwestern Oregon should not overlook the possibility that platinum-group metals may also be found associated with placer gold. Currently platinum is worth about $82 an ounce. Concentrates containing platinum-group metals can be sold to Wildberg Bros. Smelting & Refining Co., 742 Market St., San Francisco.

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OREGON OFFICIALS TAKE NEW POSITIONS

Earl S. Mollard, who has been general manager of both the Hanna Nickel Smelting Company and The Hanna Mining Operation at Riddle, Oregon, has been made vice president in charge of operations, The Hanna Mining Company, Cleveland, Ohio. Mr. Mollard has been with the Hanna organization for more than 25 years and at Riddle since 1952, when the company began its operations in Oregon. He has been succeeded by Emmons E. Coleman, formerly manager at the Hanna Nickel Smelting Company at Riddle.

Stephen Yih, formerly general manager of the Albany division of Wah Chang Corporation, has been transferred to New York to become president of the company. He has been succeeded by Douglas A. Fairgrieve, who was sales manager with the Albany division since joining the company in 1957.

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TWO MINERAL COLLECTIONS ON DISPLAY

Two very fine loan exhibits are now on display for a short time in the department's new built-in wall cases at the Portland office. One exhibit was loaned by the Willamette Agate and Mineral Society of Salem, and was arranged by Mrs. V. E. Glass, secretary of the society. This exhibit consists of an interesting variety of high-quality minerals, crystals, and agate material from various parts of the United States and Mexico. The other is a remarkable collection of native copper and copper minerals loaned by Leo Simon of Portland. In this colorful array are more than 30 different copper minerals, many of them exceedingly rare.

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BRISTOL NAMED TO BOARD

Fayette I. Bristol, Grants Pass, was appointed to the Governing Board of the Department of Geology and Mineral Industries by Governor Mark O. Hatfield on April 1, 1961, and received Senate confirmation on April 12. Bristol, who is president of Bristol Silica Company, replaces Earl S. Mollard, general manager - Oregon, The Hanna Mining Company, Riddle, Oregon, who resigned April 1 because of his transferal to Hanna's head office in Cleveland, Ohio. Bristol, a former State Representative, brings a wealth of mining experience in Oregon to the board. He is presently Chairman of the Western Governors Mining Advisory Council and President of the Oregon Mining Association. Bristol mined chrome during the stockpile program and has been president and owner of Bristol Silica Company, producers of high-quality silica, since its founding in 1932.

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LAKEVIEW URANIUM NEWS

Lake County Examiner reports that the Lakeview Mining Company's uranium mill at Lakeview, Oregon, was purchased March 27 by Kermac Nuclear Fuels Corporation, a subsidiary of Kerr-McGee Oil Industries, Inc., of Oklahoma. The Oklahoma firm also purchased a similar uranium mill owned by the Gunnison Mining Company at Gunnison, Colorado. According to D. A. McGee, president of the Kerr-McGee Oil Industries, Inc., operations of the Lakeview mill will be conducted as the Lakeview division of the Gunnison Mining Company. Both mills have contracts with the Atomic Energy Commission to produce uranium oxide. Lakeview's present contract runs through November, 1963. After expiration of the AEC contracts, it is the intention of the new owners to make use of the processing plants for treating and concentrating raw materials other than uranium.

Vance Thornburg of Grand Junction, Colorado, who holds a lease on the White King Uranium mine near Lakeview, has begun pumping water out of the large open pit. The White King first produced uranium ore from underground workings in 1955 but mining difficulties early in 1959 resulted in a switch to open-pit operation. The mine has been idle for the past year and Lakeview Mining Company gave up its lease last fall. The mine owners, Mr. and Mrs. Tracy, John and Wayland Roush, Walter Leehmann, Sr., and Walter Leehmann, Jr., subsequently leased the property to Thornburg last October.

* * * * *

OME ADDS MINERALS TO EXPLORATION ASSISTANCE LIST

The Office of Minerals Exploration announced on March 28 that it proposed to add gold, silver, bismuth, sulphur, tellurium, and iron ore to the list of minerals for which exploration assistance is given. OME also plans to increase its present maximum participation percentage from 50 to 75 percent for certain commodities. Minerals for which the government will pay 75 percent of the exploration cost are: asbestos, bauxite, beryllium, chromite, columbium, corundum, diamond (industrial), graphite (crucible flake), kyanite (strategic), manganese, mercury, mica (strategic), nickel, platinum group metals, quartz (piezoelectric), talc (block steatite), tantalum, and tin. Minerals eligible for 50 percent cost contributions are: antimony, bismuth, cadmium, cobalt, copper, fluorspar, gold, iron ore, lead, molybdenum, monazite, rare earths, rutile, selenium, silver, sulphur, tellurium, thorium, uranium, and zinc. Further information may be obtained from the Office of Minerals Exploration, Department of the Interior, Region I, South 157 Howard Street, Spokane 4, Washington.

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BIG PIPELINE PROJECT WELL UNDER WAY IN OREGON

Construction on the 36-inch pipeline connecting gas from Alberta, Canada, to users in the San Francisco Bay area of California has progressed rapidly since the first of the year. At the date of this printing, pipe has been installed from the California line to a point north of the town of Chiloquin, Oregon, a distance of approximately 50 miles. About 30 miles of ditch is opened beyond the installed pipe. In the Madras-Hermiston section about 75 miles of rough trench is opened, mostly through hard rock.

The 1400-mile Alberta to California pipeline project was sponsored by the Pacific Gas and Electric Company of California and, when installed, will be the longest 36-inch pipeline ever laid. Total estimated cost of the system will amount to over $300 million. The main line begins at the Whitecourt gas fields in Alberta and terminates at Antioch in the Sacramento River delta area east of San Francisco. Cost of gas at delivery point will be 35 cents per 1000 cubic feet. Besides supplying northern California, a portion of the gas will be allotted to the El Paso Natural Gas Company, which is the supplier for the northwestern states. El Paso Natural Gas Company will have a main-delivery-tap in the line near Spokane, Washington, and a standby-tie at Stanfield, Oregon, where gas can be taken off the Alberta-California pipeline and transferred to the Oregon-Four Corners pipeline. Taps into the new line will be made at Madras, Redmond, Bend, and Klamath Falls when demand is sufficient to warrant installation of distributing systems.

An outstanding feature on the pipeline construction project is the use of "field plants" at places along the route. Forty-foot lengths of pipe are welded together in "doubles" at these plants and are then coated inside and out with corrosion-resistant material. This assembly process shortens considerably the time in laying pipe in the trench. Cost savings up to 15 percent in construction are reported by the use of assembly plants. Two of these field plants were located in Oregon when construction on the pipeline began in December, 1960, one at Madras and the other at Sprague River. Each plant employs 85 men who coat and double-joint the pipe. As construction progresses, the field plants can be moved to central locations along the route from which they prepare pipe for another 200-mile stretch.

References

Personal communication: Mr. R. S. Nabors, general superintendent, Pacific Gas Transmission Company, Spokane, Washington.

Alberta-California Gas Pipeline System: Oil and Gas Journal, March 13, 1961, vol. 59, no. 11.

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WELL RECORDS RELEASED FROM THE CONFIDENTIAL FILES

The following well records were released as public information by the department on April 4, 1961, after being held as confidential for a two-year period as prescribed by law:

V. V. Erntson	Schermacher No. 1 Marion County	NE¼ sec. 27, T. 9S., R. 2W.	2426' T. D.	Electric Log Driller's Log
Sunnyvale Oil Co., Inc.	Federal-Mitchell No. 1 Grant County	SE¼ Sec. 14, T. 16S., R. 29E.	1168' T.D.	Geologist's description of cutting & cores.

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STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
Head Office: 1069 State Office Bldg., Portland 1, Oregon
Telephone: CApitol 6-2161, Ext. 488
Field Offices

2033 First Street
Baker

239 S. E. "H" Street
Grants Pass

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LEGISLATURE PASSES LAWS AFFECTING THE MINERAL INDUSTRY

The fifty-first Legislative Assembly, which recessed May 10, considered and passed more legislation of importance to Oregon's mineral industry than any Legislature for a great many years. In general, three broad areas were covered --sand and gravel operations, the leasing of state lands for oil and gas investigations and operations, and placer mining.

Two House Joint Memorials were acted on: HJM 11, urging the Federal Government to encourage the development of the mining industry, passed, while HJM 12, memorializing Congress to decline passage of legislation to extend Wilderness areas, passed in the House but was tabled in the Natural Resources Committee of the Senate.

As these laws will be of considerable importance to those interested in developing Oregon's mineral resources, brief explanations or section-by-section descriptions are given below. All of these bills have been signed by the Governor but only a few bore an emergency provision. Therefore it will be some time in August before most take effect. Persons wishing to obtain copies of the acts should write to the Legislative Fiscal Committee, 313 State Capitol, Salem, Oregon.

Legislation in regard to leasing of Oregon's offshore lands, leasing for hard rock minerals in the Lower Columbia River, and for pipelines across the ocean beach came about as the result of Opinion Nos. 5119 and 5124 by the Attorney General. The State Land Board had requested opinions from the Attorney General on the power of the Board to lease Oregon's offshore lands and to grant easements across the ocean beach. The Attorney General's opinions were to the effect that such authority did not exist.

The policy statements regarding sand and gravel operations were made at the request of the Governor's Natural Resources Committee and were the result of efforts by the State Game Commission and the Fish Commission of Oregon. These two commissions have long sought greater control on removal of sand and gravel from streams.

The new placer mining law was recommended by a special committee of the State Bar association. Oregon has had no state placer mining law in the past and this new law parallels the state law on location of lode claims.

The Compulsory Unitization Act was requested by the Department of Geology and Mineral Industries as a conservation measure if oil and gas are found in the state.

Laws affecting sand and gravel operations

HB 1629 - Land Board policy on Removal of Sand and Gravel Act: Amends existing law regarding the authority for the State Land Board to lease sand and gravel deposits and creates new provisions. In effect it establishes a policy for the Land Board which states that in the leasing of land for sand and gravel removal, consideration be given to protect the scenic and recreation resources, public health, and recreational enjoyment of the people and to conserve plant, aquatic, and animal life. The Land Board is now required to consult with the State Game Commission and the Fish Commission of Oregon prior to advertising for bids and to request information as to the probable effect of removal of gravel, rock, sand or silt. The Game and Fish commissions are to advise the board as to any provisions which might be included in the lease. Application to the

State Land Board for a lease on a sand and gravel deposit must include a complete description of the location of the contemplated operation, the time and manner of contemplated removal, and such other pertinent information as the board may require.

HB 1635 - Water Pollution Act: Amends the law relating to water pollution by including "gravel crushing or washing operations" in the industrial operations to be controlled. The new law requires that gravel crushing and washing operations be prevented from adding unclarified wash water to streams if it may be destructive to fish or aquatic life.

HB 1637 - Other agency policy on Removal of Sand and Gravel Act:

Sec. 1 - Declares that "The protection and conservation of the habitat and spawning areas of game and food fish are declared to be of utmost public interest" and that "It is in the public interest to preserve, develop, or prevent unnecessary damage to food or game fish habitat and spawning areas in streams, lakes or other bodies of water within this State."

Sec. 2 - Requires that all cities, county courts, or other public officers or public agencies (except State Land Board which is covered in HB 1629) notify both the State Game Commission and the Fish Commission of Oregon before issuing permits or licenses ". . . for any program which contemplates the removal of any sand, gravel, rock, silt or other material . . ." from streams or lakes.

Sec. 3 - Notice to both the State Game Commission and the Fish Commission of Oregon be by registered mail and contain complete description of contemplated operation, time and manner of removal, and "such other pertinent information as may be required by the State Game Commission or Fish Commission of Oregon."

Sec. 4 - State Game Commission and Fish Commission of Oregon to notify officer or agencies of any damage to food or game fish habitat or spawning areas.

Sec. 5 - Agency or officer cannot issue permit or license for 15 days unless notified by State Game Commission and Fish Commission of Oregon that the commissions have no interest in the matter. After 15 days a permit may be issued which may contain protective provisions established by State Game Commission and Fish Commission of Oregon.

Sec. 6 - Both Fish and Game commissions must investigate removal of materials to determine if it would "substantially affect the spawning areas or habitat of food or game fish".

Laws affecting the leasing of state lands for oil and gas investigations and operations

HB 1136 - Land Leasing Act: This new law (1) gives authority for "any State agency, board, or commission to lease land or mineral rights" after consultation with and consideration by the Department of Geology and Mineral Industries; (2) extends authority to the execution of leases and contracts covering the bed and banks of navigable lakes, rivers and streams, the leasing of which is not otherwise expressly authorized by statute; (3) provides that all leases and conveyances made prior to the effective date of this 1961 act are declared to be legal and enforceable; (4) allows for the location of hard rock mineral claims and leasing for oil and gas exploration to cover the same area without conflict; and (5) provides that the location of a mining claim on state lands is subject to the rights of any prior lessee.

HB 1316 - Beach Pipeline Act: Authorizes the State Land Board to grant easements and licenses for pipelines, cable lines, and other conduits across and under the shore of the Pacific Ocean and the adjacent submerged lands upon payment of just compensation by the grantee. (The entire beach between high and low tides from the northern boundary to the southern boundary of Oregon, except for a very few miles, belongs to the state and is declared a public highway.)

HB 1531 - Definition of submerged lands: Defines submerged lands as lands lying below the line of mean low tide and the beds of all tidal waters within the boundaries of this state as heretofore or hereafter established.

HB 1532 - The Offshore Leasing Act: In summary, this new law puts the responsibility for the offshore (submerged) lands in the hands of the State Land Board but requires the board to consult with various state agencies as to conditions for exploration and for leasing. It establishes a pro-

cedure for leasing state lands at an annual rental of 50 cents per acre with a minimum of 12½ percent royalty and the lease to go to the party offering the highest cash bonus. Bids are to be sealed and opened publicly. Primary term of lease is 10 years, with a drilling term of 5 years and production to commence within 3 years after discovery of oil or gas in "paying quantities". Individual lease parcels to be a maximum of 3 geographical miles seaward by 6 statute miles along the shore. A more detailed explanation of the law is given below.

Sec. 1 - Definitions.

Sec. 2 - Places authority for administration of submerged lands in Land Board.

Sec. 3 - Allows Land Board to grant nonexclusive permits for explorations on offshore lands. The taking of cores and other samples may be granted upon consultation with the Department of Geology and Mineral Industries. Measures to protect the fish and wildlife resources are to be included in the permit after consultation with the Fish Commission and Game Commission.

Sec. 4 - Permits are to be for no more than 2 years but are renewable. Must notify the Fish and Game commissions where work is to be done. Information supplied to the Fish and Game commissions must be kept confidential.

Sec. 5 - Records of drillings done under permit are to be delivered to the Department of Geology and Mineral Industries and kept confidential for 5 years.

Sec. 6 - Provides for public hearing on application to lease lands for drilling.

Sec. 7 - Requires board to determine if lease would be in public interest after public hearing. Sets up minimum standards to make determination.

Sec. 8 - Maximum area of any one lease to be not more than "3 geographical miles seaward by 6 statute miles along or parallel to shore". (No limit on number of areas to be put up for lease at any one time.)

Sec. 9 - Form of lease to include provisions "deemed desirable by the Board" after consultation with several state agencies.

Sec. 10 - Sets primary term of lease at 10 years.

Sec. 11 - Sets royalty as not less than 12½ percent.

Sec. 13 - Advance land rental of 50 cents per acre per year.

Sec. 14 - Size of bond to be determined by the Department of Geology.

Sec. 16 - Allows for slant drilling, drilling from islands, or drilling from floating structures.

Sec. 17 - Restoration of drilling site to be to substantially its original condition.

Sec. 18 - Avoidable pollution or avoidable contamination prohibited. "Avoidable" defined as acts or omissions of lessee and events that could have been prevented by "exercise of a high degree of care".

Sec. 20 - Drilling term set at 5 years and production within 3 years of discovery of oil or gas in "paying quantities".

Sec. 21 - Reasonable nonconflicting uses to be allowed on leasehold.

Sec. 22 - Permits, easements, or leases cannot be assigned without consent of board.

Sec. 24 - Lessee's surrender clause.

Sec. 25 - Lessor's cancellation clause.

Sec. 26 - Provides for "periodic mutual negotiations" between lessor and lessee to keep conditions and rules and regulations current.

Sec. 27 - Leasing notice to be published for two weeks in newspapers of general circulation in state and to include description of lands, rate of royalty, rental, amount of deposit, manner of filing, and time and place of filing. Lease to be awarded to person offering highest cash bonus. Bids to be placed in sealed envelope and opened publicly.

Sec. 28 - All leases, instruments, bonds, contracts, etc., to be executed by Land Board or to the Land Board.

Sec. 29 - Proceeds to go to common school fund.

Sec. 30 - No discrimination between bidders on drilling site and method.

Sec. 31 - Offshore drilling site, if man-made island, must be approved by various state agencies.

Sec. 40 - Allows the Department of Geology to promulgate rules and regulations to regulate exploration surveys and operations to remove oil and gas.

HB 1568 - The Compulsory Unitization Act: This law is essentially the Interstate Oil Compact Commission's model law for compulsory unitization. Unit operation of an oil field would take place only on written approval of "(A) those owners who, under the board's order, will be required to pay at least 75 percent of the costs of the unit operation, and (B) those persons, who at the time of the order of the board, owned of legal title 75 percent of royalty and overriding royalty payable with respect to oil and gas produced from the pool or part thereof over the entire unit area". In addition to the unitization provisions, several corrections were made to the existing Oil and Gas Conservation Act. These are as follows:

(1) Provision was made for use of bond money for the abandonment of oil and gas drillings by the Department of Geology rather than turning the bond money over to the State Treasurer and the Emergency Board reimbursing the department.

(2) New definitions were made in order to conform with definitions in the Offshore Leasing Act and new definitions of condensate, person, pool, owner, producer, protect correlative rights, and unit area were added.

(3) Unit operations were excluded from registration with the Corporation Commissioner and were declared to not violate any laws relating to trusts and monopolies.

(4) Provisions on the turning over of information to the department were amended to state that records must be kept confidential for a period of 2 years from the date of abandonment or completion rather than from the date of filing.

(5) The law requires the Department of Geology to hold hearings in conformance with the State's Administrative Procedures Act, and modifies the hearing and appeal procedures of the present department law.

Laws affecting placer mining

HB 1668 - The State Placer Mining Act:

Sec. 1 - Legal subdivision defined as a subdivision of a state survey or of a U. S. survey extended over area to be located.

Sec. 2 - Notice of discovery and location of placer deposit must contain (1) the name of claim, (2) name of locators, (3) date of location, (4) number of feet or acres claimed, together with a description, either by legal subdivisions, if practicable, or by reference to a permanent monument or natural object, which will identify the claim.

Sec. 3 - If claim is not located by legal subdivisions, the boundaries must be marked within 30 days after posting of notice and in such a way that they are readily traced. Boundary markings to be of the same size, materials and dimensions as quartz claims. Boundaries to be marked at each corner or angle and at intervals of not less than 1320 feet. Claims located by legal subdivisions need not be staked or monumented.

Sec. 4 - Location work is to be completed within 60 days of posting location notice and to consist of an open cut of not less than 5 cubic yards of material which should expose the deposit.

Sec. 5 - The claim must be filed in the county courthouse within 60 days from posting of location notice and the filing must be accompanied by an "affidavit of excavation" that the location work was done.

Sec. 6 - All placer claims located after the effective date of this law that do not comply with provision of above sections are void.

HB 1732 - Columbia River Minerals Leasing Act:

Sec. 1 - Gives the State Land Board authority to lease the bed of the Columbia River from Goble, Oregon, to the Pacific Ocean. Establishes a ceiling on royalty of not more than 10

percent of the gross value of the minerals removed.

Sec. 2 - Requires the Land Board to hold a public hearing to determine if an invitation to lease should be made. Notice of hearing to be given to certain state agencies; the public, by publication in newspapers; and prospective bidders.

Sec. 3 - After the public hearing the Land Board will determine if an invitation to lease would be in the public interest. Minimum criteria to make the determination are established.

Sec. 4 - Sets up leasing procedure as follows: (1) Notice inviting bids to be published in newspapers. Notice to contain description of lands, rate of royalty and rental, manner in which bids are to be filed, amount of deposit to accompany bid, the time and place for filing of bids, and statement that the lease will be awarded to bidder offering highest cash bonus. (2) Bid and supporting material to be in a sealed envelope. (3) Bids to be opened publicly at specified time and place.

Sec. 5 - All leases and instruments to be executed by the Land Board.

Sec. 6 - Proceeds to go to common school fund.

Sec. 7 - Maximum area in any single lease to be 640 acres.

Sec. 8 - The Land Board must consult with certain state agencies to determine provisions of lease to protect the interests of the state.

Sec. 11 - Leases may be without limitation as to time but may be cancelled if due diligence is not exercized by lessor in developing and operating.

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OREGON PALEONTOLOGIST DIES

A. W. (Lon) Hancock, retired Portland postman turned paleontologist, died Thursday, May 18, at the age of 77. Mr. Hancock was born in Harrison, Arkansas, but had lived in Portland since 1910. After his retirement from the Post Office in 1944, he devoted all of his time to his hobby of paleontology and, although not trained in this field, his enthusiastic endeavors and eventually his famed discoveries made him known the world over. His spectacular find of mammals and other vertebrates in the Clarno formation of Wheeler County completely reshaped the interpretation of Oregon's Eocene history. Mr. Hancock was one of the founders and mainstays of Camp Hancock, a summer field camp for young scientists. He was an honorary director of the Oregon Museum of Science and Industry and a charter member of both the Oregon Agate and Mineral Society and the Geological Society of the Oregon Country. His collection of more than 10,000 fossils and artifacts has been willed to the Oregon Museum of Science and Industry where a memorial room will be established to honor him.

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OME GRANTS EXPLORATION LOAN FOR MUSICK VEIN

The Office of Minerals Exploration entered into a $54,000 contract May 10 with Emerald Empire Mining Company of Cottage Grove to drive 1200 feet of tunnel on the Musick vein in the Bohemia District in southern Lane County. The contract is on a joint participation basis, with both parties contributing equally on the work, which started May 25. The Emerald Empire Mining Company is leasing the ground to be explored from Lane Minerals Company, which owns numerous mining properties in the district. The portal of the new tunnel will be 335 feet below the old No. 6 level of the Musick Mine, which was discovered in 1891 and is one of the oldest properties in the area. Principal values in the Musick vein are lead, zinc, and copper, with minor amounts of gold and silver.

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PROFITABILITY SCOREBOARD - New-Field Wildcats (17-State Area)							
Wells Productive of Some Oil or Gas in Year of Discovery					Wells Discovering Profitable Fields Based on 6 Years of Development History		
Year of Discovery	Total New-Field Wildcats	Number Productive of Some Oil or Gas	Per Cent Productive	Ratio of Productive Wells	Number of A-B-C-D Reserve Fields	Per cent of A-B-C-D Fields to Total New Field Wildcats	Ratio of A-B-C-D Fields to Total New Field Wildcats
1944	3,014	330	10.9	1 - 9.1	84	2.79	1 - 36
1945	2,913	335	11.5	1 - 8.7	71	2.44	1 - 41
1946	2,995	313	10.5	1 - 9.6	73	2.44	1 - 41
1947	3,325	378	11.4	1 - 8.8	78	2.35	1 - 43
1948	4,087	471	11.5	1 - 8.7	92	2.25	1 - 44
1949	4,238	479	11.3	1 - 8.8	108	2.55	1 - 39
1950	5,149	577	11.2	1 - 8.9	125	2.43	1 - 41
1951	6,044	666	11.0	1 - 9.1	127	2.10	1 - 48
1952	6,440	720	11.2	1 - 8.9	118	1.83	1 - 55
1953	6,634	747	11.3	1 - 8.9	156	2.36	1 - 43
1954	7,033	875	12.4	1 - 8.0	117	1.66	1 - 60
11-Year Period	51,872	5,891	11.356	1 - 8.8	1,149	2.22	1 - 45

WILL SUCCESS FOIL ROCK HUNTERS?*
By Frank J. Gardner

Who'd ever think that "success" is a bad word? Well, it can be, and it has been for at least 16 years, according to the AAPG Committee on Statistics of Exploratory Drilling.

Because of its use of the words "Successful New-Field Wildcat" and "Success Per Cent" in its annual tabulations, the committee feels it has misled some Ivy League experts on oil. In the report covering 1960 drilling, to be published in next June's AAPG Bulletin, the words will not appear.

In a Journally Speaking column headed "Pennies from Harvard" (OGJ, Feb. 13, 1961, p.41) Henry Ralph told a tale of one professor who belittled the risk involved in wildcatting, based on the annual AAPG report. It's true that this report for 16 years has indicated that one out of nine wildcats has been successful, but the good professor chose to ignore another part of the report which, for the past 11 years, has tried to point out that actual success must be measured in another way -- performance.

One of the vital tables in the report lists numbers of successful wildcats which can still be called successful after 6 years of development history. And for the 11-year period, the ratio of success to failure in wildcat drilling, as revealed by this table, averages 1 in 45 rather than 1 in 9. In 1954, the latest year for which a 6-year development history can be recorded, success hit an all-time low of 1 in 60.

The profitability scoreboard as it will appear in the June Bulletin of the AAPG, is shown above. It will not be exactly as shown here, for the "scoreboard" tag is our own, and some of the subtitles have been cropped for space, but the figures are all there. Note that the words "success" or "successful" are nowhere to be seen. Rather, the words "productive of some oil or gas" will be substituted.

The only successes, really, are those tabulated in the first column of the table on the right-- the "A-B-C-D-Reserve Fields." The smallest field to qualify as profitable is a "D" reserve of 1 million barrels of oil or 6 billion cubic feet of gas. A "C" reserve is 10 to 25 million barrels or its gas equivalent, while the "B" reserve is 25 to 50 million barrels, and an "A" reserve is 50 million or more.

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*Courtesy of The Oil and Gas Journal, April 24, 1961, p. 205.

"We're not trying to be pessimistic--just realistic," says the AAPG Committee. Its chairman, J. Ben Carsey of Humble Oil & Refining Co., feels that the figures must be fully understood by those inside and outside the industry if they are to be of any benefit.

It all reminds us of a speech by George C. Hardin, Jr., Houston consulting geologist, when he appeared before a group of Gulf Coast geologists in 1959. His subject was "Beware the Semantic Trap"; its theme was that different words mean different things to different people. To some people, success is a great word; to others, it's a real stinker.

* * * * *

OREGONITE, A NEW MINERAL

A new mineral called "Oregonite" has been named and described by Paul Ramdohr and Margaret Schmitt in Neues Yahrbuch für Mineralogie, Monatsh. 1959, no. 11-12. Oregonite is a metallic nickel-iron arsenide occurring as water-rolled pebbles in Josephine Creek, Oregon. The pebbles have a smooth brown crust. Composition of the mineral is given as $Ni_{10}FE_6As_9$ or Ni_2FeAs_2. A little cobalt and traces of copper are present. Under the microscope the mineral is metallic white with high reflectivity. Hardness is about 5. Associated minerals include small amounts of native copper, bornite, chalcopyrite, molybdenite, chromite, and perhaps niccolite. The gangue (40% by volume) consists of penninite and serpentine. (Extracted from The American Mineralogist, Sept.-Oct. 1960.)

Note: This mineral is not to be confused with josephinite, which has similar properties but contains no arsenic. Its composition is given as $FeNi_3$.

* * * * *

APPLICATIONS MADE FOR OFFSHORE EXPLORATION

The State Land Board, composed of Governor Mark O. Hatfield, Secretary of State Howell Appling, and State Treasurer Howard C. Belton, received applications for offshore explorations from Shell Oil Company and Gulf Oil Corporation at its meeting May 23. Also in attendance at the meeting were representatives from Standard Oil Company and Pure Oil Company. The Governor instructed the Department of Geology and Mineral Industries, the State Game Commission, and the Fish Commission of Oregon to prepare rules and regulations for operation and indicated that action on the applications for exploration would be taken at the next Land Board meeting June 5. This meeting will take place in the Board of Control Room, State Capitol Building, Salem, Oregon, and will begin at 10 a.m.

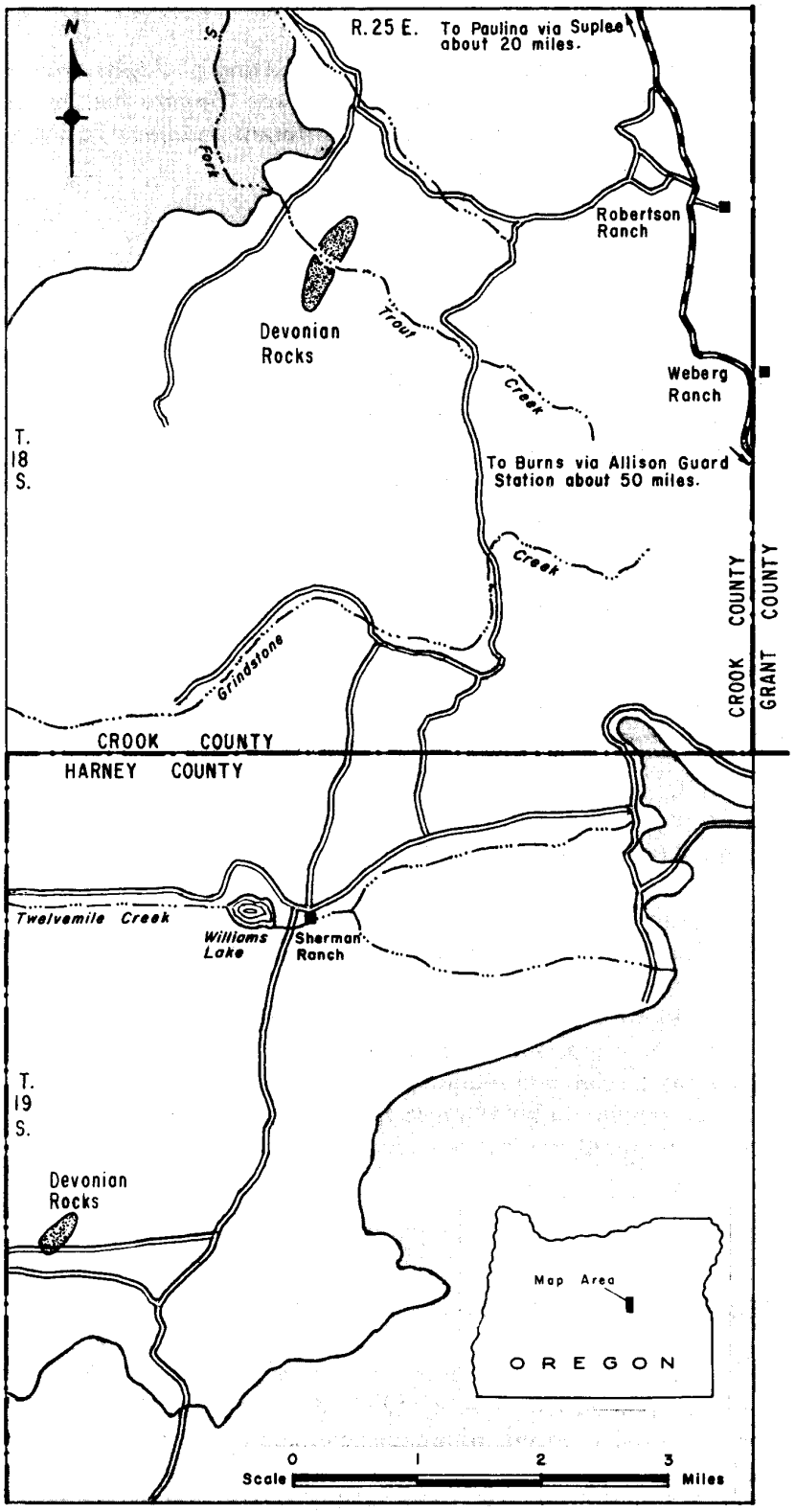
* * * * *

HANNA MINING COMPANY PURCHASES RIDDLE NICKEL PLANT

Hanna Mining Company has completed purchase from the government of the Riddle Nickel plant in Douglas County. The plant started production in July, 1954, and has been in continuous operation ever since. More than 100 million pounds of nickel have been produced under contract with the General Services Administration. This contract has been filled and Hanna Nickel Smelting Company, a wholly owned subsidiary, has begun selling ferronickel on the open market.

* * * * *

DEVONIAN ROCKS IN THE SUPLEE AREA OF CENTRAL OREGON



ABSTRACT*

By W.P.Kleweno,Jr., & R.M. Jeffords, Humble Oil & Ref.Co., Houston, Texas

Fossiliferous limestones and associated clastic rocks in the Suplee area of the pre-Tertiary inlier, central Oregon, have been determined to be of Devonian age. The two small outcrops are the only known occurrences of Devonian rocks in Oregon. Mississippian, Pennsylvanian, Permian, and Triassic strata crop out near-by.

The main outcrop, in Crook County, consists of 100 feet of highly folded, massive, cherty, stromatoporoidal limestone. This bed is underlain by about 200 feet of massive green chert grit and sandstone and apparently is overlain by chert and argillite. A second small outcrop, a few miles away in Harney County, consists of poorly exposed fossiliferous limestone.

The light- to medium-brown limestone consists largely of skeletons of organisms in their original growth positions and surrounded by a very fine granular matrix. The fauna included stromatoporoids (Gerronostroma elegans), corals (Dohmophyllum involutum, Heliolites porosa, Thamnopora cervicornis, and Alveolites lemniccus?), and brachiopods (Meristella robertensis, Rhipidomella sp., Atrypa sp., and Gypidula? sp.). These forms indicate a Middle Devonian age; they also suggest a correlation with beds in the Roberts Mountains of Nevada and with beds in the Shasta Lake and Yreka areas of northern California.

*Paper presented by W. P. Kleweno, Jr., and R. M. Jeffords, Humble Oil & Refining Co., Houston, Texas, at the meeting in San Diego, Calif., March 26-31, 1961, of the Cordilleran Section (Geological Society of America), Pacific Coast Section (The Paleontological Society), and The Seismological Society of America.

* * * * *

EXPLANATION

- Improved Gravel Road
- Unimproved Dirt Road
- Tertiary Rocks
- Pre-Tertiary Inlier
- Devonian Rocks

WESTERN GOVERNORS ADOPT POLICY ON MINING

At the Western Governors Conference in Salt Lake City, Utah, May 14-17, governors of all western states except Hawaii met to consider many items of mutual interest. One of the more important policy statements adopted unanimously by the conference was the one on mining. In their statement of policy the governors noted that the mining industry had contributed greatly to the development and economy of the West but that in recent years there has occurred a progressive deterioration that has seriously impaired mining's capacity to maintain its traditional contribution to the western economy and the nation's welfare. Part of the resolution adopted by the western governors is as follows:

(1) That the administration and the Congress take a firm and positive position to develop a national minerals policy;
(2) That the national minerals policy recognize the necessity for immediate inventory and appraisal of the domestic mineral resources through geological and geophysical mapping, accelerated research for new and expanded uses and beneficiation of low-grade ores, the consideration of incentive measures to encourage investment, the proper use of and access to our public lands, and reasonable controls on imports to protect the ability of the domestic minerals industry to produce at fair prices in our economy; and
(3) That in order to enhance our security and that of the Free World, our national minerals policy should recognize our ability and intent to cooperate in meeting international mineral requirements for the economic growth and development of the Free World, we encourage and urge cooperation in the inventorying of the mineral resources of the Free World and in the more accurate reporting of international statistical information related to international mineral resources; and
(4) That to facilitate the adoption and implementation of a national minerals policy, the National Minerals Advisory Council be re-established.

More specifically, it is recommended that:

As to government stockpiles: No sale or other distribution of these shall be made until an adequate national minerals policy has been adopted, and thereafter no such disposal of stockpiles shall be made which would interfere with the maintenance of a healthy domestic mineral industry under such national minerals policy.

As to foreign aid: The Congress should specifically prohibit the making of loans and grants to develop foreign production of any minerals and metals which are being imported into the United States in surplus amounts.

As to mercury, fluorspar and cobalt: An annual quota (or tariff) be imposed on imports to preserve something over one-half of the domestic market for mercury and fluorspar producers, and something slightly less than one-half for domestic cobalt producers.

As to antimony, chrome and manganese: Small excise taxes (or tariffs) be imposed on foreign imports of these metals, the proceeds from which should be sufficient when distributed among United States producers to maintain a healthy nucleus of domestic production of these strategic metals, the car-lot program for manganese be resumed and present stockpiles of non-usable manganese be processed to usable form.

As to public lands: (1) Since the mineralized area of economic potential in public lands makes up but a small fraction of one percent of the total area, it is not to the advantage of the western states or of the nation as a whole that these mineralized areas be withdrawn for all time or locked up in wilderness systems or other federal reserves; furthermore, under no circumstances should there be any permanent withdrawals of any federal lands without the concurrence of the Governor of the State in which the lands are located; and (2) an adequate study be made to determine if the true intent of the principle of multiple use of public lands is being properly carried out in all areas by all agencies of the government.

As to federal taxes: There should be no decrease in present depletion or depreciation rates which might further injure the already seriously weakened western mining industry, and further, additional exploration should be encouraged by removing the present limitation on tax deductible exploration.

As to the Buy American Act: This policy should be strictly followed on a national basis, and a similar policy is equally applicable on a state-wide basis, and should be followed wherever possible, and the Government should immediately cease the use of barter of surplus agricultural products for the procurement of current government agency requirements.

* * * * *

SEISMOLOGICAL STATION NEAR BAKER

A temporary seismological station has been set up east of Baker to record earth movements and seismic disturbances. The test station is being operated by a four-man team from the Geotechnical Corporation, a scientific instrument manufacturing firm at Garland, Texas, which is under contract to the U. S. Government to select sites for seismological stations. The program is part of Project Vela-Uniform and is being conducted under the technical supervision of the Air Force Technical Applications Center and under the overall direction of the Advanced Research Projects Agency. Selection of the Baker site as a permanent station depends on additional studies and measurements. However, the preliminary geologic investigations indicated that the area satisfies the basic criteria for such an installation. Called on for professional help regarding the geology of the area was Norman Wagner, geologist at the Oregon Department of Geology and Mineral Industries' Baker office. (Information from Baker Democrat-Herald, May 9, 1961)

* * * * *

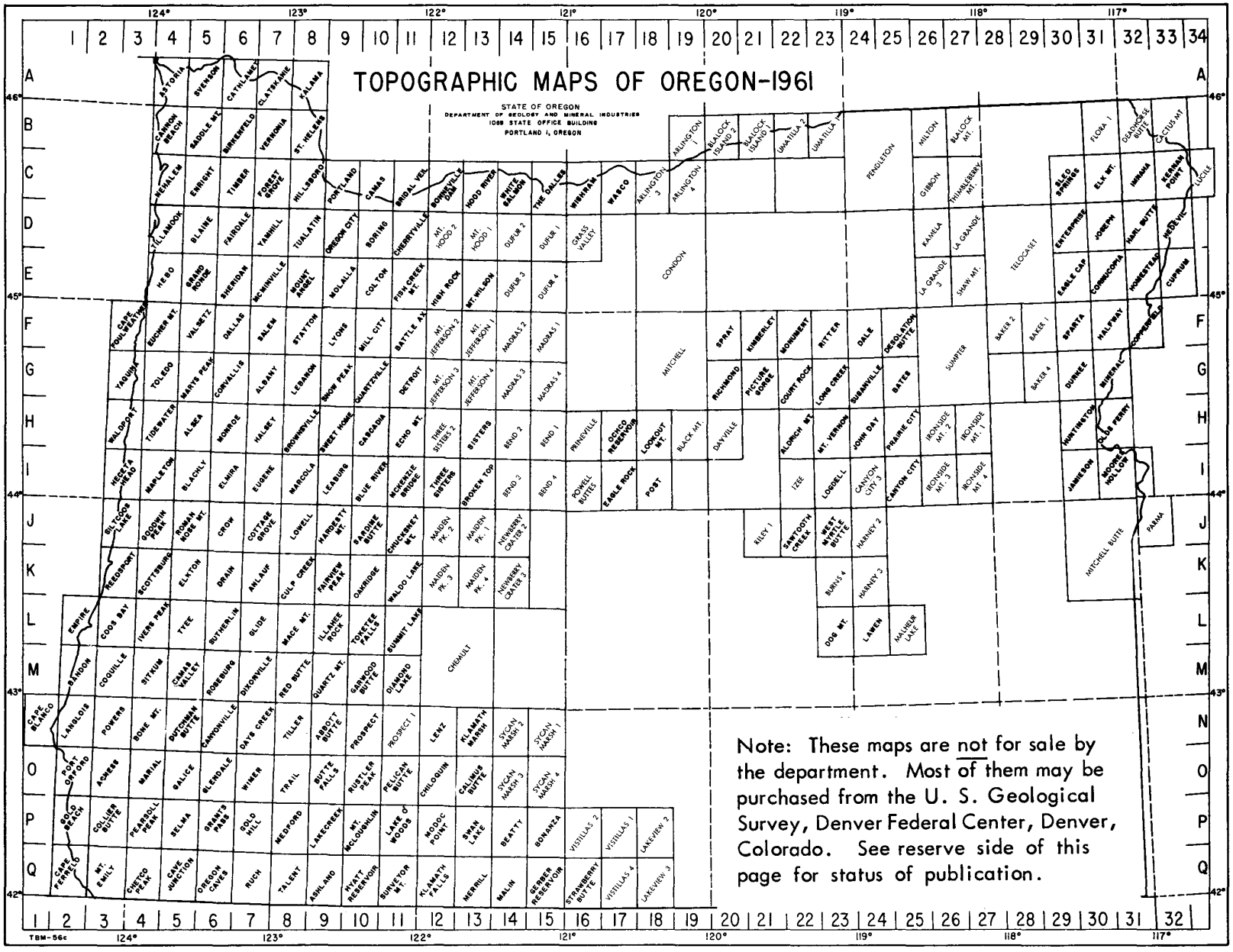
BILL INTRODUCED TO END GOLD BACKING OF CURRENCY

Representative Abraham J. Multer (New York), Chairman of a House Subcommittee on Banking and Currency, has introduced a bill which, if passed, would end the present 25 percent gold backing of currency. This bill, H.R. 6900, would (1) eliminate the requirement that Federal Reserve Banks maintain gold certificate reserves of at least 25 percent against deposit and note liabilities, and (2) remove federal limits on the interest rate insured banks and Federal Reserve member banks may pay on time deposits of foreign governments and central banks. Hearings were scheduled on this bill to begin May 17 but in a recent letter from Robert L. Cardon, Clerk and General Counsel of the Committee, it was stated "Hearings on this legislation have been postponed in order to provide more time to develop a witness schedule that will give a fair opportunity to present all viewpoints on this legislation, without scheduling witnesses who would merely offer repetitive testimony." This letter and the delay in hearings were the result of a large volume of protests deploring the speed with which efforts were being made to push this bill through Congress. One of the protests appeared in the column, "Business Tides" In NEWSWEEK, May 22, 1961, under an article entitled "Keep the Gold Reserve" by Henry Hazlitt. Mr. Hazlitt stated, in part, "The International gold standard when it prevailed, was the chief safeguard against tampering with the currency on the part of politicians and bureaucrats. It was the chief safeguard against domestic inflation." Another powerful force in delaying hearings was the resolution on gold adopted by the western governors at their conference in Salt Lake City May 14-17.

The conclusions of this resolution, which also called for assistance to the western gold miners, stated: (1) That the Western Governors urge an incentive or bonus payment that will assure to domestic producers a fair economic return; and (2) That they express their opposition to changing the present law requiring the Treasury to hold gold to the value of 25 percent of the outstanding notes and deposit liabilities of federal reserve banks until a careful and exhaustive study is made of the relationship of gold to the value of the dollar, with particular reference to the effect of this relationship on the economics of the western states where the major portion of domestic gold is mined.

It seems likely that efforts will be made to set up hearings on H.R. 6900 some time in the future. Mr. Cardon states that anyone wishing to testify should send a letter to him c/o House of Representatives Committee on Banking and Currency, Washington 25, D.C. It was also stated that those who would be unable to attend the hearing would undoubtedly be allowed to submit statements for the record.

* * * * *


TOPOGRAPHIC MAPS OF OREGON-1961
STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
1069 STATE OFFICE BUILDING
PORTLAND 1, OREGON
Note: These maps are not for sale by the department. Most of them may be purchased from the U. S. Geological Survey, Denver Federal Center, Denver, Colorado. See reserve side of this page for status of publication.
TBM-56c

TOPOGRAPHIC MAPS OF OREGON—1961

15-Minute Quadrangles
(Scale 1:62,000)

KEY TO SYMBOLS

A Map scheduled for publication 7-1-61 to 6-30-62

B Map scheduled for publication 7-1-62 to 6-30-63

C Map published by U. S. Army 29th Engineers

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
1069 STATE OFFICE BUILDING
PORTLAND 1

Name	Location	Date
Abbott Butte	N- 9	1947
Agness	O- 3	1954
Albany	G- 7	1960
Aldrich Mountain	H-22	1943
Alsea	H- 5	1958
Anlauf	K- 7	1956
Arlington 1	B-19	B
Arlington 3	C-18	B
Arlington 4	C-19	B
Ashland	Q- 9	1954
Astoria	A- 4	C1939
Baker 1	F-29	B
Baker 2	F-28	B
Baker 4	G-29	B
Bandon	M- 2	1944
Bates	G-25	1951
Battle Ax	F-11	1956
Beatty	P-14	1955
Bend 1	H-14	B
Bend 2	H-13	B
Bend 3	I-13	B
Bend 4	I-14	B
Birkenfeld	B- 6	1955
Blachly	I- 5	1956
Black Mt.	H-19	B
Blaine	D- 5	1955
Blalock Island 1	B-21	B
Blalock Island 2	B-20	B
Blalock Mt.	B-27	B
Blue River	I-10	1955
Bonanza	P-15	A
Bone Mountain	N- 4	1954
Bonneville Dam	C-12	1957
Boring	D-10	1944
Bridal Veil	C-11	1954
Broken Top	I-13	1961
Brownsville	H- 8	1952
Burns 4	K-23	A
Butte Falls	O- 9	1954
Cactus Mountain	B-33	B
Calimus Butte	O-13	1956
Camas	C-10	1958
Camas Valley	M- 5	1955
Cannon Beach	B- 4	1955
Canyon City 3	I-24	A
Canyon City 4	I-25	A
Canyonville	N- 6	1956
Cape Blanco	N- 1	1956
Cape Ferrelo	Q- 2	1956
Cape Foulweather	F- 3	1957
Cascadia	H-10	1955
Cathlamet	A- 6	1941
Cave Junction	Q- 5	1954
Cherryville	D-11	1955
Chetco Peak	Q- 4	1954
Chiloquin	O-12	1957
Chucksney Mountain	J-11	1955
Clatskanie	A- 7	1952
Collier Butte	P- 3	1954
Colton	E-10	1955
Coos Bay	L- 3	1945
Copperfield	F-32	1957
Coquille	M- 3	1945
Cornucopia	E-31	1954
Corvallis	G- 6	1956
Cottage Grove	J- 7	1959
Courtrock	G-22	1951
Crow	J- 6	1945
Culp Creek	K- 8	1955
Cuprum	E-33	1957
Dale	F-24	1951
Dallas	F- 6	1957
Days Creek	N- 7	1954
Dayville	H-20	B
Dead Horse Butte	B-32	B
Desolation Butte	F-25	1951
Detroit	G-11	1956
Diamond Lake	M-11	1956
Dixonville	M- 7	1954
Dog Mt.	L-23	1961
Drain	K- 6	1954
Dufur 1	D-15	B
Dufur 2	D-14	B
Dufur 3	E-14	B
Dufur 4	E-15	B
Durkee	G-30	1957
Dutchman Butte	N- 5	1948
Eagle Cap	E-30	1954
Eagle Rock	I-17	1948
Echo Mountain	H-11	1955
Elgin	C-28	B
Elk Mountain	C-31	1957
Elkton	K- 5	1955
Elmira	I- 6	1957
Empire	L- 2	1944
Enright	C- 5	1955
Enterprise	D-30	1957
Euchre Mountain	F- 4	1957
Eugene	I- 7	1949
Fairdale	D- 6	1955
Fairview Peak	K- 9	1955
Fish Creek Mountain	E-11	1956
Flora 1	B-31	B
Forest Grove	C- 7	1956
Galice	O- 5	1948
Garwood Butte	M- 9	1956
Gerber Reservoir	Q-15	1961
Gibbon	C-26	B
Glendale	O- 6	1954
Glide	L- 7	1954
Gold Beach	P -2	1954
Gold Hill	P- 7	1954
Goodwin Peak	J- 4	1956
Grand Ronde	E- 5	1955
Grants Pass	P- 6	1954
Grass Valley	D-16	B
Halfway	F-31	1957
Halsey	H- 7	1960
Hardesty Mountain	J- 9	1955
Harl Butte	D-32	1954
Harney 2	J-24	A
Harney 3	K-24	A
Hebo	E- 4	1955
Heceta Head	I- 3	1956
He Devil	D-33	1957
High Rock	E-12	1956
Hillsboro	C-8	1943 B
Homestead	E-32	1957
Hood River	C-13	1957
Huntington	H-30	1951
Hyatt Reservoir	Q-10	1955
Illahee Rock	L- 9	1955
Imnaha	C-32	1954
Ironside Mt. 1	H-27	B
Ironside Mt. 2	H-26	B
Ironside Mt. 3	I-26	B
Ironside Mt. 4	I-27	B
Ivers Peak	L- 4	1955
Izee	I-22	A
Jamieson	I-30	1950
John Day	H-24	1943
Joseph	D-31	1957
Kalama	A-8	C1943
Kamela	D-26	B
Kernan Point	C-33	1954
Kimberley	F-21	1953
Klamath Falls	Q-12	1957
Klamath Marsh	N-13	1957
LaGrande	D-27	B
LaGrande 3	E-26	B
Lakecreek	P- 9	1954
Lake O'Woods	P-11	1955
Lakeview 2	P-18	B
Lakeview 3	Q-18	B
Langlois	N- 2	1954
Lawen	L-24	1961
Leaburg	I- 9	1951
Lebanon	G- 8	1957
Lenz	N-12	1957
Logdell	I-23	A
Long Creek	G-23	1951
Lookout Mountain	H-18	1951
Lowell	J- 8	1955
Lucile	C-34	B
Lyons	F- 9	1951
Mace Mountain	L- 8	1955
Madras 1	F-15	B
Madras 2	F-14	B
Madras 3	G-14	B
Madras 4	G-15	B
Maiden Pk. 1	J-12	B
Maiden Pk. 2	J-11	B
Maiden Pk. 3	K-11	B
Maiden Pk. 4	K-12	B
Malheur Lake 1	L-25	A
Malin	Q-14	A
Mapleton	I- 4	1957
Marcola	I- 8	1952
Marial	O- 4	1954
Marys Peak	G- 5	1957
McKenzie Bridge	I-11	1955
McMinnville	E- 7	1943
Medford	P- 8	1954
Merrill	Q-13	1957
Mill City	F-10	1955
Milton	B-26	B
Mineral	G-31	1957
Modoc Point	P-12	1957
Molalla	E- 9	C1943
Monroe	H- 6	1957
Monument	F-22	1951
Moores Hollow	I-31	1951
Mount Angel	E- 8	1943
Mount Emily	Q- 3	1954
Mount Hood 1	D-13	B
Mount Hood 2	D-12	B
Mount Jefferson 1	F-13	B
Mount Jefferson 2	F-12	B
Mount Jefferson 3	G-12	B
Mount Jefferson 4	G-13	B
Mount McLoughlin	P-10	1955
Mount Vernon	H-23	1943
Mount Wilson	E-13	1956
Nehalem	C- 4	1955
Newberry Crater 2	I-13	B
Newberry Crater 3	J-13	B
Oakridge	K-10	1956
Ochoco Reservoir	H-17	1950
Olds Ferry	H-31	1952
Oregon Caves	Q- 6	1954
Oregon City	D- 9	1945 A
Pearsoll Peak	P- 4	1954
Pelican Butte	O-11	1955
Picture Gorge	G-21	1955
Portland	C- 9	A
Port Orford	O-2	1954
Post	I-18	1951
Powell Butte	I-16	B
Powers	N-3	1954
Prairie City	H-25	1959
Prineville	H-16	B
Prospect	N-10	1956
Prospect 1	N-11	B
Quartz Mountain	M-9	1955
Quartzville	G-10	1956
Red Butte	M-8	1955
Reedsport	K- 3	1956
Richmond	G-20	1953
Riley 1	J-21	A
Ritter	F-23	1952
Roman Nose Mountain	J- 5	1945
Roseburg	M- 6	1955
Ruch	Q- 7	1954
Rustler Peak	O-10	1955
Saddle Mountain	B- 5	1955
Salem	F- 7	1957
Sardine Butte	J-10	1956
Sawtooth Creek	J-22	1959
Scotts burg	K- 4	1955
Selma	P- 5	1954
Shaw Mt.	E-27	B
Sheridan	E- 6	1956
Siltcoos Lake	J- 3	1956
Sisters	H-13	1961
Sitkum	M- 4	1955
Sled Springs	C-30	1957
Snow Peak	G- 9	1951
Sparta	F-30	1957
Spray	F-20	1953
Stayton	F- 8	1960
St. Helens	B- 8	1954
Strawberry Butte	Q-16	1961
Summit Lake	L-11	1956
Surveyor Mountain	Q-11	1955
Susanville	G-24	1951
Sutherlin	L-6	1954
Svensen	A- 5	1955
Swan Lake	P-13	1957
Sweet Home	H- 9	1951
Sycan Marsh 1	N-15	A
Sycan Marsh 2	N-14	A
Sycan Marsh 3	O-14	A
Sycan Marsh 4	O-15	A
Talent	Q- 8	1954
The Dalles	C-15	1957
Three Sisters 2	H-12	A
Three Sisters	I-12	1959
Thimbleberry Mt.	C-27	B
Tidewater	H- 4	1956
Tillamook	D- 4	1955
Tiller	N-8	1946
Timber	C- 6	1955
Toketee Falls	L-10	1956
Toledo	G- 4	1960
Trail	O- 8	1945
Tualatin	D- 8	1943
Tyee	L- 3	1955
Umatilla 1	B-21	B
Umatilla 2	B-20	B
Valsetz	F- 3	1956
Vernonia	B- 7	1955
Vistillas 1	P-17	B
Vistillas 2	P-16	A
Vistillas 4	Q-17	B
Waldo Lake	K-11	1956
Waldport	H- 3	1956
Wallowa	C-29	B
Wasco	C-17	1957
West Myrtle Butte	J-23	1959
White Salmon	C-14	1957
Wimer	O-7	1954
Wishram	C-16	1957
Yamhill	D-7	C1942
Yaquina	G- 3	1946 A

30' Quadrangle Maps Available
Scale (1:125,000)

Name	Location	Date
Arlington	C-19	1941
Baker	G-29	1934
Bend	I-15	1940
Blalock Island	C-21	1944
Chemult	M-13	1941
Condon	E-19	1916
Dayville	I-21	1936
Dufur	E-15	1945
Hood River	C-13	1940
Ironside Mt.	I-27	1908
Madras	G-15	1931
Maiden Pk.	K-13	1944
Mitchell	G-19	1926
Mitchell Butte	K-31	1921
Mt. Hood	E-13	1944
Mt. Jefferson	G-13	1938
Newberry Crater	K-15	1935
Pendleton	C-25	1935
Sumpter	G-27	1939
Telocaset	E-29	1932
The Dalles	C-15	1941
Three Sisters	I-13	1941
Umatilla	C-23	1921

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Telephone: CApitol 6-2161, Ext. 488
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239 S. E. "H" Street
Grants Pass

* *

PLANT FOSSILS IN THE CLARNO FORMATION, OREGON

By

Herbert L. Hergert*

Introduction

The Clarno formation was originally described by Merriam (1901) from outcrops at Mitchell and Clarno's Ferry, Oregon. Since that time the formation has been found to be very widely distributed throughout central Oregon (Wilkinson, 1959). It is composed of an unknown thickness of volcanic rocks and interfingering terrestrial sediments which contain a newly discovered vertebrate fauna and an abundance of fossil plant remains.

Wilkinson (1959) and Taylor (1960) describe several distinctive rock types that make up the Clarno formation. Of special importance are the beds of tuff ranging from coarse gritty tuffaceous sandstones to fine-grained tuffaceous shales, some of which are water-laid and contain fossil leaves. Another important unit in which plant remains are found, is composed of volcanic conglomerates and breccias of mud-flow origin. Associated with the conglomerates and breccias are andesite and basalt flows. Welded tuffs occur at several horizons. Plugs, dikes, and sills of andesite, rhyolite, and dacite are characteristic of the Clarno formation and are topographically expressed on the landscape as prominent buttes and ridges.

The range in age of the Clarno formation has not been determined with certainty. In the few places where its base is observed, it lies unconformably on Cretaceous deposits, and it is overlain unconformably by the upper Oligocene-lower Miocene John Day formation.

Up until recently, writers have generally favored a middle to upper Eocene age for the Clarno formation, the assignment being based almost entirely on fossils found in the vicinity of the type locality at Clarno's Ferry. Thus, R. A. Scott (1954) in his excellent monograph on the fossil nuts and fruits occurring 1½ miles east of Clarno's Ferry, suggests an age somewhat older than upper Eocene. Until recently, animal fossils were thought to be of such rare occurrence in the formation that Stirton (1944) used a single tooth, presumably belonging to the genus Hyrachyus, to establish a middle Eocene age for the Clarno formation. Recently an extensive deposit of animal fossils near the type locality was discovered by the late A. W. Hancock and is being studied by J. A. Shotwell of the University of Oregon. Preliminary work suggests an upper Eocene or, possibly, lower Oligocene age for these fossils, but the stratigraphic relationship of the vertebrate bed to the plant locality is problematical (Taylor, 1960).

Plant fossils have been found at many other places in the Clarno formation in addition to those occurring at the type locality (see accompanying map). Comparison clearly shows the non-contemporaneity of many of the florules and suggests that the age of the Clarno formation is of an appreciably greater range than that proposed by many previous authors. Since some of these localities have not been described in detail in the literature previously, it would seem to be of value to summarize our present state of knowledge of the Clarno flora. Descriptions of the localities are presented below in the order of decreasing age of the

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*Olympic Research Division, Rayonier, Inc., Shelton, Washington. Dr. Hergert holds a PhD degree in Chemistry and a minor in Paleobotany from Oregon State College, 1954.

flora. Numbers refer to locality numbers on the map.

Clarno Flora Localities

West Branch Creek Locality:

Most of the generalizations in the more recent literature concerning the Clarno flora are based on the leaf remains found on West Branch Creek in Wheeler County. Howard (1955) has suggested that the best collecting areas are in tuffaceous and shaly sediments in secs. 20, 29, and 30, T. 11 S., R. 21 E. The notable fossils from West Branch Creek are the large multilobed leaves of Platanophyllum angustiloba which is thought to be an ancestor of the modern sycamore. The author considers this species to be characteristic of middle to upper Eocene floras in Oregon. Chaney (cited in Scott, 1954) has furnished the following list of genera from this locality, but complete results of his study have not been published.

Astronium	Celastrus	Nectandra	Ficus
Rhus	Alchornia	Vitus	Alangiophyllum
Catalpa	Casearia	Persea	Platanophyllum
Cordia	Cinnamomum	Abuta	Gouania
			Meliosma

It may be noted that the indicated composition of the flora from this locality differs appreciably from that present at Pilot Rock (described on pages 58-60). The West Branch Creek flora is considered to be the oldest in the Clarno formation.

M. Pabst (1948) has studied the ferns from this locality and identified the following species:

Lygodium kaulfussii	Lastrea (Goniopteris) fischeri
Anemia elongata	Salpichlaena anceps
Dennstaedtia	Woodwardia latiloba
Pteris? sp.	Hemitelia pinnata
Dryopteris sp.	

A close correlation with species of the Paleocene of the Rocky Mountains was indicated, and a middle to upper Eocene age was suggested for the West Branch Creek flora.

Clarno type locality:

One and one-half miles east of Clarno's Ferry (SE¼ sec. 27, T. 7 S., R. 19 E.), Wheeler County, near the type locality of the Clarno formation is a remarkable occurrence of fossil fruits and seeds. These fossils have been described by Scott (1954), Scott and Barghoorn, (1955), as previously noted, and correlated with flora of the Ypresian (upper lower Eocene) London clay. The specimens were assigned to eight genera, the most common fossil being a small walnut (Juglans clarnensis). Leaf impressions are also present in rocks at this locality but are of more limited occurrence. Chaney (1936) has noted the presence of a cycad, provisionally assigned to the genus Dioon, at this locality. Further description of the fossil leaves at this locality are wanting in the literature, however.

In addition to fruits, nuts, and leaves, silicified wood may also be found in this area. Some of this wood contains representations of fungi, two species having been described by Scott (1955). In the same paper, Scott indicated that he had identified more than 25 species of fossil wood from this locality, but they were not described.

The author has also collected fossil wood from this area. Palm, walnut (Juglans), Cinnamomum, sycamore, (Platanus), and wood from several other as yet unidentified genera are present. Significantly, gymnosperm wood was absent. This locality is probably one of the few plant fossil localities in the entire world that offers the opportunity of correlating species identifications from fruits, wood, and leaves of a plant. The age of this locality is considered to be middle upper Eocene.

Cherry Creek and Currant Creek localities:

The first fossil plants studied in the Clarno formation were obtained from two localities in Jefferson County, Cherry Creek (T. 10 S., R. 19 E.) and Currant Creek (T. 9 S., R. 18 E.), the exact geographical locations of which are not precisely described in the literature. Collections from these localities were first studied by Newberry (1883, 1898), and Lesquereux (1883) and subsequently by Knowlton (1902). Although the determinations are mainly of historical interest, and undoubtedly require revision in the light

of newer work, they are included here for comparison with the lists of fossils from other Clarno localities.

Cherry Creek:		
Lygodium kaulfussii	Quercus furcinervis	Diospyros alaskana
Allantodiopsis erosa	americana	Phyllites wascoensis
Equisetum oregonense	Cercis tenuinervis	Phyllites sp.
Salix schimperi	Magnolia culveri	Currant Creek:
Juglans rugosa	Cinnamomum dilleri	Pteris pseudopinnaeformis
Juglans? bendirei	Rhamnus cleburni	Goniopteris lesquereuxi
Hicoria? oregoniana	Platanus basilobata	Equisetum oregonense

More recently, Arnold (1952) has described the remains of a silicified tree fern, Osmundites chandleri, from this same general area. This striking fossil was found 9½ miles east and 3 miles north of the small town of Ashwood (T. 9 S., R. 18 E.), on or near the east-west line separating sections 15 and 22. This same area yields scattered remains of silicified wood, none of which have been described in the literature, and stems of a fern provisionally referable to the genus Eorhachis.

Post fossil wood locality:

On the Clarno surface, north and east of Post in Crook County, considerable silicified plant remains may be found. Arnold (1945, 1952) has described a fern stem, Osmundites oregonensis, which is closely related to the fern stems obtained near Currant Creek. The locality is in the northwestern corner of sec. 27, T. 16 S., R. 20 E., 8 miles due east of Post on a small tributary of Crooked River, known locally as Lost Creek, that flows into it from the north.

The author has obtained silicified wood from two areas, one of which is 8 miles due east of Post and the other 3 miles north of the first. Neither of these yielded any coniferous woods in contrast to the Mitchell and Hampton Butte fossil wood localities (see below). Seventeen species have been differentiated, but only a few have been identified with any certainty. The predominant fossil is a sycamore (Platanus), similar to but not identical with any living sycamore with which the author is acquainted. Palm wood and roots, Quercus (one specimen only), and a wide rayed wood apparently referable to Cryptocarya are notable. Other genera provisionally identified were Juglans (identical with that occurring at Clarno's Ferry), Vitus, Rhamnus, Magnolia, Ocotea, and Nyssa. Several woods, though not identified as to genera, appear to be identical with specimens obtained from the type locality. It is concluded that the fossil-bearing stratum in this area is slightly younger than that at Clarno's Ferry, or upper Eocene.

Pilot Rock localities:

The most extensively studied flora, outside of the type locality, is that obtained from two locations on East Birch Creek about 10 miles southeast of the town of Pilot Rock in Umatilla County. Leaf impressions (see illustrations) were obtained from a variably textured sandstone dipping 26° due east. The basal beds are an unfossiliferous white tuff, while the sediments are unconformably overlain by northwesterly dipping Columbia River basalt (middle Miocene). Extensive collections were made by students of the late Dr. Ethel Sanborn of Oregon State College from the NE¼ sec. 7, T. 2 S., R. 33 E., and the SW¼ sec. 12, T. 2 S., R. 32 E. Notes left by Dr. Sanborn and subsequent studies by the author show the presence of the plants listed on the following page.

The only published reference to the composition of the flora at this locality is that of G. M. Hogenson (1957), who includes a third location in the NW¼ NE¼ sec. 31, T. 2 S., R. 33 E. He reports determinations of 7 species made by R. W. Brown of the U. S. Geological Survey, which are in general agreement with those reported here. From the composition of this flora, the age of the locality is considered to be intermediate between that of the Comstock and Goshen floras of Western Oregon, namely lower Oligocene, and younger than that of the type locality at Clarno's Ferry.

Species identified:

Cinnamomum acrodromum
Platanus aceroides
Glyptostrobus dakotensis
Equisetum oregonensis
Laurus princeps
Ocotea eocernua
Sabalites eocenica*
Cordia rotunda
Ilex oregona
Siparuna ovalis
Siparuna standleyi
Callichlamys zeteki
Mallotus oregonensis
Magnolia leei*
Ficus goshensis
Persea praelingue*
Anona prereticulata
Laurophyllum merrilli*
Ficus quisamburgii
Magnolia reticulata
Magnolia californica
Goniopteris lesquereuxi
Allantodiopsis erosa
Asimina eotriloba

New species recognized:

Tetracera prescandens
Cryptocarya eocenica*
Litsea oregonensis*

Specimens identified only as to genera:

Thuites sp.
Ficus cf. F.hispada Linne
Oreodaphne sp.
Calyptranthes cf. C.arbutifolia C. and S.
Nectandra cf. N.presanguinea, C. and S.
Ocotea sp.
Aralia (Platanophyllum)
Rhamnus cf. R.pseudogoldianus Hollick
Credneria sp.
Aristolochia cf. A.mexicana C. and S.
Cryptocarya sp.
Dillenia sp.

* Species illustrated.

Arbuckle Mountain localities:

A group of Clarno formation localities yielding abundant remains of palms (Sabalites) occurs in the vicinity of Arbuckle Mountain in Morrow County about 20 miles southeast of Heppner. Two small collections, numbered PF61 and PF62 in the department museum include Magnolia sp., Sabalites eocenica, Salix?, and Laurophyllum. Fossils from PF61 were collected in 1945 by C. O. Clark on the headwaters of Johnson Creek, a tributary of Butter Creek, near the divide with Willow Creek in sec. 19, T. 4 S., R. 29 E. Fossils from PF62 are probably from the same general area, but exact location is not available.

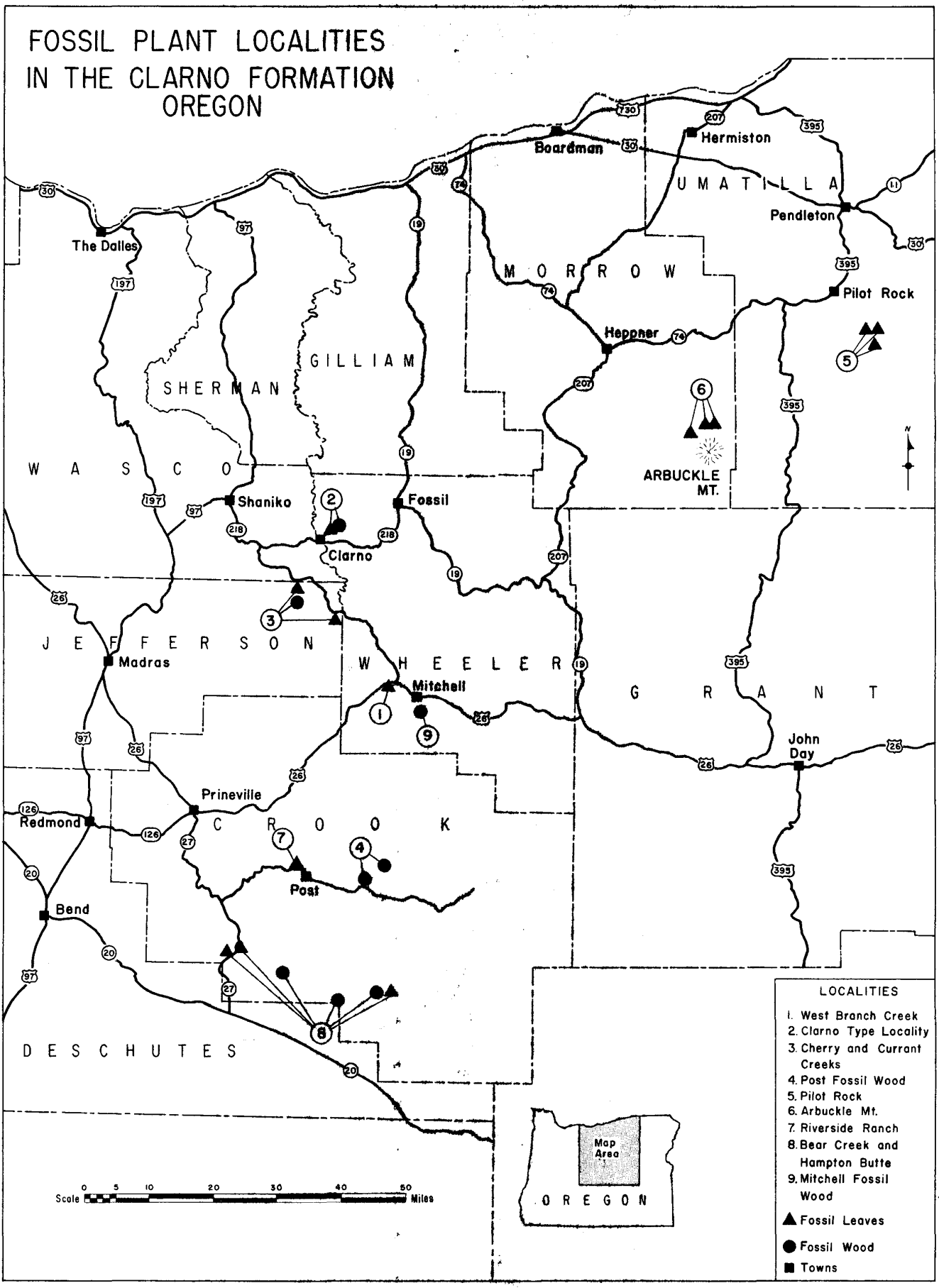
Another location known as the Arbuckle Mountain locality, briefly mentioned by Chaney (1948), was discovered by J. E. Allen (1947) during a coal survey for the department. His notes describe the location as being 1½ miles northwest of Arbuckle Mountain at the junction of the Heppner-Ukiah road with the Arbuckle corral road in the NW¼ SW¼ sec. 19, T. 4 S., R. 29 E., 24 miles southeast of Heppner. Fossil leaves were picked up, over a distance of several hundred feet, from a shaly bed in sandstone which crosses the road junction. It is possible that this locality is the same as PF62.

Allen also mentions that leaf imprints occur in sandstone and shale beds associated with the coal at three mines in the vicinity of the Arbuckle Mountain locality. These are: mine No. 1 in the SW¼ NE¼ sec. 20 and mine No. 3 in the SW¼ NE¼ sec. 19, both in T. 4 S., R. 29 E., and at mine No. 7 in the NW¼ SW¼ sec. 34, T. 4 S., R. 28 E.

Allen's mine No. 7 (Willow Creek prospects) was described previously by Mendenhall (1909) of the U. S. Geological Survey, who submitted specimens of fossil plants to F. H. Knowlton for determination. Knowlton reported the following species which he regarded as "upper Clarno" or upper Eocene.

Monocotyledenous plant ("unknown to me")
Glyptostrobus cf. G.europaeus Heer
Quercus consimilis? Newberry
Populus sp.?

Hogenson (1957) collected fossil leaves in the Arbuckle Mountain area from "a shale bed underlying massive sandstone bed which forms a ridge top" in the NE¼ NW¼ sec. 20, T. 4 S., R. 29 E. The fossils from this location were identified by R. W. Brown as set forth on page 61.


FOSSIL PLANT LOCALITIES
IN THE CLARNO FORMATION
OREGON
Boardman
Hermiston
UMATILLA
Pendleton
The Dalles
MORROW
Pilot Rock
Heppner
GILLIAM
SHERMAN
WASCO
ARBUCKLE MT.
Shaniko
Fossil
Clarno
JEFFERSON
Madras
WHEELER
Mitchell
GRANT
John Day
Prineville
Redmond
CROOK
Post
Bend
DESCHUTES
Scale 0 5 10 20 30 40 50 Miles
Map Area
OREGON
LOCALITIES
1. West Branch Creek
2. Clarno Type Locality
3. Cherry and Currant Creeks
4. Post Fossil Wood
5. Pilot Rock
6. Arbuckle Mt.
7. Riverside Ranch
8. Bear Creek and Hampton Butte
9. Mitchell Fossil Wood
Fossil Leaves
Fossil Wood
Towns

SABALITES EOCENICA (Lesq) Dorf (PALM)

MAGNOLIA LEEI Knowlton (MAGNOLIA)

LAUROPHYLLUM MERRILLI Chaney and Sanborn (LAUREL)

CRYPTOCARYA EOCENICA, new species

LITSEA OREGONENSIS, new species

PERSEA PRAELINGUE Sanborn (AVOCADO)

(All specimens approximately one-half natural size)

SOME TYPICAL FOSSIL LEAVES FROM THE CLARNO FORMATION
NEAR PILOT ROCK, OREGON

Aneimia sp.	Quercus banksiaefolia Newberry
Glyptostrobus dakotensis Brown	Magnolia sp.
Sabalites sp.	Carpites verrucosus Lesquereux
Numerous other dicotyledonous leaves	

Although the fossils from the Arbuckle Mountain localities have not been studied completely, it seems likely that they are contemporaneous with the Pilot Rock flora.

Riverside Ranch locality:

A small assemblage of leaf fossils, closely related in composition to those obtained from Cherry Creek, has been described by Chaney (1927). They were obtained on the Riverside Ranch, 34 miles up the Crooked River from Prineville, "one-half mile north of the highway on the west bank of Wickieup Creek" in Crook County. Although only 5 species were characterized (Pinus sp., Quercus furcinervis americana, Sassafras sp., Platanus cf. nobilis, and Rhamnus cleburni), they hold considerable significance. It is questionable if any of these species are present in the Clarno's Ferry, West Branch Creek, or Pilot Rock collections. It appears that this locality is lower to middle Oligocene in age.

Bear Creek and Hampton Butte localities:

A number of authors (Mote, 1939; Bowman, 1940; Lowry, 1940; and others) have suggested division of the Clarno formation in southern Crook County into a lower and upper member on lithologic grounds. A younger age for an upper division seems also to be justified on the basis of plant fossil differences. Two fossil leaf localities near the junction of the road in the upper Bear Creek Valley (secs. 9 and 17, T. 18 S., R. 17 E.) are mentioned by Lowry (1940). A few specimens from this locality were present in collections at Oregon State College. Although the collection is meager and preservation is only fair, the following could be identified: Thuites sp. Knowlton, Pinus knowltoni, Cercidiphyllum crenatum, Quercus clarnensis, Carpinus grandis, Ostrya oregoniana, Platanus sp., Alnus (?) sp., and Pteris sp. Many of these occur in the Bridge Creek flora (John Day formation) (Chaney 1927, 1952) and it is possible that these localities might be more properly referred to the John Day because of this.

A few miles to the southeast may be found extensive deposits of fossil wood. These have a composition which is closely related to that of the previously mentioned leaf locality, but which also contains a few subtropical species not present in the John Day. The best collecting appears to be in the Hampton Butte area in sec. 36, T. 19 S., R. 19 E., 12 miles north of the Bend-Burns highway. The silicified wood in this area is frequently colored in green or carnelian shades and therefore is highly prized by hobbyists. Approximately three-fourths of the specimens collected by the author in this area were coniferous, half of these being a species of pine similar to that occurring in the John Day formation, but definitely not identical. Cypress and Taxodium (bald cypress) or Sequoia (redwood) also appeared to be present. Of the angiosperms, more than half were a Quercus of the live-oak type. Eleven other genera were distinguished, including Cinnamomum, Magnolia, Ocotea, and Platanus. Palm, tree ferns, Juglans, and most other Clarno type-locality genera were absent.

Specimens of fossil wood were also collected at Lowry's (1940) petrified wood locality (SW corner sec. 8, T. 19 S., R. 18 E.). This locality yielded only conifers (Pinus and Taxodium or Sequoia) and sycamore (Platanus), but there is little question about its contemporaneity with the Hampton Butte locality because of the distinctive coloring of the specimens. Bowman (1940) reported the presence of three fossil leaf horizons in the valley of the south fork of Camp Creek (T. 19 S., R. 21 E.), but preservation was poor and only Platanus and Equisetum could be identified. All of the wood studied was either in situ or traceable to its original source.

Mitchell fossil wood locality:

Silicified wood, similar in appearance and composition to that obtained from the Hampton Butte and Bear Creek areas, may be found 1½ miles south of Mitchell in sec. 15, T. 12 S., R. 21 E., on the east side of Nelson Creek. The locality was discovered by Howard (1955) and mapped as upper Clarno. The wood has been eroded from tuffs and breccias reminiscent of Lowry's and Bowman's "Upper Clarno" member of the Clarno formation. More than half of the specimens from this area are pine, identical with that

found in the vicinity of Hampton Butte. Of the 12 or more angiosperms found at this locality, at least 6 are also identical with those at Hampton Butte. Insufficient work has been done to characterize them completely, but there is little doubt that the flora from both this and the Hampton Butte locality are much more closely related to the subsequent John Day flora than the earlier Clarno type flora. A middle to upper Oligocene age for these localities appears to be justified on the basis of the present evidence.

Conclusion

An examination of the plant fossils from 9 groups of Clarno formation localities in Central Oregon shows such a diversity of composition that it must be concluded that this formation was laid down over a considerable period of time. Best estimates on the basis of floral evidence suggest a range from middle-upper Eocene to middle-upper Oligocene. This conclusion also coincides with that of some of the more recent lithologic studies (Wilkinson personal communication).

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ATOMIC RESEARCH PROGRAM AT ALBANY

The U. S. Bureau of Mines has announced plans to build an atomic-research facility at its Metallurgy Research Center in Albany, Oregon. The structure, to be completed within a year, will house 100,000 curies of radioactive cobalt for use in studying the effects of gamma radiation on the properties of minerals and fuels. Preliminary studies by the Bureau of Mines have already indicated that gamma irradiation may help advance mineral processing techniques by altering certain properties of minerals and speeding up chemical reactions.

All safety factors will be incorporated into the design and operation of the laboratory. The radioactive cobalt will be sealed in capsules and housed in a cell-like structure with 4-foot walls of heavy-density concrete. Experiments will be conducted by means of viewing windows and remote-controlled manipulators. Materials removed from the cell will have no residual radioactivity.

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OFFSHORE EXPLORATION PERMITS GRANTED

The State Land Board issued offshore exploration permits to the Shell Oil Company and the Gulf Oil Corporation on June 13, 1961. Shell Oil Company was granted a 120-day permit to conduct seismic shooting in Oregon waters. The seismic boat operated by Shell will carry a representative for the Fish Commission and the Game Commission, who will observe effects of explosives on marine life during the shooting. Gulf Oil Corporation was issued a 90-day permit to conduct nonexplosive seismic surveys. Permits for exploration are non-exclusive and give no preference for leasing.

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MINING NEWS

Eastern Oregon

Rare Metals Corporation has leased the Hulin Quicksilver Claims adjacent to Cave Creek in the Burnt River area in Baker County. A small amount of preliminary exploratory work was done on the property this spring by company geologists.

Test work on a portion of the Pine Creek Placers north of Halfway in Baker County is being continued by the McDonald brothers.

Bill Wood and Bill Close have brought in a drag line in order to continue test work on the O'Brien Creek placer in the Eage Creek area in Baker County.

Southwestern Oregon

Cleanup work is about completed at the Joe-Joe Placer (Ruble) Mine on Upper Coyote Creek, Josephine County, after 3½ months of winter and spring hydraulic operation. The owner-operators, J. E. Fitzpatrick and J. E. Inman, calculate they have "piped" approximately 150,000 cubic yards of gravel through their sluice boxes. Work of cleaning fine gold from crevices in the fractured slaty shale bedrock is tedious but profitable.

A gold-saving circuit has been installed at the Roy Houck & Sons Corp. gravel operation on Foots Creek where dredge tailings are being crushed and screened for highway construction near Gold Hill. The concentrates are recovered from the minus ¼ inch material by means of under currents and a pair of Clark Bowl concentrators. The crushing plant has been operating on a 2-shift basis at the rate of about 500 yards per hour. Work at the project is nearly completed. Gold is being recovered from the concentrates by the Zinc Creek Mining Company mill located in the Illinois Valley between Cave Junction and O'Brien.

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OREGON THESES ADDED TO DEPARTMENT LIBRARY

The following unpublished material has been added to the department library since issuance of a similar list in the October, 1960, Ore.-Bin:

Bateman, Richard L., 1961, The Geology of the south-central part of the Sawtooth quadrangle, Oregon: Univ. of Oregon master's thesis, 97 pp., illus., geol. map. (Area in northern Harney County, contains southernmost extension of the pre-Tertiary inlier of central Oregon, consisting of complexly folded Middle and Late Jurassic marine graywackes, siltstones, and mudstones, overlain by Tertiary basalts and Danforth welded tuff.)

Carnahan, Gary L., 1962, Geology of the southwestern part of Eagle Cap quadrangle, Wallowa Mountains, Oregon: Oregon State Univ. master's thesis, 98 pp., illus., geol. map. (Lower Sedimentary Series, Martin Bridge, and Hurwal formations in overturned anticline represent continuous deposition of about 11,000 feet of Upper Triassic sediments. Overlain unconformably by Columbia River basalt and sculptured by Pleistocene glaciers.)

Howard, John K., 1961, Stratigraphy and structure of the Cape Sebastian-Crook Point area, southwest Oregon: Univ. Wisconsin master's thesis, 52 pp., illus., geol. map. (Area on coast in Curry County. Highly folded and sheared sandstones, greenstone, and serpentine of probable Late Jurassic-Early Cretaceous age overlain by gently folded Late Cretaceous rocks composed of a massive sandstone unit grading into alternating sand-shale unit. Diagnostic marine fossils found in both units.)

Johnson, Arvid M., 1961, Stratigraphy and lithology of the Deer Butte formation, Malheur County, Oregon: Univ. of Oregon master's thesis, 144 pp., illus. (Seven members are recognized: composed of basalts, breccias, and interbedded lacustrine and fluvial sediments, determined to be of late Miocene to possibly early Pliocene age on the basis of the vertebrate fossils.)

Patterson, Peter V., 1961, Geology of the northern third of the Glide quadrangle, Oregon: Univ. of Oregon master's thesis, 83 pp., illus., geol. map. (Lower Eocene marine sedimentary rocks and pillow basalt of Umpqua formation, middle Eocene marine sandstone and siltstone of Tyee formation, late Eocene-early Oligocene Fisher formation of marginal marine-terrestrial sediments and volcanic rocks, Miocene (?) basalt flows, and post Eocene intrusives.)

Payton, Clifford C., 1961, The Geology of the middle third of the Sutherlin quadrangle, Oregon: Univ. of Oregon master's thesis, 81 pp., illus., geol. map. (Map area underlain by early Eocene marine sedimentary and volcanic rocks of Umpqua formation in which 6 units are recognized, unconformably overlain by middle Eocene marine Tyee sandstone.)

Pigg, John H., Jr., 1961, The Lower Tertiary sedimentary rocks in the Pilot Rock and Heppner areas, Oregon: Univ. of Oregon master's thesis, 67 pp., illus., geol. map. (Mapped area underlain by pre-Tertiary metamorphic complex, Eocene sediments, Eo-Oligocene Clarno lavas, and Miocene Columbia River basalt. Makes unit distinction between pre-Clarno sedimentary section and Clarno basaltic lavas.)

Prostka, Harold, 1960, Preliminary report on the geology of the Sparta quadrangle, Oregon: Oregon Dept. Geology and Min. Industries unpublished preliminary report, 5 pp., geol. map. (Summarizes relation of Clover Creek greenstone to other pre-Tertiary rocks in area and interprets age of the greenstone as wholly Triassic.)

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PERLITE OCCURRENCES IN SOUTHEASTERN KLAMATH AND SOUTHWESTERN LAKE COUNTIES, OREGON

by
Norman V. Peterson*

A preliminary study of perlite occurrences in southeastern Klamath and southwestern Lake Counties was made by the writer during 1960 while extending the reconnaissance mapping of the Lakeview uranium area. Large bodies of glassy rhyolite-dacite rocks with associated perlite were found to be widely distributed in Klamath and Lake Counties. This distribution and the possibility of new and larger markets in the lightweight aggregate industry and increasing use of perlite as a filtering medium, made it desirable to delineate and sample the perlite occurrences and to indicate areas of possible commercial importance.

The mapping of the rhyolite-dacite rocks was limited generally to the Lakeview uranium area in Lake County and to accessible areas adjacent to Oregon Highway 66 and the railroad to the west near Bly and Beatty in Klamath County. Detailed work will surely show more outcrops of the glassy rhyolite-dacite rocks and associated perlite occurrences.

Definition of Perlite

Strictly defined, perlite is a volcanic glass having numerous concentric cooling cracks which give rise to a perlitic structure (concentric onion-like partings). Most perlites have a water content that is greater than normal obsidian and an overall composition that varies between rhyolitic and dacitic. Perlite ranges in color from light gray to almost black and has a waxy to pearly luster. Owing to its water content turning to vapor, perlite, when crushed, sized, and heated quickly to its softening temperature, expands into fluffy pellets that resemble pumice.

Commercially, the term perlite refers to any naturally occurring glass of igneous origin that will expand when heated quickly and yield a frothy, light-colored mass of glass bubbles. The expanded product is also called perlite.

Perlite Industry

Since perlite is a low-cost industrial mineral, economic production requires cheap mining and processing methods and low transportation cost to markets. Most deposits are quarry-type operations where bulldozer ripping, carryall or power-shovel loading methods are used. Crude perlite is usually crushed and screened at or near the quarry and then shipped to a processing plant for drying, pre-heating, and expansion. The expansible properties of different perlites are seldom the

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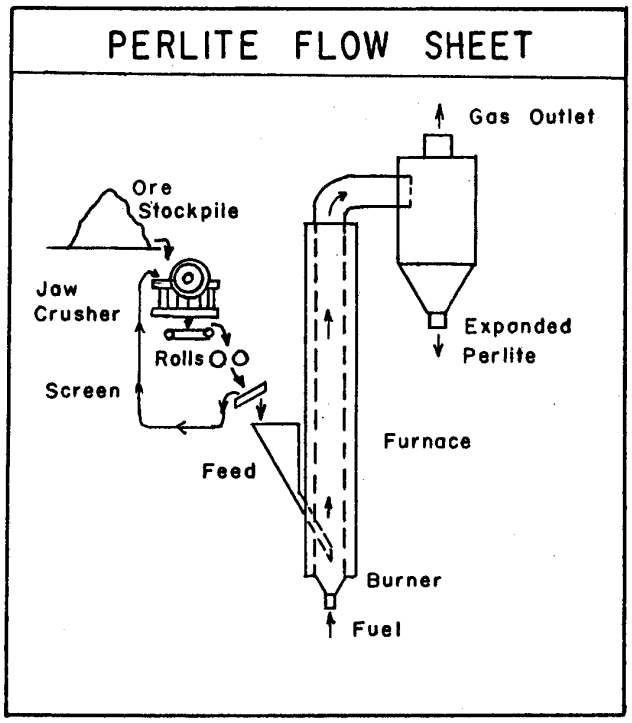
*Field geologist, State of Oregon Dept. of Geology and Mineral Industries

same so that the processing plant design is based on trial tests of the perlite for:

1. Physical characteristics, mainly fracture.
2. The temperature at which the perlite expands.
3. The extent to which water vapor has been driven out of the perlite particles before the softening temperature has been reached.
4. The particle size of the raw perlite fed to the furnace.

Vertical and horizontal oil or gas fired furnaces of several designs are used. A typical flow sheet of the operation is shown in the accompanying illustration. After expansion, the hot perlite is cooled and separated into various size fractions by a series of cyclones. The sized product is then bagged or sent to bulk storage.



Uses of Perlite

Perlite can be made in a variety of densities, it is chemically inert, flame-proof, mildew-proof, does not disintegrate when wet and has excellent heat and sound insulating properties. The most important uses from a rapidly growing list are shown below.

Plaster aggregate: For making a plaster that is lightweight, easy to apply, has good acoustic and thermal insulating properties, is fireproof, resilient, nailable, sawable, and has good bonding properties.

Lightweight concrete aggregate: For roof decks, beams, building blocks, prefabricated units and floors, modern curtain-wall construction.

Loose-fill insulation: For insulating between wall studs, around steam pipes, in refrigeration cars, and deep freezers, and as a loose fill medium for imbedding hot steel ingots during shipping.

Fillers: Perlite fines are used in rubber goods, cleansers, paints, glazed tile, glazes, plastics, resins, and metal surface plaster. Also used as a porous support for catalysts and chemicals in gaseous reactions.

Industrial filtering: For filtering juices, dry cleaning compounds, alcoholic beverages, and other chemicals.

Cementing and grouting of oil well casing.

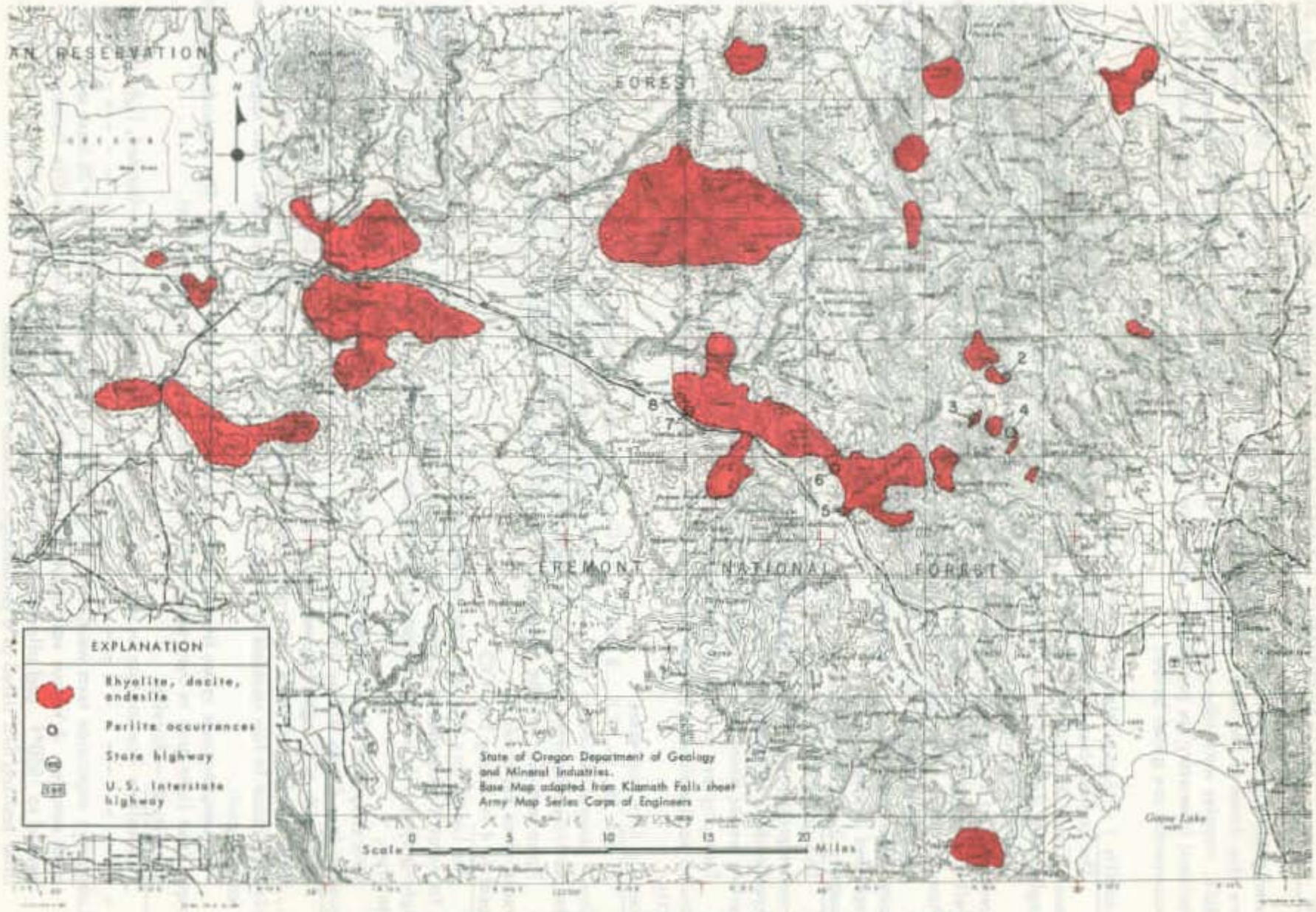
Refractory: For making medium temperature-range refractory brick.

Horticultural applications: Used as a soil conditioner, a plant propagating medium, packing material for shipping, and as a diluent in insecticides.

Klamath and Lake County Occurrences

In southeastern Klamath County and southwestern Lake County, the perlite occurrences are almost always found as a selvage zone around glassy flow-banded rhyolite-dacite rocks. Pumiceous tuffs and breccias are generally associated. The zones of perlitic rocks vary from a few feet thick to large dome-shaped masses that cover several acres.

On the accompanying map, rocks of predominantly rhyolitic to andesitic composition have



PERLITE OCCURRENCES IN KLAMATH AND LAKE COUNTIES, OREGON

been generally outlined. Previously known perlite occurrences and others found during this study are also shown on the map. No detailed study of any occurrence was attempted, but, when feasible, samples were taken and submitted to L. L. Hoagland, assayer-chemist at the department's Portland laboratory, for preliminary expansion tests (see table). Data on eight individual perlite occurrences are given below:

Locality 1 -- Eagles Nest (Paisley Perlite)

The Eagles Nest or Paisley Perlite is located along the crest and east flank of Tucker Hill in secs. 25 and 36, T. 34 S., R. 19 E., about 10 miles southeast of Paisley in Lake County. The Eagles Nest deposit is being developed by A. M. Matlock of Eugene, Oregon.

A large amount of light-gray perlite has been explored along the east flank of the elongated dome-shaped mass of glassy flow-banded rhyolite that makes up Tucker Hill. Perlitic structure is well developed and the rocks break down into perlite sand with common to abundant obsidian cores (Apache tears). This deposit was studied in some detail by N. S. Wagner (1950).

Samples of perlite from the Eagles Nest submitted to the department for preliminary expansion tests* show the perlite to have good to excellent expansible properties and a very light-colored expanded product.

Locality 2 -- Glass Slipper

This occurrence, in sec. 14, T. 37 S., R. 18 E., was discovered adjacent to the Marty K uranium prospect in 1955. The perlite is light to dark gray and occurs at the contact of a large rhyolite dome and massive pumice tuffs. Where it has been exposed in several bulldozer cuts the perlite breaks down into a translucent sand. Obsidian is common as "Apache tears".

Two samples, one of the perlite sand with occasional obsidian and the other a dark-gray banded perlite showed volume increases of 350 percent and 200 percent when tested for expansibility.

Locality 3 -- No Name

In sec. 28, T. 37 S., R. 18 E., perlite occurs on both edges of a northeast trending rhyolite dike. Several bulldozer cuts made while exploring for uranium minerals expose perlitic rocks. The perlite varies from light gray to dark gray and grades into a pink and green glassy rhyolite.

Three samples from the west edge of the dike showed a 25 percent to 100 percent volume increase when expanded.

Locality 4 -- Lucky Day OO

The Lucky Day OO is a uranium prospect in sec. 35, T. 37 S., R. 18 E. Here again perlite is found at the contact of a small rounded mass of glassy flow-banded rhyolite and volcanic tuffs. Light-gray perlite has been exposed in a shallow bulldozer cut on the northwest edge of the rhyolite plug.

One sample of almost white perlite showed a volume increase of 50 percent when tested.

Locality 5 -- Drews Valley Ranch

Just north of Oregon Highway 66 on Drews Valley Ranch in secs. 16 and 17, T. 38 S., R. 17 E., there is a large mass of light-gray perlitic rock. The perlite and glassy dacite with zones of obisidian occur in low rounded hills that are possibly remnants of a thick flow. This appears to be a large deposit.

Four samples were taken from widely separated points on the low hills. The expanded products ranged from light gray to very white with volume increases up to 550 percent.

Locality 6 -- Roselite

Quicksilver exploration in sec. 5, T. 38 S., R. 17 E., has exposed flow-banded, light gray to

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*Laboratory expansion tests were made by grinding and screening to obtain a +28 mesh and a -20 mesh sample. A known volume of the sample is placed in an electric muffle furnace preheated to 1850°F. and allowed to remain for 10 seconds. The expanded volume is measured after cooling and listed as a percentage increase in volume.

EXPANSION PROPERTIES OF PERLITE FROM KLAMATH and LAKE COUNTIES, OREGON

Locality Number and Name	Sample No.	Fused Color	Expanded Volume	Temp.	Time	Minus	Plus	Sample Description
1. Eagles Nest Perlite	P-26137	Very light	200%	1600° F.		20	28 mesh	Perlite.
" " "		" "	650%	1850° F.	30 sec.	20	28 mesh	
	P-26138	Very light	700%	1850° F.	30 sec.	10	20 mesh	Perlite.
2. Glass Slipper	P-25602		350%	1900° F.	30 sec.	20	28 mesh	Perlite sand. Translucent, occasional obsidian fragments (this sample badly shattered).
" "	P-25603		200%	1900° F.	30 sec.	20	28 mesh	Dark gray banded perlite from upper cut.
3. No Name	P-25604		25.0%	1900° F.	30 sec.	20	28 mesh	Dark gray banded perlite.
" "	P-25605		25.0%	1900° F.	30 sec.	20	28 mesh	Dark gray-green vitreous perlite (?).
" "	P-25606		100%	1900° F.	30 sec.	20	28 mesh	Light gray banded perlite.
4. Lucky Day OO	P-25567		50%	1900° F.	30 sec.	20	28 mesh	White to light gray perlite.
5. Drews Valley Ranch	P-25488	Gray	125%	1850° F.	30 sec.	150% @ 1950° F.		Gray perlite w/common obsidian.
" " "	P-25489	Gray	25%	1850° F.	30 sec.			Gray perlitic flow banded glassy rhyolite.
" " "	P-25490	White	550%	1850° F.	30 sec.	400% @ 1700° F.		Gray glassy rhyolite.
" " "	P-25491	White	550%	1850° F.	30 sec.			Gray perlite sand.
6. Roselite			No data					Light gray-green perlitic rhyolite.
7. No Name	P-25653	White w/few blk. specks	500%	1850° F.	30 sec.			Pinkish-gray perlite common feldspar & biotite crystals.
8. No Name	P-25654	Very white	700%	1850° F.	30 sec.			Medium gray perlite, common feldspar.

green glassy rhyolite. Where opalization and clay alteration are not present the rocks have a perlitic structure. Drill holes are reported to have encountered perlite for considerable depth. No samples were submitted from this occurrence.

Locality 7 - No Name

Pinkish-gray glassy biotite dacite (?) with a perlitic structure occurs in prominent rounded outcrops just north of Oregon Highway 66 in NW¼ sec. 30, T. 37 S., R. 16 E. This occurrence is very close to the western border of Lake County. Small crystals of feldspar and biotite mica are common to abundant in the sugary textured massive rock.

One sample expanded 500 percent and the product was white with a few black specks.

Locality 8 -- No Name

On the eastern edge of Klamath County in sec. 24, T. 37 S., R. 15 E. medium-gray perlitic rocks crop out over a wide area. The sugary-textured rocks weather easily into low-rounded outcrops. Feldspar and biotite are common to abundant. The widespread outcrops indicate a large quantity of perlitic material.

One sample chipped from several outcrops showed a very white expanded product with a volume increase of 700 percent.

Conclusions

During this preliminary study the individual occurrences were not mapped in detail or completely sampled, nor were tonnages calculated. The study does indicate, however, that large amounts of perlite with good to excellent expansible properties are available. If the problem of cost of transportation to market can be worked out there certainly is a good possibility of finding a suitable, adequate source of perlite in this area.

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RARE MINERAL COLLECTION DISPLAYED

Albert and Stella Keen of Portland, members of the Oregon Agate and Mineral Society, have placed a supremely fine mineral display in the department's loan-exhibit case. The Keen's minerals, which have come from many parts of the world, show a perfection in color and crystalline form rarely seen in such collections. The specimens will be shown until the middle of August.

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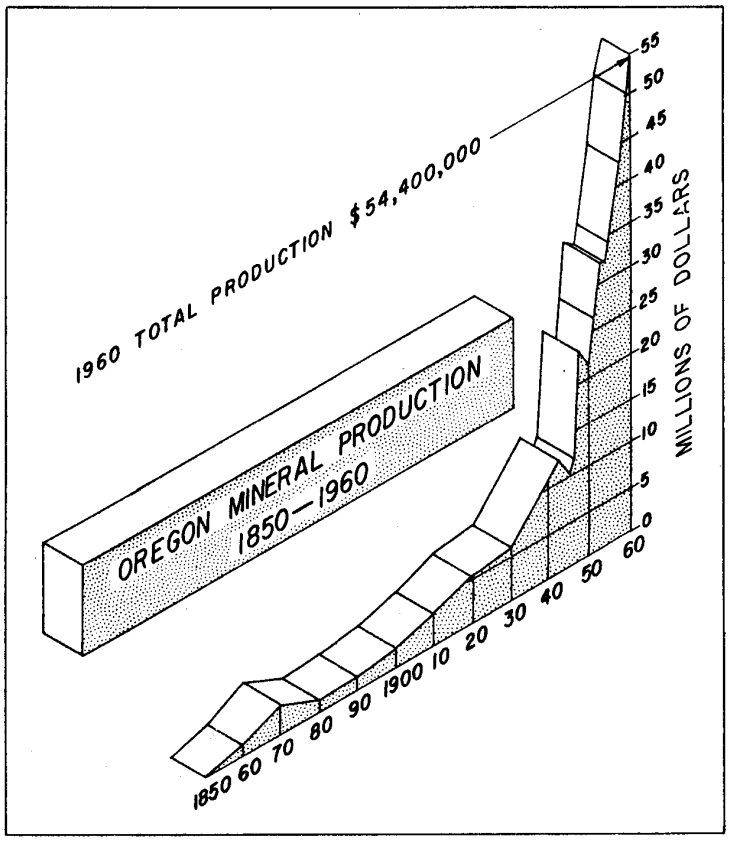
OREGON MINERAL PRODUCTION SETS PACE FOR STATE'S INDUSTRIES

by

Ralph S. Mason*

With the posting of a 9 percent gain over 1959, Oregon's mineral industries last year climbed to another record-breaking production total valued by the U. S. Bureau of Mines at $54,419,000. This achievement is all the more remarkable because practically every other segment of the state's economy suffered declines during the same period and the new record resulted almost entirely from increases in production and not from price advances. The growing importance of two basic industrial mineral commodities, sand and gravel and crushed stone, to the economy of the state is shown in their 13 percent increase during 1960.

Taken as a whole the value of mineral production in Oregon has increased 153 percent in the past 10 years. (See accompanying graph.) Of considerable surprise is the fact that Oregon mineral production has now reached to within a pick handle length of Idaho, long famous as a heavy mineral producer. In 1960 Idaho produced only 5.5 percent more mineral wealth than did Oregon. It must also be borne in mind that values assigned to mineral commodities by the U. S. Bureau of Mines are usually based on the raw rather than the processed material. (See Table 1.) If mineral wealth produced in Oregon was reported on the same basis that lumber is, the value would be far in excess of $100 million for 1960.



Despite the large increase in production during the year, some minerals suffered declines. Diatomite was off 6 percent, pumice and volcanic cinders were down 4 percent, sand and gravel 3 percent, and mercury 58 percent. Sharp increases over the previous year were registered by cement, up 18 percent; clays and shale, up 8 percent; stone, up 26 percent; and limestone, up 10 percent. Production of building stone increased markedly in 1960. Gold, silver, copper and nickel were produced in slightly greater quantity than in 1959.

Employment in the mining and metallurgical industries of the state increased 4 percent in 1960. Primary metals, with an average annual 7 percent increase in payrolls from 1955 to 1960, are among the fastest growing manufacturing sectors in the state. A summary of employment and payrolls is given in Table 2. Typical of the rapid changes that have occurred in the metallurgical industry in the past few years is the growing list of "new" metals refined either in electric arc,

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*Mining Engineer, State of Oregon Department of Geology and Mineral Industries.

vacuum-arc, or the new electron-beam furnaces. Metals refined by these methods include nickel, aluminum, silicon, hafnium, zirconium, tantalum, columbium, and titanium. Although the employment statistics reported in Table 2 include the primary metallurgical industry, the value of the production from them is not included in the state totals (Table I).

Viewed from the standpoint of their economic impact on the state, the mining and metallurgical industries contribute far more than the dollar totals would indicate. Characteristically these industries operate the entire year, use no migrant workers, create no shortages of boxcars and are not subject to the host of maladies and the vagaries of weather which beset agriculture, lumbering, and cattle raising. The accompanying map shows the mineral commodities produced in each county of the state and their total values.

Table 1

Mineral Production in Oregon, 1959 - 1960 1/

Mineral	1959		1960	
	Short tons (unless otherwise stated)	Value (thousands)	Short tons (unless otherwise stated)	Value (thousands)
Clays - thousand short tons	294	$308	318	$370
Copper (recoverable content of ores, etc.)			6	4
Gold (recoverable content of ores, etc.) troy ounces	686	24	835	29
Mercury 76-pound flasks	1,224	278	513	108
Nickel (content of ore and concentrate)	12,374	2/	13,115	5,246
Sand and gravel thousand short tons	18,087	15,506	17,539	16,170
Silver (recoverable content of ores, etc.) troy ounces	242	3/	284	3/
Stone thousand short tons	13,341	16,126	16,864	19,620
Value of items that cannot be disclosed: Asbestos, carbon dioxide, cement, diatomite, gem stones, iron ore (pigment material) 1959, lime, pumice, uranium, and values indicated by footnote 2		18,607		14,125
Total 4/		49,843		54,419

1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Figure withheld to avoid disclosing individual company confidential data.
3/ Less than $500.
4/ Total adjusted to eliminate duplicating value of raw materials used in manufacturing cement and lime; 1959 total revised.

Table 2
Oregon Mineral Industry Employment and Payrolls*

	1959		1960	
	Employment	Payrolls	Employment	Payrolls
Mining	1,227	$6,955,000	1,181	$6,662,000
Mineral manufacturing	2,552	14,341,000	2,860	16,740,000
Primary metals	5,650	35,586,000	5,751	37,128,000
Miscellaneous	762	4,549,000	796	4,786,000
Totals	10,191	$61,431,000	10,588	$65,316,000

* Oregon State Employment Department figures.

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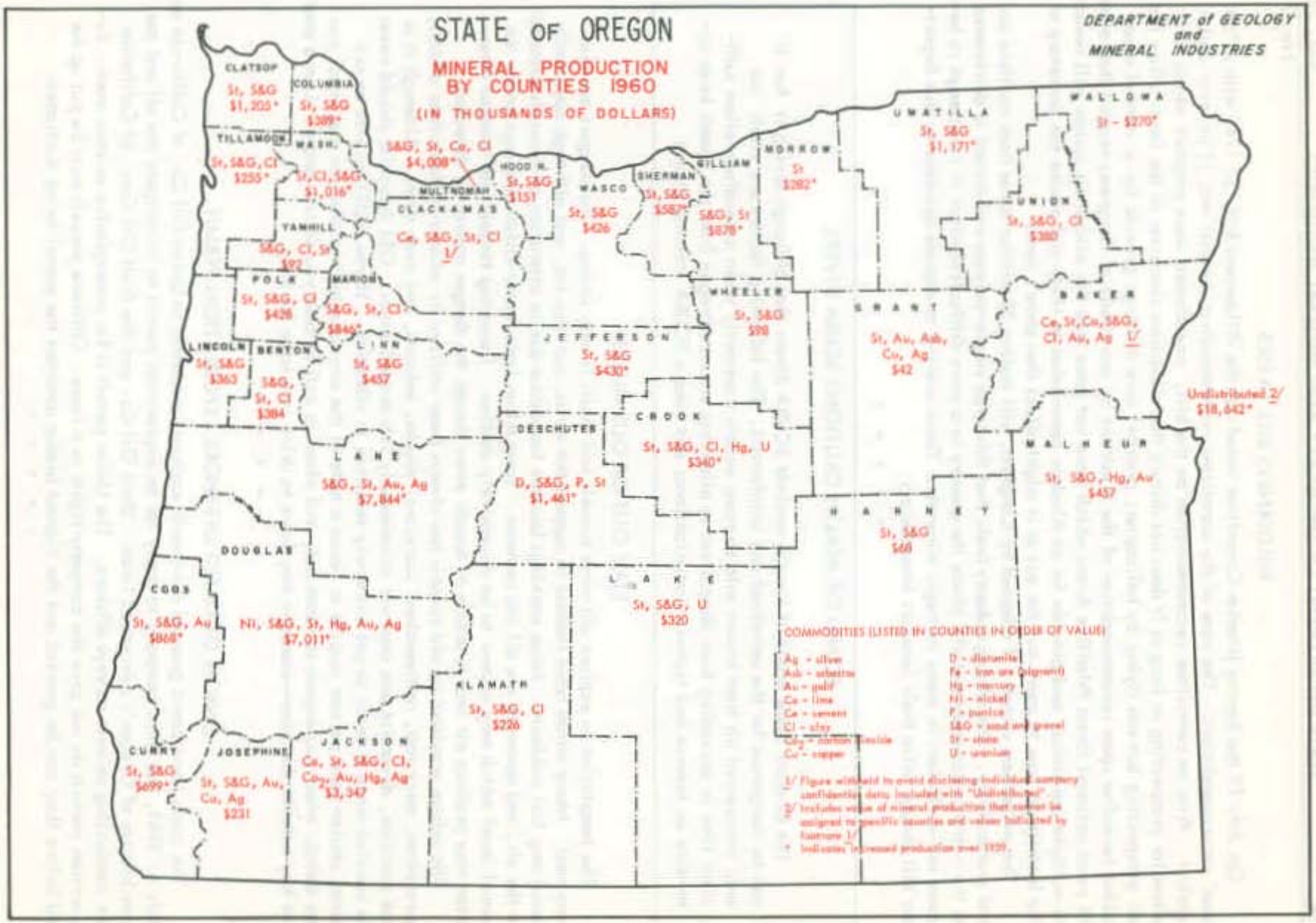
STATE OF OREGON
MINERAL PRODUCTION BY COUNTIES 1960
(IN THOUSANDS OF DOLLARS)
DEPARTMENT of GEOLOGY and MINERAL INDUSTRIES
CLATSOP
St, S&G $1,205*
COLUMBIA
St, S&G $389*
TILLAMOOK
St, S&G, Cl $255*
WASH.
St, Cl, S&G $3,016*
S&G, St, Ce, Cl $4,008*
HOOD R.
St, S&G $151
MULTNOMAH
CLACKAMAS
Ce, S&G, St, Cl 1/
WASCO
St, S&G $426
SHERMAN
St, S&G $587*
GILLIAM
S&G, St $878*
MORROW
St $282*
UMATILLA
St, S&G $1,171*
WALLOWA
St - $270*
UNION
St, S&G, Cl $380
YAMHILL
S&G, Cl, St $92
POLK
St, S&G, Cl $428
MARION
S&G, St, Cl* $846*
WHEELER
St, S&G $98
GRANT
St, Au, Ash, Cu, Ag $42
BAKER
Ce, St, Ce, S&G, Cl, Au, Ag 1/
LINCOLN
St, S&G $363
BENTON
S&G, St, Cl $384
LINN
St, S&G $457
JEFFERSON
St, S&G $430*
Undistributed 2/ $18,642*
DESCHUTES
CROOK
St, S&G, Cl, Hg, U $340*
LANE
S&G, St, Au, Ag $7,844*
D, S&G, P, St $1,461*
MALHEUR
St, S&G, Hg, Au $457
HARNEY
St, S&G $68
DOUGLAS
COOS
St, S&G, Au $868*
Ni, S&G, St, Hg, Au, Ag $7,011*
LAKE
St, S&G, U $320
KLAMATH
St, S&G, Cl $226
CURRY
St, S&G $699*
JOSEPHINE
St, S&G, Au, Cu, Ag $231
JACKSON
Ce, St, S&G, Cl, Co2, Au, Hg, Ag $3,347
COMMODITIES (LISTED IN COUNTIES IN ORDER OF VALUE)
Ag - silver
Ash - asbestos
Au - gold
Ca - lime
Ce - cement
Cl - clay
Co2 - carbon dioxide
Cu - copper
D - diatomite
Fe - iron ore (pigment)
Hg - mercury
Ni - nickel
P - pumice
S&G - sand and gravel
St - stone
U - uranium
1/ Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed".
2/ Includes value of mineral production that cannot be assigned to specific counties and values indicated by footnote 1/.
* Indicates increased production over 1959.

WILDERNESS BILL PASSES

On July 13 the Senate Interior Committee voted out the Wilderness Bill, S. 174, with a "do pass" recommendation. The vote of the committee recommending the bill was 11 in favor and 4 against. Prior to committee recommendation on the bill, amendments were adopted which will allow for prospecting so long as it does not disturb the wilderness character of the land; allow for air prospecting but not flying by helicopter; prohibit core drilling; provide for a veto of areas added hereafter upon recommendation of the President by one House of Congress; require that after 14 years national forest Primitive Areas which have not gone into the wilderness system will revert to multiple use status; and provide for an Alaskan commission to study and advise the Secretary of the Interior on how to carry out the act as it might affect that state's lands.

The wilderness system, if adopted by Congress, will isolate 35 million acres from multiple use and productivity. The mining industry feels that this large single-purpose withdrawal is detrimental to the nation's economy and will place the country in a more difficult position in its attempt to become self-sufficient in many strategic minerals. Those wishing to express opinions on this important bill should write their Senators immediately.

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BOARD OF HEALTH CAUTIONS SCUBA DIVERS

The Oregon State Board of Health reminds SCUBA divers that although diving is fun it can be dangerous for the untrained and uninformed. The following factors are vital: use only compressed air from known safe sources; exhale constantly when ascending; allow sufficient time in ascending from deep dives to eliminate excess nitrogen from the blood; keep up-to-date on tetanus and typhoid immunizations; and take a SCUBA training course.

STAY OUT OF OLD MINES!

The temptation to explore old mine tunnels and shafts is very strong. The dangers are also very real. Many mines have timbers to support the walls, but they rot, and although apparently sound may fail suddenly. Mine workings become hazardous due to alteration of minerals exposed to the air, and cave-ins are all too common. Some mines have water-filled openings below the tunnel level which may appear to be deceptively shallow. Decaying timbers and mineral alteration may produce air that is unsafe to breath even though the danger cannot be detected.

The refuge provided by old tunnels has always been utilized by wild animals such as spiders, porcupines, pack rats, rattlesnakes, scorpions, skunks, bobcats, and even bears. Although it is bad practice, dynamite and caps are occasionally left around mines. Old dynamite should never be handled since it tends to get extremely sensitive to vibration. If you MUST go into an old mine, station your partner outside or leave a note at the entrance telling who you are, what you are doing, when you expect to come out, and whom to call in case you do not return. Leave your car key outside the mine--someone may have to drive into town for help.

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UNION GRANTED OFFSHORE EXPLORATION PERMIT

The State Land Board granted a 4-month exploration permit to Union Oil Co. of California on July 6, 1961, the third company to apply for an exploration permit to investigate the oil and gas possibilities of Oregon's submerged lands. Shell Oil Co. and the Gulf Oil Corp. of California are conducting seismic surveys offshore. The Union permit is for nonexplosive seismic work. Exploration permits do not give the company rights to a lease. Offshore parcels must be put up for bid before they can be granted and the highest bidder awarded the parcel being auctioned.

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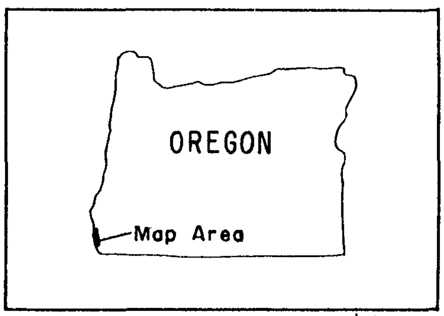
GEOLOGY OF CAPE SEBASTIAN STATE PARK AND ITS REGIONAL RELATIONSHIPS*

By

J. K. Howard and R. H. Dott, Jr.**

INTRODUCTION

The Cape Sebastian-Crook Point area of the southwest Oregon coast is unique in being one of the few areas in the Klamath-Siskiyou geologic province with preserved Late Cretaceous deposits. Because rocks of this age are only mildly deformed, they provide an important means for bracketing the age of the very severe deformation suffered by all older rocks of this region. At least two major late Mesozoic orogenic pulses can be recognized, the most severe of which affected pre-Lower Cretaceous rocks as demonstrated clearly in the Humbug Mountain area, 30 miles to the north and reported on in the March, 1961, Ore.-Bin (Koch and others, 1961). A subsequent disturbance deformed the Lower Cretaceous strata as well throughout the northern Siskiyou region. Study of the few scattered areas of post-orogenic, Upper Cretaceous deposits, such as those at Cape Sebastian and Crook Point, is not only of importance in unraveling this complex geologic history in detail, but is also important because strata of this age contain some of Oregon's most promising potential petroleum reservoir sandstones. A third, unexpected reward from the present work, has been the delineation of a relatively clear-cut structural pattern which provides a valuable clue to the probable dominant pattern for the whole coastal region, even for areas containing only the more obscure older rocks.



The area comprises all of Cape Sebastian State Park at the north and extends in a narrow belt south along the coast (straddling U. S. Highway 101) to the northernmost part of the presently undeveloped Samuel H. Boardman State Park (see accompanying geologic map). Private land intervenes. Coastal outcrops are excellent, but those inland are very sparse and generally deeply weathered. Results of investigation of the Upper Cretaceous strata and their structure have been used by Howard (1961) for a thesis subject for the Master of Science degree at the University of Wisconsin. Continuing doctoral research studies by J. M. Widmier, a graduate student at the University of Wisconsin, in the adjacent Brookings region to the south (including Harris Beach and Samuel Boardman Parks), and by Dott in the upper Pistol River area, hopefully will reveal more concerning the age and structure of the older rocks as well as extrapolation of regional structural patterns. It is hoped that within a year preliminary geologic mapping of the coast will be completed from Port Orford to the California border. Partial financial aid for the present study from the Oregon State Department of Geology and Mineral Industries and from the Wisconsin Alumni Research Foundation is gratefully acknowledged.

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*A progress report of continuing field work in the area.

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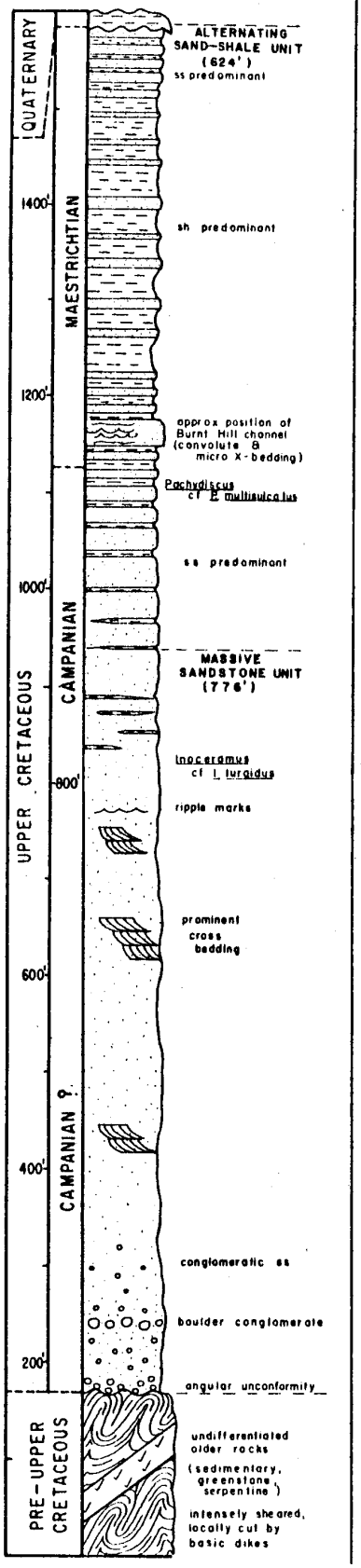
COMPOSITE COLUMNAR SECTION
CAPE SEBASTIAN AREA, OREGON



PREVIOUS WORK

The area was originally mapped superficially by Butler and Mitchell in 1916 during a preliminary survey of the resources of Curry County, later by Treasher (1943), and finally by Wells (1955). None of these determined the structural relationships nor did they recognize the strata as being Upper Cretaceous. Instead, they classified them either as the Myrtle formation (Jurassic-Cretaceous) or as the Eocene Arago formation. The bulk of the Arago is now included in the Coaledo formation of the Coos Bay district, 60 miles north. Upper Cretaceous fossils were found at three localities near Cape Sebastian (see accompanying geologic map) by Howard during the summer of 1960. Soon thereafter Popenoe and others (1960) re-classified these rocks as Upper Cretaceous on the basis of fossils collected by J. S. Diller about 1900 while mapping the Port Orford quadrangle. Diller's fossils, although in the U. S. Geological Survey collections, were unknown to any workers during the intervening years.

STRATIGRAPHY

Pre-Upper Cretaceous

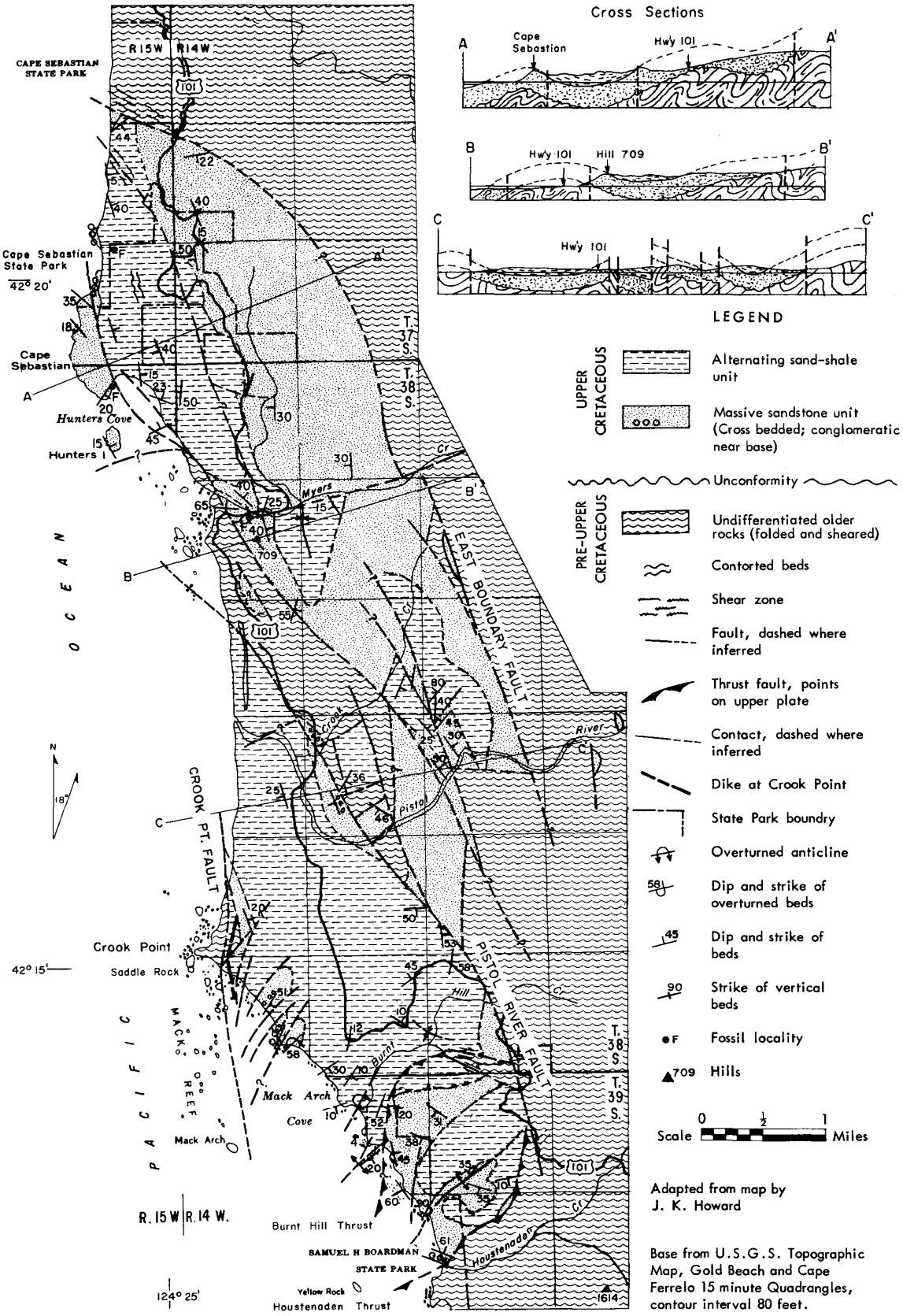
The oldest rocks recognized in the Cape Sebastian-Crook Point area are intensely sheared and folded sandstone and mudstones mixed with greenstone and serpentine. A pillow lava occurs within these strata in NW¼ sec. 22, T. 38 S., R. 14 W. Their age is probably Late Jurassic or Early Cretaceous, but no fossils were found to substantiate this inference. Correlation is based solely upon similarity to sedimentary rocks of this age in the Humbug Mountain-Port Orford area 30 miles to the north (Koch and others, 1961).

Upper Cretaceous

Massive sandstone unit: A massive sandstone unit overlies the older rocks with marked angular unconformity. This relationship can be seen in lower Myers Creek and with less certainty along U. S. Highway 101 near Wildwood Inn and just north of Pistol River. The massive sandstone unit is typically quite conglomeratic in its lower part, but local conglomerate lenses may occur higher as well. Small fossil oysters suggest shallow, near-shore and beach environments of deposition. It seems likely that the conglomerate was formed essentially in place and that the sands infiltrated around beach pebbles and cobbles as the area became submerged. This unit grades upward from the conglomeratic base into a well-sorted, fine-grained sandstone 150 feet above the lower contact (see accompanying columnar section). Thin section studies of this rock indicate that it is a feldspathic wacke (Williams and others, 1954). The massive sandstone forms all of Cape Sebastian proper and crops out extensively along U. S. Highway 101, but particularly in the vicinity of Myers Creek bridge. Cross stratification, ripple marks and sole marks are numerous throughout the upper part of this unit, indicating that it was deposited in a current-agitated environment. The cross stratification is best seen on the sea cliffs on the northwest side of Hunters Cove. The fossil clams Inoceramus turgidus? and Cucullaea? were found within this unit on the south side of Cape Sebastian and on U. S. Highway 101, about 100 feet west of Myers Creek bridge.

Alternating sand-shale unit: The massive sandstone unit grades upward into an alternating, olive to gray, sand-shale unit which can easily be seen on the sea cliffs around Hunters Cove on the southeast side of

GEOLOGIC MAP OF THE CAPE SEBASTIAN—CROOK POINT AREA, OREGON



Looking northwest toward Cape Sebastian State Park from a point just south of the mouth of Myers Creek on U.S. 101. Stacks in foreground are pre-Upper Cretaceous sediments and greenstone; Cape Sebastian in background is Upper Cretaceous massive sandstone. Head of cove to right is Upper Cretaceous shale.

(Photo by Dott)

Cape Sebastian. It is also well exposed in a U. S. Highway 101 roadcut at the south end of the Pistol River bridge (sec. 19, T. 38 S., R. 14 W.). The contact between the two units was chosen at the first well-developed shale stratum, though shale lenses occur some distance below the contact. A true alternating sequence is developed within the first 100 feet of the second unit, and is characterized by sandstones averaging 3 inches in thickness, each separated by one foot of shale. Locally, however, the shales and sandstones range up to 10 feet in thickness. The sandstones contain fine cross-stratification throughout. Animal burrows and current sole markings occur on many stratification surfaces. A large, well preserved ammonoid, Pachydiscus multisulcatus? was found within this unit on the north side of Cape Sebastian (sec. 36, T. 37 S., R. 15 W.). It, together with Inoceramus turgidus? below, indicates a Late Cretaceous age. Additional fossils are also reported by Popenoe and others (1960), but most of the listed localities do not agree with the present land survey network so cannot be rechecked.

Of special note within the alternating sand-shale unit are channel-like sandstone bodies of fluvial or shallow marine origin. They are best exposed on the headlands north and south of Burnt Hill Creek (NW¼ sec. 5, T. 39 S., R. 14 W.). This channel is composed of light tan, well-sorted, fine-grained sandstone quite similar to that of the underlying massive sandstone unit, but is characterized by prominent current features such as fine cross-stratification, sole markings, convolute laminations, and rolled-up sandstone balls. Convolute laminae have been recorded elsewhere only in the finer grain sizes and, where associated with cross lamination, have been attributed to intense hydraulic deformation, in particular to turbidity current action (Ten Haaf, 1956). This latter assumption is apparently unjustified, for no graded bedding or other evidence of turbidity current deposition was found in any of the local deposits. In fact the environment and mechanism envisioned for deposition of the sequence is hardly favorable for any significant turbidity current activity in spite of superficial similarities to known "turbidites". (See Dott and Howard, 1961). At least one channel-like body in the alternating sand-shale unit on the east side of Hunters Cove contains a thin zone of coarse conglomerate.

STRUCTURE

The fault system of this area is composed of two nearly perpendicular sets, the dominant one trending northwest, the other northeast. (See accompanying structure map.) Three major northwest-trending faults are herein named the East Boundary, Pistol River, and Crook Point faults. Movement along them is speculative, but on the Pistol River fault zone, which is half a mile wide, there is evidence of right lateral, strike slip movement. A fold axis truncated by this fault constitutes a piercing point (or displacement reference point) as defined by Crowell (1959). Offset of this fold axis suggests right lateral movement on this fault (that is, the northeast side apparently moved to the right or southeast). Offset on the northeast-trending set is more

clearly defined. In the vicinity of Myers Creek, a synclinal fold axis is truncated by the fault paralleling Myers Creek (sec. 8, T. 38 S., R. 14 W.). The continuation of this axis on the north side of the fault is located west of U. S. Highway 101, indicating left lateral displacement of about one-half mile. Employing the strain ellipsoid concept, left lateral displacement on the northeast-trending set should produce right lateral movement on the northwest-trending set and vice versa. (See stress diagram on structure map). Such seems to be the case.

At the south end of the area two small thrust faults have been recognized and named the Burnt Hill and Houstenaden thrusts. Together with several small folds, they indicate northward compression in that area, and as they lie on the west side of the Pistol River fault zone, this evidence tends to substantiate right lateral movement on that fault.

The lineation of stacks offshore from major shear zones is an interesting feature of this area. This is most noticeable south of Crook Point where large stacks are parallel and adjacent to the submerged portion of the Crook Point fault. Though less obvious, stacks of the older rocks are also present offshore to the northwest of the East Boundary and Pistol River faults. The relationship between the faults and aligned stacks is not entirely clear, but their association has proven valuable in locating offshore extensions of faults in the mapping of other coastal areas both to the north (see Koch and others, 1961) and to the south where J. M. Widmier is working.

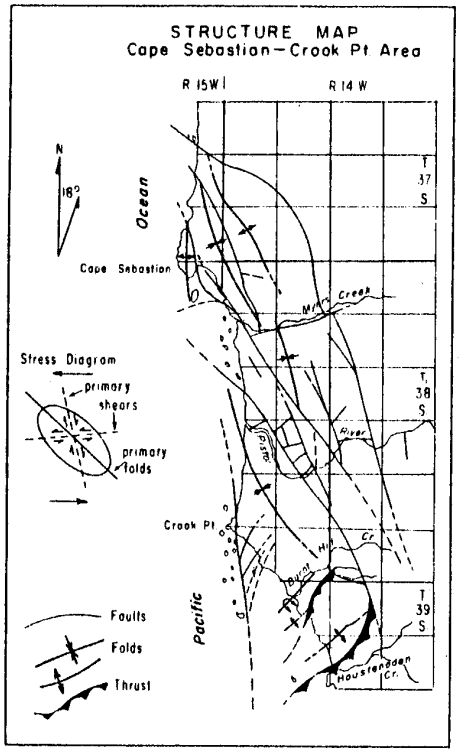
The Upper Cretaceous strata of this area are folded into a series of doubly-plunging anticlines and synclines with a general trend of N.30°W. The relationship between the fold and fault patterns is not clear. The folds may be primary structures formed simultaneously by the same forces that produced the fault system. This pattern also could be produced by secondary forces set up by a rupture with fold trends at an angle between 5° and 30° to a major fault (Moody and Hill, 1956).

REGIONAL HISTORICAL AND STRUCTURAL SYNTHESIS

Scattered Late Cretaceous deposits of the whole Klamath-Siskiyou province represent eroded remnants of a once far more extensive overlapping sequence which apparently blanketed much of the region after the last strong mid-Cretaceous orogenic pulse. The writers envision a rise in relative sea level in the Cape Sebastian area in Late Cretaceous (Campanian?) time resulting in a series of embayments into which rivers debouched sands and mud that accumulated on deltas and shallow shelves. As the sea level rose further, the energy level of the depositional environments decreased, and near the close of the Campanian epoch periodic influxes of mud produced the rythmic alterations of sand and shale. The cyclic deposition presumably continued into the Maestrichtian epoch.

Because the topography was moderately irregular, and because marine transgression spanned practically all of Late Cretaceous time, the exact age of the basal "post-orogenic" deposits varies considerably from place to place. Judging from rather incomplete fossil evidence, transgression apparently began in "middle" Cretaceous time (Albian to Cenomanian) in the eastern Siskiyou region from Roseburg southeast through upper Grave Creek, Medford, and Ashland to Hornbrook, California, and south to Redding as it did in central Oregon (Popenoe and others, 1960). On the west, however, transgression did not commence until later Cretaceous time (probably Campanian) as evidenced around Cape Sebastian (this paper), just north of Port Orford (Koch and others, 1961), and at Dement Creek about 25 miles northeast of Port Orford (Popenoe and others, 1960).

The Cretaceous near Takilma and Waldo, Josephine County (near Oregon Caves), remains an enigma. Meager fossil evidence suggests an Early Cretaceous age (Hauterivian to Barremian) which would compare most closely with the Myrtle group of the Roseburg region (Popenoe and others, 1960). These strata have been examined by Dott, and their practically undeformed character as well as their lithology suggests that they are in fact "post-orogenic" and more akin to the later Cretaceous overlapping sequence. All known Myrtle strata were severely deformed during the mid-Cretaceous, but it is of course possible that this area, deep in the interior of the Siskiyou province, escaped effects of the last orogeny. This is unlikely, however, for the nearby Ashland batholith was apparently formed simultaneously or slightly after Myrtle deposition (102 million years ago according to Jaffe and others, 1959). Like practically all of the younger localities, this area contains a coarse basal conglomerate grading up through a thick massive sandstone unit to an upper rhythmically-alternating sandstone-shale unit. The similarity of all these sequences is indeed striking. Dott



feels that all physical stratigraphic evidence favors a later Cretaceous age in spite of biostratigraphic evidence. He suggests that those deposits should be compared to the Albian-Cenomanian ones of the Grave Creek and Medford areas.

Apparently most of Oregon was affected by the "middle" Cretaceous orogeny, and soon thereafter was invaded widely by the transgression of the sea eastward to the Mitchell-Blue Mountains region (Popenoe and others, 1960) and into half or more of the Klamath-Siskiyou region. "Middle" Cretaceous transgression is evidenced on all continents and is thought to represent a world-wide rise in sea level. The sea apparently covered the western two-thirds of Oregon and Washington. Therefore, Upper Cretaceous marine strata probably underlie practically all of that region. General regression of the sea occurred during the early Cenozoic as evidenced by complete absence of known Paleocene deposits and unconformable overlap of basal Eocene strata in the northern Siskiyou region.

Severe faulting occurred on the coast prior to deposition of Upper Cretaceous strata, but the faults discussed above have also been active during the Cenozoic. At Crook Point and north of Port Orford, Upper Cretaceous strata are in clear fault contact with older rocks. Scattered dikes and sills of rhyolitic and basaltic composition between Crook Point and Brookings are unaltered and appear to be relatively young; they are assumed to be related to the regional fault system.

Great shear zones along the coast are in marked contrast with the typical northeast-trending structural and metamorphic pattern of the interior Siskiyou province as indicated by Koch and others (1961). The present coastal structure, which is nowhere so clear as in the Cape Sebastian-Crook Point area, is regarded as a profound pattern superimposed upon the older structure along the western fringe of the province. Similarity of trends, similar apparent movement, and prevalence of large-scale shearing suggests a genetic relation with the San Andreas-Mendocino fault system and an extension of California "coast range structure" north well into Oregon. Dott believes that this structural pattern persists as far north as Bandon, 50 miles north of Cape Sebastian. It has been suggested that these great fault systems have resulted from counter-clockwise rotation of the Pacific Ocean basin relative to the continent (St. Amand, 1957); to gigantic twisting and shearing of blocks of the crust within the whole of western North America, and the great arcuate bend of Pacific Coast fold trends in the Klamath region (Carey, 1958); and to differential movement and tension within large "oceanic blocks" on the flanks of the recently-discovered East Pacific Rise. The Rise presumably passes from the equatorial Pacific beneath western California and out to sea again off southwestern Oregon (Menard, 1960). The present study clarifies the extent, pattern, probable types of movement and partial age of the great California fault systems in Oregon, but can not shed light upon their ultimate cause.

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GEOPHYSICAL EXPLORATION AUTHORIZED ON CONTINENTAL SHELF

The Department of the Interior announced on August 3 approval for permitting geophysical exploration by oil companies on the outer continental shelf of the Pacific Ocean off the Oregon and Washington coasts. Oil companies interested in doing exploratory work in federal offshore waters of these states must comply with the following conditions:

1. To obtain a permit from the regional oil and gas supervisor of the U.S. Geological Survey, Los Angeles, California.
2. To confine operations to such areas as are designated in the permit.
3. To file a stipulation with the regional supervisor to comply with requirements protecting and conserving the aquatic life in the designated area.

Companies authorized to conduct geological and geophysical explorations are not empowered to drill exploratory wells under a federal exploration permit, nor does the permit confer preference in obtaining oil and gas leases.

The announcement by the Department of the Interior will allow companies operating off the Oregon and Washington coasts to extend their geophysical surveys beyond the 3-mile limit. Shell Oil Company, Gulf Oil Corporation of California, and Union Oil Company of California have obtained exploration permits to explore in Oregon waters. State permits differ from federal in allowing core-hole drilling to a depth of 500 feet; no drilling can be done under the federal permit.

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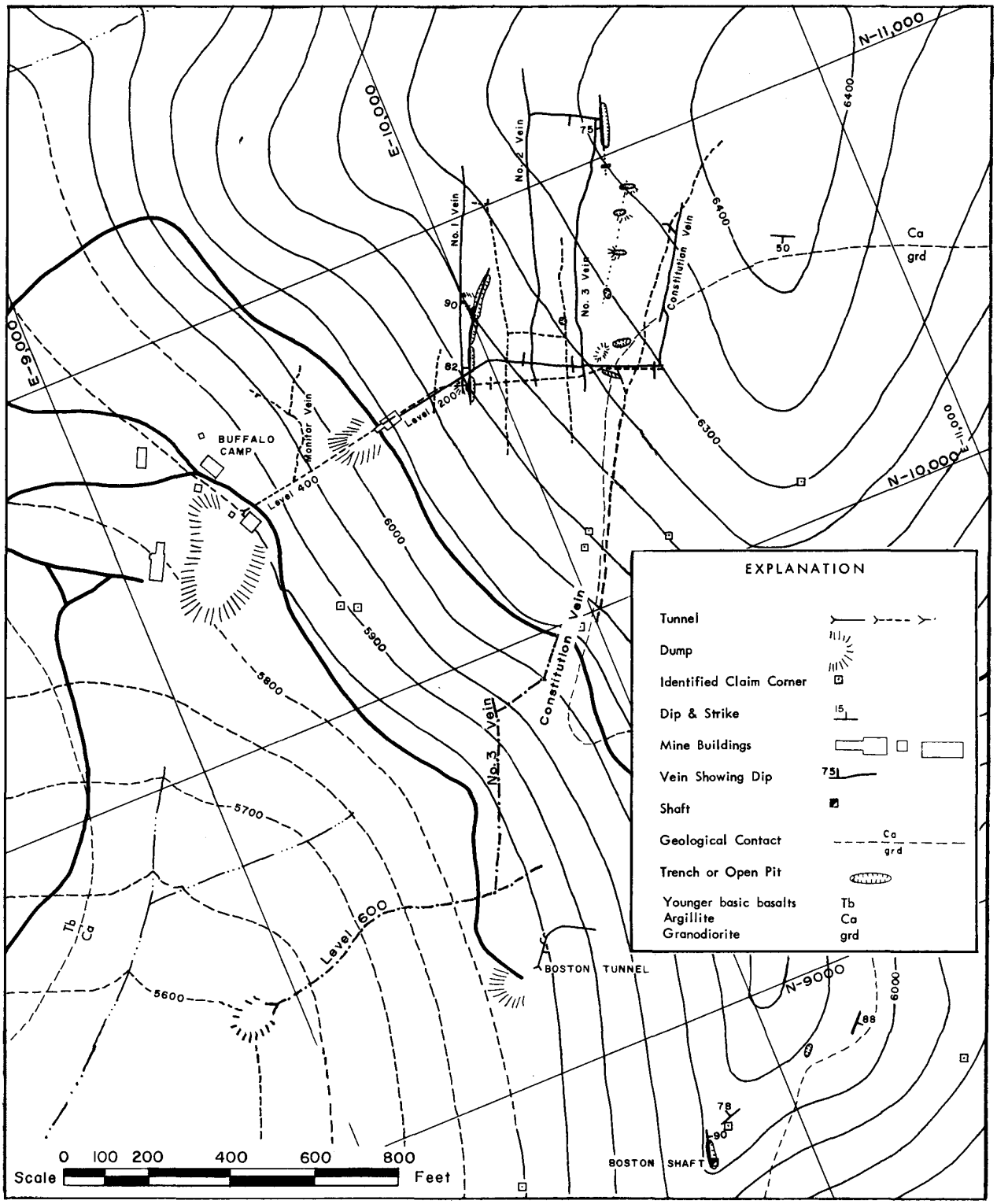

Buffalo mine, Grant County, Oregon.
Map of surface and principal underground workings, August, 1961.

RECENT DEVELOPMENT WORK AT THE BUFFALO MINE

Recent development work at the Buffalo mine, long-time Grant County gold producer, has exposed the Constitution vein on the 600 level, 253 feet below the south end of the last known drift on the 400 level. The discovery followed two years of tunneling from a new hillside portal, in part following an old adit driven years ago. As shown on the accompanying map, about 1500 feet of tunnel have been driven on the new low level.

The Constitution vein was reached on the 600 level in early July, 1961, and by August 1 some 265 feet of drift had been driven on the vein, which is two to three feet wide and of generally good grade, carrying both gold and silver. The vein is similar in appearance to that stoped on the two levels above and contains, besides the gold and silver, pyrite, pyrrhotite, sphalerite, chalcopyrite, and galena in a gangue of quartz and calcite.

Prior to encountering the Constitution vein, the tunneling exposed several stringers and a narrow but well-defined vein in the drift marked "No. 3 vein" on map. These stringers and the vein improve markedly to the north and probably correspond to the No. 3 vein on the 400 level. Mr. James P. Jackson, Jr., mine owner and manager, plans to drift northward on the Constitution vein before starting stoping.

Of particular significance in the discovery is the demonstration that these veins, and presumably some of the other gold veins of northeastern Oregon, persist at depth and can be located and mined profitably.

Earlier work at the Buffalo and nearby mines was described in Department Bulletin 49, Lode mines of the central part of the Granite mining district, Grant County, Oregon, published in 1959.

* * * * *

EDEN RIDGE COAL EXPLORATION SLATED

A coal exploration crew has been assigned by Pacific Power & Light Company to conduct core drilling this summer in the Squaw Basin area near Eden Ridge in southeastern Coos County. Geological explorations by the company on Eden Ridge in 1956 and 1957 mapped two veins of subbituminous coal. Mining rights were subsequently obtained on 5,000 acres in connection with plans for a future steam-electric power plant to serve southwest Oregon. (Ore.-Bin, August, 1956.)

The Eden Ridge coal field is adjacent to the site of a proposed hydroelectric development on the South Fork Coquille River. The power company has a license application pending before the Federal Power Commission for the two-dam $23,000,000 project. A 77,000 kilowatt powerhouse would be located at the north side of a 12-mile long bend in the river. It would be at the foot of a penstock which would drop the water 1600 feet down the side of Eden Ridge to drive the turbines and generators.

* * * * *

HANDBOOK ON TERTIARY STRATIGRAPHY AVAILABLE

A very useful addition to the literature has just been published in the form of a handbook of western Oregon and Washington stratigraphic units, consisting of 92 pages and 2 correlation charts. Original descriptions, supplements, and revisions heretofore widely scattered are brought together in a concise form in this handy reference booklet. Author and publisher is Walter Youngquist, Professor of Geology, University of Oregon, Eugene. The booklet, entitled "Annotated Lexicon of Names Applied to Tertiary Stratigraphic Units in Oregon and Washington West of the Cascade Mountains, with Bibliography", may be obtained for $3.00 (postpaid) from the author, Box 5201 University Station, Eugene, Oregon.

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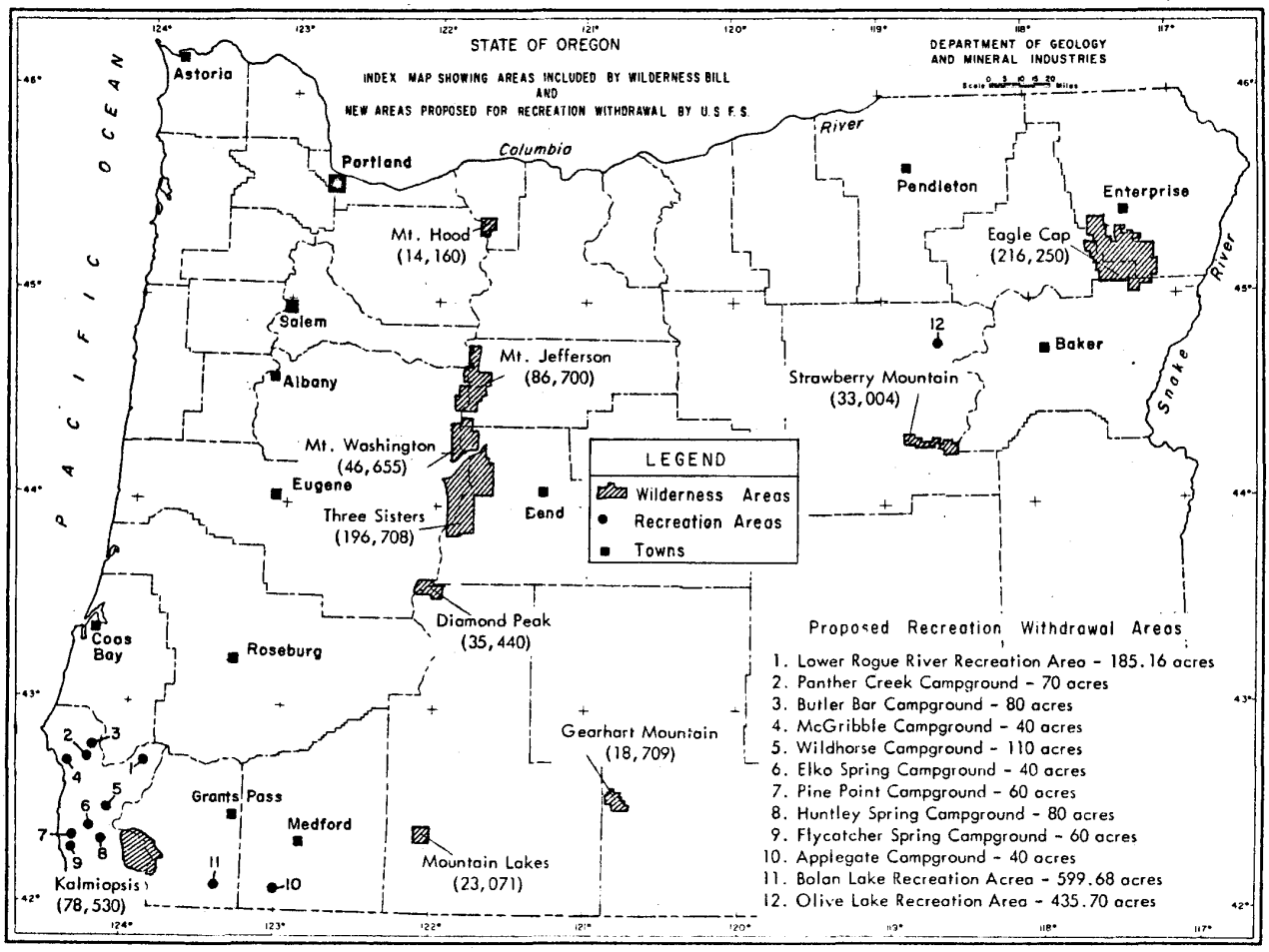

WILDERNESS BILL NEARS SENATE ACTION

The highly controversial national wilderness bill, S 174, has been approved by the Senate Interior Committee and is nearing Senate action. As noted in the February, 1961, Ore.-Bin, this bill would exclude from mineral exploration millions of acres of national forest and public domain lands formerly subject to the general mining laws. The American Mining Congress points out that although an amendment to the bill empowers the President to authorize mining in an area if it be of greater public good than preservation of the wilderness, the bill would still prevent modern scientific prospecting, which is the first step in locating hidden mineral deposits, and would thus preclude the discovery of important mineral deposits in extensive unexplored areas holding great geologic promise.

Passage of the bill would affect 10 areas in Oregon totalling 749,227 acres (see wilderness-type areas on map above), and would make certain other areas subject to consideration for future inclusion in the wilderness system.

* * * * *

U. S. FOREST SERVICE ADDS TO RECREATION WITHDRAWALS

The U.S. Forest Service, through the Bureau of Land Management, has filed two applications for withdrawal of 12 parcels of land totalling 1,800 acres exclusively for recreation use. These lands are mainly in Curry, Jackson, and Josephine Counties and are noted on the above map. The withdrawal application states that the land is withdrawn "from all forms of appropriation under the public land laws including the general mining laws but excepting the mineral leasing laws". Those wishing to file objections on the withdrawals have 30 days from July 26 to file their statements with the Bureau of Land Management, 710 N. E. Holladay Street, Portland 12, Oregon. If circumstances warrant it, a public hearing will be held.

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GEOLOGY OF THE ECOLA STATE PARK LANDSLIDE AREA, OREGON

by

H. G. Schlicker, R. E. Corcoran, and R. G. Bowen*

During February 1961 a large mass of earth began sliding seaward at Ecola State Park on the coast of Clatsop County, Oregon (figure 1). The slide virtually destroyed the parking and picnic areas and dumped much of the ground into the sea. The area involved was more than half a mile long and covered approximately 125 acres (see accompanying map). Because of salvage operations and unsafe roads, the State Parks and Recreation Division has closed the entire area to the public for an indefinite length of time.

Nature of the Slide

The sliding action occurred as a slow, glacierlike movement continuing over a period of about two weeks. During the early stages the motion was at a rate of about 3 feet per day, but it gradually diminished and finally ceased.

Vertical displacement was the greatest at the head of the slide where the surface dropped roughly 40 feet. Horizontal movement was the most noticeable between the parking areas and the toe of the slide. One of the more spectacular examples of horizontal motion was seen in a narrow zone along the eastern edge where the mass of material was squeezed through a constriction (figure 2). Horizontal displacement in this area was nearly 100 feet.

The effect of the slide on the park facilities was severe. The surface of the ground was greatly modified by a series of closely spaced fractures accompanied by vertical displacement of almost 6 feet. The breaking up of the ground was most apparent in the asphalt parking zones (figure 3); in the lawn areas the sod

Figure 1. Aerial view of Ecola Park showing 1961 landslide (outlined in white). Ecola Point and Sea Lion rock in right foreground.

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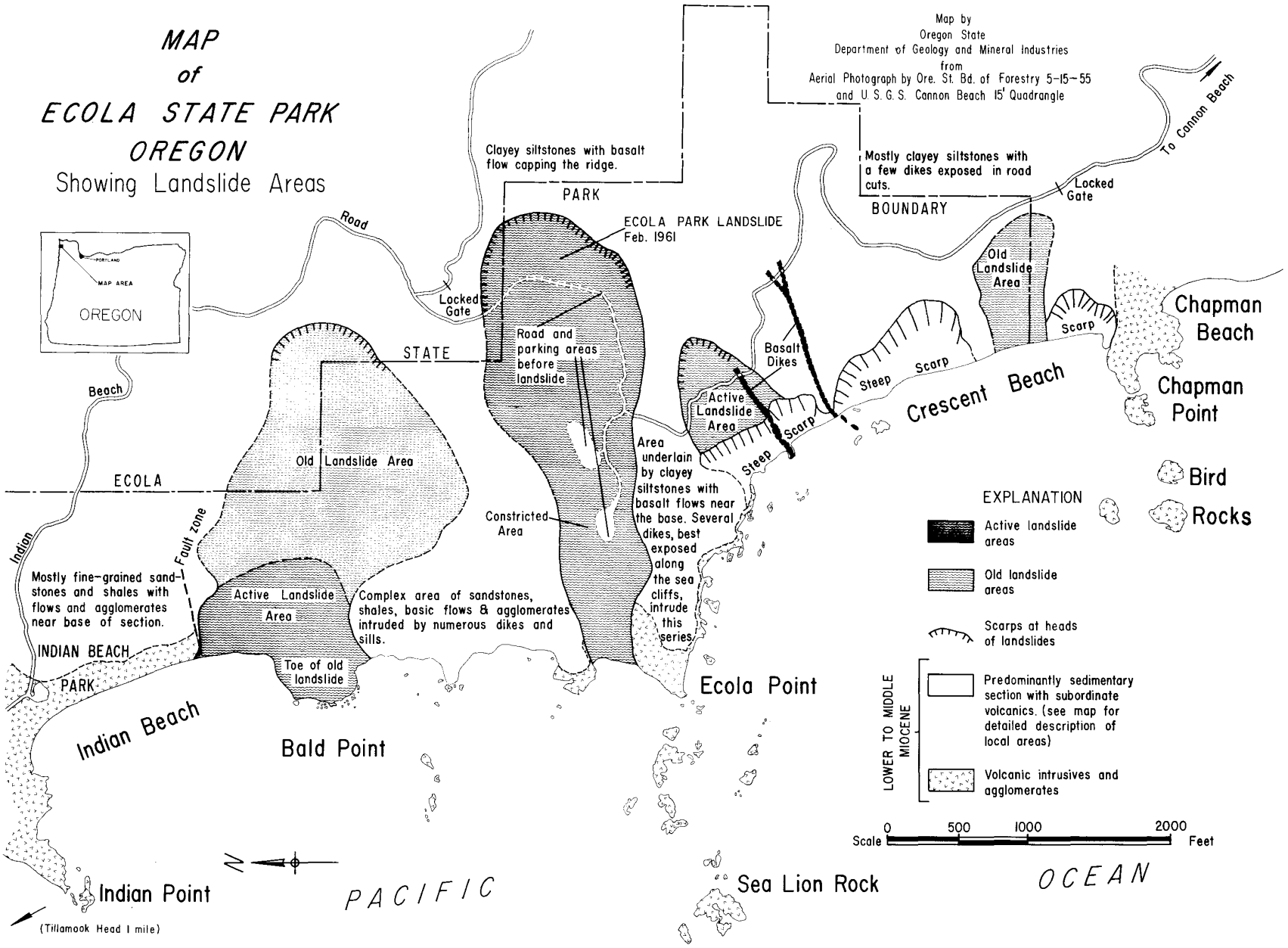
MAP
of
ECOLA STATE PARK
OREGON
Showing Landslide Areas
Map by
Oregon State
Department of Geology and Mineral Industries
from
Aerial Photograph by Ore. St. Bd. of Forestry 5-15-55
and U. S. G. S. Cannon Beach 15' Quadrangle
PORTLAND
MAP AREA
OREGON
Road
Locked Gate
Clayey siltstones with basalt flow capping the ridge.
PARK
ECOLA PARK LANDSLIDE
Feb. 1961
Mostly clayey siltstones with a few dikes exposed in road cuts.
BOUNDARY
Locked Gate
To Cannon Beach
Old Landslide Area
Scarp
Chapman Beach
Chapman Point
STATE
Road and parking areas before landslide
Basalt Dikes
Active Landslide Area
Steep
Scarp
Crescent Beach
Beach
Old Landslide Area
ECOLA
Area underlain by clayey siltstones with basalt flows near the base. Several dikes, best exposed along the sea cliffs, intrude this series.
Bird Rocks
Indian
Fault zone
Constricted Area
EXPLANATION
Active landslide areas
Old landslide areas
Scarps at heads of landslides
LOWER TO MIDDLE MIOCENE
Predominantly sedimentary section with subordinate volcanics. (see map for detailed description of local areas)
Volcanic intrusives and agglomerates
Mostly fine-grained sandstones and shales with flows and agglomerates near base of section.
Active Landslide Area
Complex area of sandstones, shales, basic flows & agglomerates intruded by numerous dikes and sills.
INDIAN BEACH
PARK
Toe of old landslide
Ecola Point
Indian Beach
Bald Point
0 500 1000 2000
Scale Feet
N
PACIFIC
OCEAN
Sea Lion Rock
Indian Point
(Tillamook Head 1 mile)

tended to stretch and pull over the smaller fractures (figure 4).

Sliding is not new to this section of the Oregon coast. Aerial photographs taken in 1939 clearly show the outline of an older slide in the park area identical to that of the recent slide. The scarp at the head of the Ecola slide today is 75 feet high, but the top 35 feet of it is covered with plant growth showing that the recent 40-foot vertical movement is a renewal of the earlier activity.

Study of aerial photographs and inspection of the ground from Chapman Point near Cannon Beach to Indian Point near Tillamook Head reveal several major landslide areas in the State Park property. These are indicated on the accompanying map. Along Crescent Beach, there are three areas of steep scarps. These earth falls are possibly related to earlier slump movements but more probably are the result of oversteepened coastal cliffs. Immediately south of the big Ecola Park slide is a smaller active area. Recent movement in this slide can be detected by fractures and displacement of the paved entrance road to the park. It is possible that this slide will continue to move.

A large area between Ecola Point and Indian Beach shows evidences of a former landslide (see accompanying map). The scarp at the head is plainly visible in the field and also shows on the 1939 aerial photographs. Recent movement appears to have been limited to the toe of the slide, but future movement is likely to involve the entire slide area much the same as at the park. So far only the trails near the toe of this slide have been damaged. Fortunately this section of the Indian Beach road is not endangered, because it traverses the area behind the head of the slide.

Landslides in Ecola State Park are essentially the result of oversteepening of unstable rocks in the sea cliffs by wave erosion. Stable volcanic rocks resist erosion and form nearly vertical headlands such as Tillamook Head, Ecola Point, and Chapman Point. But less competent sedimentary rocks, when undermined by wave erosion and further weakened by water saturation during the winter months, begin moving seaward under the force of gravity. This motion continues until equilibrium is established between the head and toe of the slide. The size and shape of the slide are dependent on a variety of conditions, such as the relative distribution of the stable and unstable rocks, the steepness of the slopes, and the amount of water saturation. Renewed movement of the slide occurs if wave erosion oversteepens the toe at a time when excessive rainfall has reduced the strength of the rock materials.

Geology of the Area

Ecola State Park is underlain by marine sediments and volcanic rocks of Tertiary age. The sedimentary strata are thin-bedded, fine- to medium-grained sandstones and silty shales that grade upward into massive fine-grained clayey siltstones. Basic flows and agglomerates are intercalated with the sediments, particularly in the lowest beds exposed along the beach. Most of the lavas are finely crystalline but appear to be basaltic in composition.

Wells and Peck (unpublished geologic map of western Oregon, in press) have mapped the sediments and flows in the Tillamook Head area as part of the Astoria formation and Columbia River basalts of middle Miocene age. Several exposures of yellowish-gray clayey siltstone along the beach below the park and also near the head of the main slide were examined for fossils. No significant megafossils were found, but foraminifera were in relative abundance. Selected samples of this material were sent to Dr. Weldon Rau, micropaleontologist for the Washington Division of Mines and Geology, for examination and identification.

One sample from a beach cut a short distance south of Ecola Point showed a diagnostic assemblage of late early Miocene to early middle Miocene age. Of this fauna Rau remarks, "The presence of good Siphogenerina branneri, together with other forms, indicates an age slightly younger than most assemblages from the Astoria formation".

Another sample from a locality approximately 1/4 mile north of Chapman Point contained

foraminifera of early Miocene age, and according to Rau, "The assemblage is quite comparable to the fauna known from the type Astoria formation".

The sedimentary rocks have been intruded by dikes and sills of basaltic rock similar in composition to the intercalated flows. The intrusive activity, which took place before the sands and silts had become completely consolidated, squeezed the sediments into a series of complex folds and small-scale faults, particularly in the zones adjacent to the intrusions. This action has undoubtedly contributed to the instability of the sedimentary rocks and made them more susceptible to landsliding. Excellent exposures of rock along the beach below the park area show the contortion of the beds and the complex relationship between the sedimentary section and the igneous intrusions (see figures 5 and 6).

Some of the dikes or sills, because of their generally resistant nature, extend out from the shore for almost a mile as a series of small basaltic islands or "stacks". Ecola and Chapman points, as well as the isolated sea stacks farther south off Cannon Beach, are examples of igneous rock that has withstood the intense erosive activity of the sea waves.

Because most of the section along the coast between Chapman Point and Bald Point has been an active slide area at one time or another, good exposures of undisturbed bedrock are relatively rare except in the beach cliffs. No attempt was made, therefore, to show details of the areal extent of any particular lithologic unit in this unstable region. Between Ecola Point and Chapman Point, sediments clearly predominate over flows or other igneous rock types. To the north, however, igneous flows, sills, breccias, and agglomerates are prominent along the sea cliffs above the beach, with the sediments mainly in the upper slopes east of the coastal strip. Tillamook Head is the center of a large igneous mass, the bulk of which appears to be a series of flows that interfinger to the south and east with a more sedimentary section.

Only one large fault was seen in the exposures along the beach. This fault zone bounds the north side of a landslide a short distance south of Indian Beach (see accompanying map). Other faults can be inferred from aerial photographs of this area, but modification of the topography by sliding has tended to obscure the structural pattern. For this reason it is difficult to determine the relationship of fault zones to landslides or how they may influence the stability of the area in general. Fault zones would probably contribute to instability where clayey sediments in the upper part of the section have been dropped down against more resistant flows and agglomerates characteristic of the lower part of the section.

Summary

Oregon, because of its rugged coastal topography, possesses one of the most scenic shorelines in the country, and many places along it make excellent homesites and recreation areas. Unfortunately some of these localities, as exemplified by Ecola Park, are susceptible to landsliding through erosion by storm waves, so that their period of use is limited.

Aerial photographs taken more than 20 years ago show that Ecola State Park is marked by numerous old slides, and the recent renewal of movement in one of these same areas proves that this will remain an unstable region for many years to come. Adjacent areas of lower topography, as at Cannon Beach, or of resistant rock, as at Tillamook Head, have been affected only by the gradual wearing back of the land.

The Oregon coast is undergoing vigorous attack by the sea, and anyone who has visited the beaches during a storm can appreciate the energy expended by wave action. At the Tillamook Rock lighthouse near Tillamook Head, waves have more than once broken the plate glass of the light 132 feet above sea level. Modification of the earth's surface by erosion is a continuing process, and along the high sea cliffs such action is particularly intensified to the detriment of homes, parks, roads, or any other feature situated nearby, especially those in areas of unstable rock.

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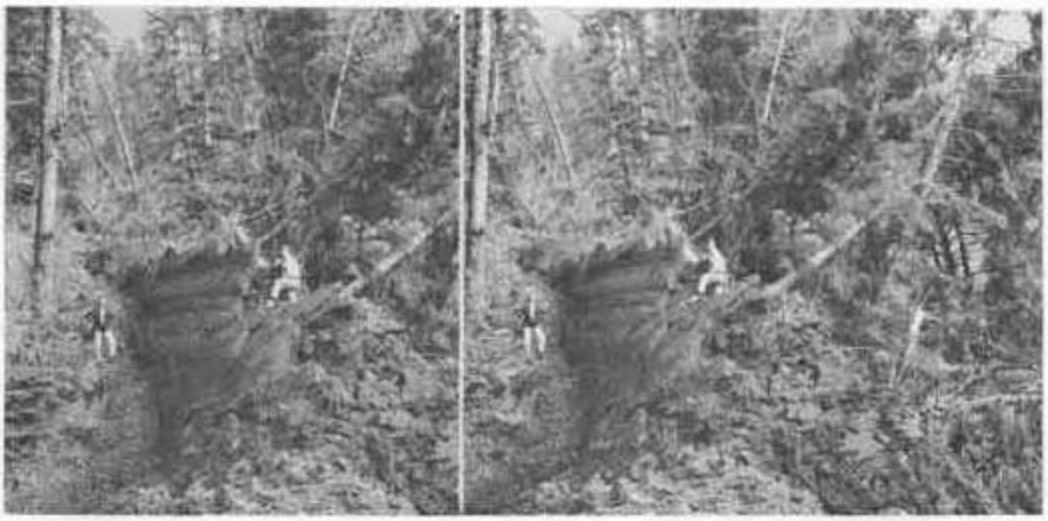

Figure 2. "Dike" of landslide material squeezed out against a buttress of more stable rock in constricted zone. Striations on wall show that direction of movement was nearly horizontal. (Use stereoscope to see third dimension).

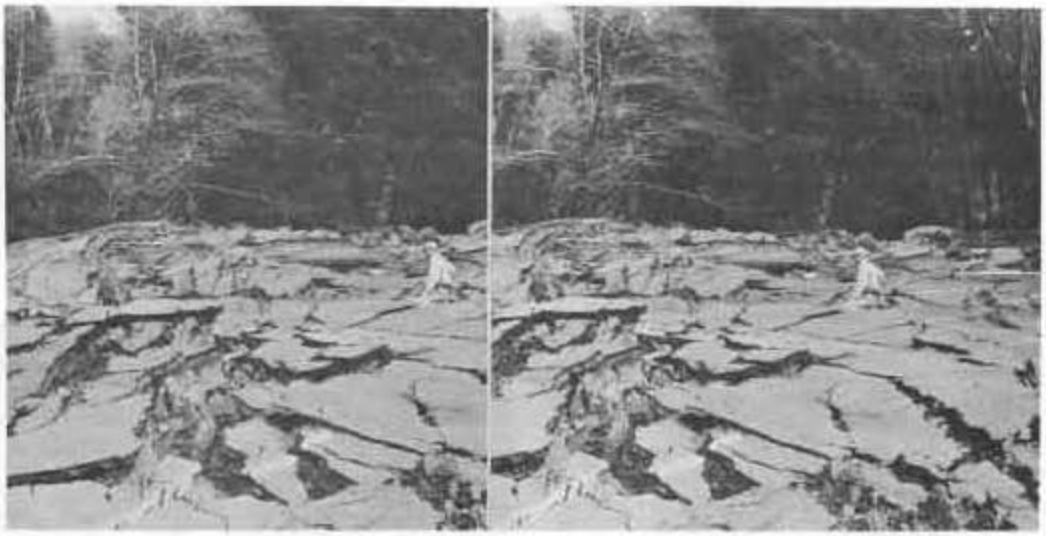

Figure 3. View of upper parking area showing broken asphalt with vertical displacement on separate blocks of as much as 4 feet. Vertical movement here was caused by upwarping and later settling of underlying sediments. (Use stereoscope to see third dimension).

Figure 4. Panoramic view of lower parking area. Vertical displacement of asphalt surface was almost 6 feet in center background. Lawn area in foreground shows only minor fracturing because turf-covered soil drapes over and obscures movement.

← Figure 5. Alternating mudstones and sandstones and overlying basaltic sill have been steeply folded. Part of deformation may be due to faulting which is obscured by slide material in valleys on either side.

Figure 6. View of sea cliff south of main slide. Bedded clayey siltstones, shales, and underlying volcanic rocks have been contorted by intrusion of basaltic dike (outlined in white). Slumping of sedimentary material on steep slopes has covered upper part of dike. →

WHITHER GOLD?*

Even though the heavy gold outflows came to an end last February, and the U.S. Treasury's gold stock has since been recovering modestly, gold continues to figure prominently in public discussions. Yet, looking through the record, one is struck by a disconcerting lack of depth in much of our thinking about gold.

The suggestion is offered--most recently by the Commission on Money and Credit--that we repeal the 25 per cent gold reserve requirement against Federal Reserve note and deposit liabilities. The idea is to free ourselves of the rigidity of a fixed reserve, and to show the world that our entire $17.5 billion gold stock is available, if necessary, to defend the price of $35 an ounce. This proposal has a good measure of support; it would no doubt be many years before Fort Knox could be totally emptied. But what then?

The proposal raises more questions than it answers. We should know where we are heading and where we want to come out. Would we expect foreign government officials, bankers, and businessmen to believe that all our gold would be allowed to go out to maintain the $35 price? Or do we wish to put ourselves in the posture of wanting to get rid of gold, thus making the dollar a straight-out credit or fiat money? Could the dollar as a currency and the United States as a nation maintain their world prestige if other countries were the sole possessors of the precious metal? Or would it be contemplated that other nations, too, would give up their official gold reserves and make gold a simple commodity, traded in free markets?

It is only by facing up to issues like these that we can arrive at intelligent policies. We have the problem of defining the proper place for gold in our monetary set-up as well as in the world currency system.

Monetary Status Today

The United States abandoned the gold standard in 1933 and, since the enactment of the Gold Reserve Act in January 1934, has been on what has been called an international gold bullion standard. The differences between the full gold standard and our present gold arrangements stand out clearly in the table.

Full Gold Standard and Present U.S. Gold Arrangements Compared

Full Gold Standard	Present U.S. System
Monetary unit defined by law in terms of specific weights of gold.	The dollar defined as a specific weight of gold by Presidential proclamation under the Gold Reserve Act of 1934.
Currency freely redeemable in gold coins or bullion.	No gold coins coined; no U.S. currency redeemable in gold; private holding of gold unlawful.*
Free buying and selling of gold at a fixed price.	Purchases and sales at a fixed price, with sales limited to foreign monetary authorities for "legitimate monetary purposes" and to licensed domestic dealers for approved purposes.
Free gold export and import.	Free import of gold; export of gold subject to license.
Gold--legal tender for payment of debt.	All coins and currencies of the United States declared legal tender.
Gold cover for domestic currency.	Legal gold reserve requirement of 25% of Federal Reserve note and deposit liabilities.

*Except for gold in its natural state and gold coins of recognized value to collectors.

The present monetary status of gold is thus a hybrid one. The dollar is defined in law as a quantity of gold, but no dollars of the present weight of gold have ever been coined and U.S. currency is irredeemable in gold. Yet, at the same time, the U.S. dollar is linked to gold in the sense that the Treasury buys and sells gold at the statutory price of $35 an ounce in transactions with foreign central banks and governments "for legitimate monetary purposes." These words have never been defined officially, but they were interpreted quite broadly in late 1960, following the flare-up in the London gold price, when the United States supplied gold through the Bank of England to private holders at a price in excess of $35 in order to counter speculation that the dollar might be devalued.

The U.S. Treasury has no commitment to buy or sell gold; the present practice could, therefore, be changed without notice. But if the U.S. Treasury were to stop selling gold to foreign central banks at the official price, or buying gold from them, gold would be free to fluctuate in terms of the dollar, and foreign exchange markets of the Free World would be thrown into confusion until U.S. intentions were clarified.

No other country patterns its gold policy on that of the United States. We alone give fixed-price gold convertibility--though only to foreign monetary authorities. On the other hand, we suppress private holding and trading, while nations abroad permit or even encourage free markets. Of these, the London market, reopened in 1954 after sixteen years, is the most important.

The United Kingdom forbids its citizens to hold or trade in gold, only nonresidents of sterling-area countries are allowed to buy gold in the London market--in effect against U.S. dollars. More commonly, however, free gold markets are conducted in local currencies; as in England, the monetary authorities participate. Only a few countries--including Germany and Switzerland--allow their nationals to export gold freely. A number of countries mint gold for

*Reprinted from First National City Bank Monthly Letter, August, 1961. Section on European views concerning gold has been omitted.

sale in free markets. But no country has fixed prices for gold coins. None is on a gold coin standard. The last nation that could be so classified was Saudi Arabia, and the coin of the realm was the sovereign.

Less than half of the central banks in the world have--like the Federal Reserve System--legal gold (or gold and foreign exchange) requirements against their note issues and deposit liabilities. In many countries, including the United Kingdom, these requirements have been repealed or suspended, usually at times of national emergency; a number of central banks established since World War II, including the German Bundesbank, have no such requirements.

Cutting Loose From Gold

It is against this background that the recommendation of the Commission on Money and Credit to repeal the gold reserve requirement "as an archaic instrument of monetary control" should be considered. The law requires the Federal Reserve Banks to keep gold certificates equal to at least 25 percent of their note and deposit liabilities. (The gold certificates are issued by the Treasury which has actual physical custody of the metal.) On this formula, the required gold cover works out to something over $11 billion, as against the U.S. stock of $17.5 billion. This leaves some $6.5 billion in excess gold reserves--approximately $3.5 billion less than our short-term liabilities to official foreign institutions, which are eligible for conversion into gold. Our short-term liabilities to private foreign holders stand at $7 billion; these are not eligible for conversion unless sold to a central bank.

The idea is to make all of our gold available to cover short-term liabilities to foreigners, including those that may accrue in the future. Actually, the gold is already available since present legislation permits temporary suspension, with penalties, of the gold reserve requirement in case of need. But the Commission believes that:

"...threat of a confidence crisis would be greatly reduced if it were regenerally recognized, both here and abroad, that all of the U.S. gold is available to meet our international obligations. Any doubts about the U.S. policy should be removed by elimination of the gold reserve requirement at the earliest convenient moment so that all of the U.S. gold stock is available for international settlements."

Arguments like these are persuasive. A "reserve", in the truest sense, should be available to meet emergencies. Another appealing point is that, since the dollar is no longer convertible into gold except for transactions with foreign governments and central banks, the need for a specific domestic currency cover is outdated.

Missing from the Commission's report, however, is any consideration of the need of the United States, with its far-flung international commitments and its position at the center of the monetary universe, for a gold reserve. Is it realistic to expect that, even with all our productive power to give real value to money, the U.S. dollar could command full respect under all circumstances? Unless gold is demonetized by international agreement--something that does not appear to be in the cards--the United States needs a gold reserve commensurate with its economic and financial strength and responsibilities. It also needs gold for use in emergencies; as a matter of fact, Russia attaches vital importance to gold as a war chest.

Granted this, it follows that we must form some conception of the levels below which the U.S. gold stock should not be allowed to fall. The British seem to have in mind something of this sort: for example, a decline in British reserves below £1,000 million at the end of June tripped off an emergency program announced by the Chancellor of the Exchequer on July 25 to defend the pound.

We must incorporate into our thinking on this question a clearer recognition of the need and function of a gold reserve, and emphasize more strongly the necessity of accepting the disciplines required to maintain it. What the minimum reserve requirements might be, and whether determination of the minimum should be incorporated in law, are arguable questions, but it is indisputable that protection of the gold reserve should be an objective of public actions and policies.

As the centerpiece of the international monetary structure, the dollar needs an especially strong reserve. Perhaps 40 to 50 per cent of our overseas liabilities should be construed as something of a danger point. The $11 billion required gold cover under present law works out to somewhat over 50 per cent of gross overseas liabilities. Thus, by accident if not design, it affords a reasonable conception of a level at which we should be awakened to a sense of crisis and need to take stern measures to retain for the dollar its place as an anchor of monetary stability. This is not to suggest either that in a time of gold losses corrective actions and policies can safely be deferred until this level is reached--that lesson was learned in 1960--or that we should take the occasion of a decline in reserves to this point as a reason for suspending gold payments or devaluing the dollar.

It may also be asked whether there is a point at which retaining a minimum gold reserve could become more important than keeping the $35 selling price. Assuredly, it would make no sense to let all the gold go out and then to raise the bid price to recoup some of the loss. The way to avoid a devaluation of the dollar is, of course, to deal effectively with the hard core of our balance-of-payments difficulties, along lines often discussed in these pages. The real question is whether policies necessary to maintain financial stability would be implemented as promptly, as courageously, and as effectively if we were to eliminate the gold requirement as if we kept it. The requirement, as W. Randolph Burgess once said, is like a "red light"--a warning to hold inflation in check and keep spending abroad to what we can afford.

The Role of Gold

Gold has won its place in the world today as, over many centuries, man has groped toward workable ways to facilitate trade

and store value through the use of money. Commodity money grew out of bartering; gold (and silver) coins became convenient media of exchange and stores of value; promises to pay gold became the most convenient means of payment; and nations, departing from the full-fledged gold standard, embarked upon monetary "management." But "management" did not always show itself as vigilant, skillful, and courageous as was necessary to ensure monetary stability at home and to enable the international monetary system to function properly.

There is no way to turn the clock back. By the same token, however, there is no practical possibility of cutting loose from gold altogether. There are times and circumstances when no other "money" is acceptable. Recognition of this helps reinforce monetary discipline--something we must have if we want an orderly society.

Gold guards against reckless budgetary and monetary practices by making it necessary for a country--whether or not it has a prescribed gold cover for its currency--to frame its domestic economic and financial plans and policies with continuing regard to the external influences to which it is subject, as well as to the external repercussions of its own acts. Now that many currencies of Western Europe rank as good as the dollar, we are confronted with a healthy challenge to keep the dollar as the key reserve currency. The dollar and the gold reserve will take care of themselves if we restrain inflationary pressures, compete successfully in world markets, and measure government commitments abroad against what we can, by trade and judicious investment, earn overseas.

* * * * *

STANDARD OIL APPLIES FOR EXPLORATION PERMIT

The Standard Oil Co. of California applied for a permit to do seismic work off the Oregon coast on September 1, 1961. This brings the total to four companies that have obtained offshore exploration permits, as follows:

Company	Type Survey	Exploration Period Applied For
Shell Oil Co.	Seismic - explosive	6-13-61 to 12-31-61
Gulf Oil Corp.	Seismic - gas exploder and sparker	6-15-61 to 12-31-61
Union Oil Co.	Seismic - gas exploder	7-10-61 to 11-10-61
Standard Oil Co.	Seismic - gas exploder	9-1-61 to 8-31-62

* * * * *

PROPOSED LAND WITHDRAWALS

Two applications for withdrawal of lands from all forms of appropriation under the general mining laws were filed recently with the Bureau of Land Management, Portland, as follows:

The U. S. Forest Service applied August 9 for withdrawal of 4,872 acres in the Ochoco National Forest, Crook County, for the purpose of consolidating national forest land for administrative purposes.

The Bonneville Power Administration filed September 15 for withdrawal of about 10 acres in sec. 13, T. 21 S., R. 19 E., Deschutes County, to construct the Hampton substation and facilities for service to the Central Electric Cooperative.

* * * * *

HISTORY OF THE BONANZA MINE

Oregon's largest and most productive quicksilver mine, the Bonanza, situated about 7 miles east of Sutherlin in Douglas County, was closed in October 1960. During the current year mining and reduction equipment has been dismantled and the property offered for sale. The mine had been in almost continuous operation since 1937 and had produced more than 39,000 flasks to account for about 38% of Oregon's total quicksilver production. Although the eventual depletion of minable reserves of any quicksilver mine must be considered inevitable, closure of the Bonanza mine was like the passing of an old friend to the mining people of the West.

The history of the Bonanza mine dates back to the early days of mining in Oregon. Cinnabar is said to have been discovered there some time during the 1860's. Some of the early development was done by the Bonanza Quicksilver Mining Co., which was organized in 1878. This company reportedly installed the Scott furnace, parts of which are still on the property. Following these activities, the property passed through the hands of several individuals and groups, none of which succeeded in putting the mine on a paying basis.

Most of the early operations were confined to float and surface ore mined from a glory hole in the outcrop of the north or main ore body and from several short adits all less than 250 feet long. In 1935 the mine was acquired by H. C. Wilmot, who organized Bonanza Mines, Inc. (renamed Bonanza Oil & Mines Corp. in 1951), and development of a small ore body that lay several hundred feet to the south was started. A 5-deck Herreshoff furnace of 50-tons-per-day capacity was installed and in late 1937 production began.

Continued underground exploration led to the discovery of "good" ore in the north hill in 1939 just as the south ore body was playing out. As a result, two 100-ton-per-day Gould rotary furnaces were added to the treatment plant. Discovery and development of the rich ore body had come at a period when war time demands were forcing quicksilver prices to record highs, and for the year 1940 the Bonanza mine ranked second among the quicksilver producers in the United States with a production of 5733 flasks. The Bonanza mine was the only major quicksilver mine in Oregon to continue operations through the war years. One of the rotaries was dismantled and moved to the company's property at Hermes, Idaho, in the summer of 1942. For several years prior to closure of the mine only the remaining rotary furnace had been in use.

The ore bodies at the Bonanza mine occurred as irregular lenses scattered along a shear zone in Eocene sandstone beneath a layer of relatively impervious shale. The shear zone, having an average dip of about 45°, approximately parallels the bedding in the sandstone, but in some places transects it, particularly at points where flexures in the latter occur. Localization of the mineralizing solutions within the shear zone is thought to have been aided considerably by the imperviousness of the overlying shale. For much of its length the shear zone was found to be thin and indistinct but locally and unpredictably it widened to form lens-shaped zones which contained the ore bodies.

Where first encountered on the 370 or main haulage level, the principal ore body of the mine proved to be about 600 feet long and as much as 60 feet thick. Because of a gradual tapering of the ore body to a width of about 4 feet and a length of 150 feet on the 700 foot level, it was feared in 1944 that mining below the 700 foot level would prove unprofitable. Fortunately nodal extensions and subsidiary lenses of good ore were encountered along the shear zone materially lengthening the life of the mine. Ore has been mined from the surface to an inclined depth of about 1450 feet. Economical recovery of ore from the 1450 foot level, the last to be developed, proved impossible under present conditions.

- Howard Brooks, Field Geologist, Baker Office

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HOLE-IN-THE-GROUND, CENTRAL OREGON
Meteorite Crater or Volcanic Explosion?

by

Norman V. Peterson* and Edward A. Groh**

Lewis McArthur, in Oregon Geographic Names, has described Hole-in-the-Ground as follows: "Hole-in-the-Ground, Lake County. This very remarkable place is well described by its name. It covers an area of about a quarter of a square mile, and its floor is over 300 feet below the surrounding land level. It is about eight miles northwest of Fort Rock."

Hole-in-the-Ground is a large, almost circular, bowl-shaped crater in the northwest corner of Lake County. It has a slightly elevated rim and looks very much like the famous Meteorite Crater in north-central Arizona. This remarkable resemblance and the lack of an explanation of the origin in the published literature was brought to the attention of the department by Groh and is the basis for the present study.

The original plans for the study included only Hole-in-the-Ground and the nearby larger, shallower crater, Big Hole, but very soon after arriving in the area the writers noticed other interesting volcanic features of explosion origin. These features, shown on the index map (figure 1), include Fort Rock, Moffit Butte,

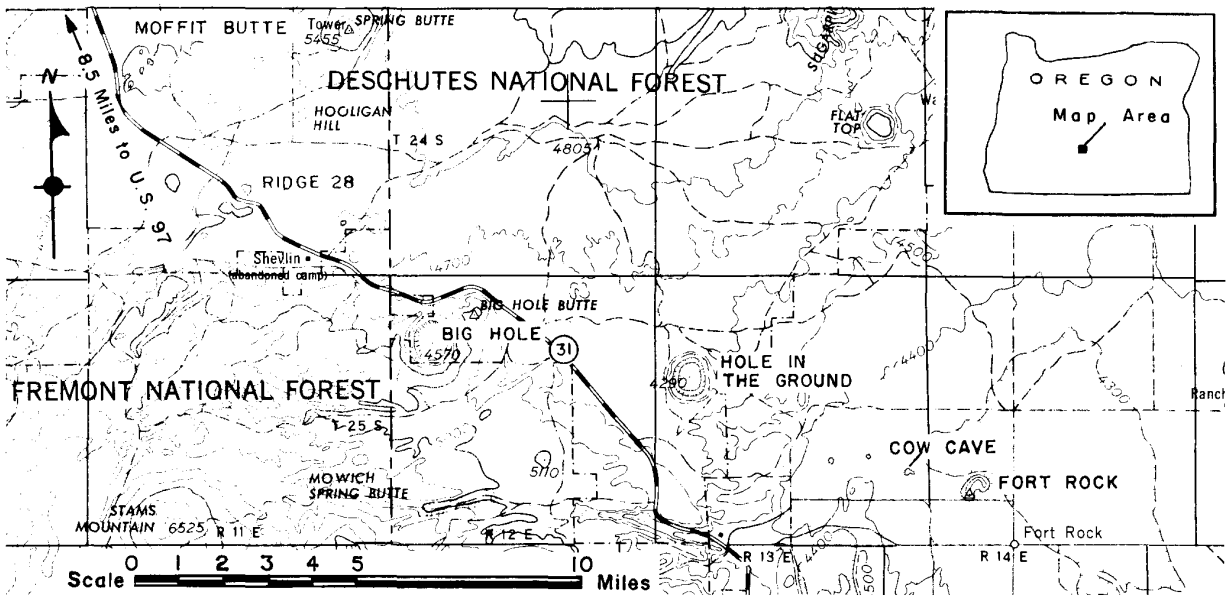

Figure 1. Index map of the Hole-in-the-Ground area, central Oregon.

*Field geologist, State of Oregon Department of Geology and Mineral Industries.
**Private geologist, Portland, Oregon.

Flat Top, and several unnamed landforms north and west of Hole-in-the-Ground. All were examined and are described briefly in later paragraphs.

After a reconnaissance of the geology of the whole area was made, two days were spent studying the rocks in the walls and rim of the Hole-in-the-Ground crater and searching for evidences of meteoritic material.

Hole-in-the-Ground

Hole-in-the-Ground (figure 2) is in sec. 13, T. 25 S., R. 13 E., in the extreme northwestern corner of Lake County. It can be reached by turning east from Oregon Highway 31 on a well-marked Forest Service road 25 miles southeast of the junction with U.S. Highway 97 near Lapine, Oregon.

The depression or crater has many of the characteristics of a meteorite crater. It is almost circular with steep walls sloping to a flat floor that is about 425 feet below a raised rim. The highest point on the rim is at an elevation of 4800 feet, about 500 feet above the floor of the crater.

The resemblance between Hole-in-the-Ground and the Arizona meteorite crater is shown by the following comparison:

	"Hole-in-the-Ground"	"Meteorite Crater"
Diameter	5000'	4000'
Depth (crest of rim to crater floor)	425'	613'
Height of rim above surrounding plain	100' to 200'	148' to 223'
Rim slope to plain	about 5°	3° - 5° ($\frac{1}{2}$ mile)
Rock in walls	Basalt, ash flow, tuff, and explosion debris	Limestone and sandstone
Age	At least 2000 to 9000 years, based on dating of pumice falls from Newberry Crater and Mount Mazama (Crater Lake).	20,000 to 75,000 years.

The rocks that crop out in the walls of Hole-in-the-Ground are shown on the accompanying cross-section (figure 3) and are, from bottom to top, an ash flow tuff, a series of fine-grained light-gray olivine basalt flows, explosion tuffs that contain many types and colors of rock fragments, and large blocks as much as 10 feet in diameter of explosion debris including a conspicuous porphyritic olivine basalt that is believed to occur deeper than the rocks exposed in the crater walls. The floor, steep slopes, and rim are blanketed by pumice from Mount Mazama (Crater Lake) and Newberry Crater. A thin soil zone has developed on the pumice. The rim is slightly higher and broader to the east, indicating a westerly wind at the time of the explosion. A small fault offsets the basalt flow in the east wall of the crater.

The crater rim was carefully examined to determine if metallic meteoritic material, shattered rocks, deposits of rock flour, or minute metallic droplets of vaporized meteoritic nickel-iron were present. As the crater and explosion debris were already present when the latest pumice showers occurred, holes were dug to a level beneath the pumice and the soil screened and tested with strong magnets for the presence of metallic magnetic material. Magnetite from the pumice and underlying lavas and tuffs is abundant in the soil, but no identifiable meteoritic fragments or metallic droplets could be found. An examination of the outcrops of the basalt flows also did not show the great shattering and upward tilting that should accompany the explosion of a large meteorite.

It is almost certain that, if this crater were the result of a meteoritic impact explosion, fragments of nickel-iron and metallic droplets or their oxidized products would be present in abundance on and around the rim, as is the case at the Arizona Meteorite Crater. This should be true even for a stony meteorite, because they generally contain several percent of nickel-iron in metallic form. It is very doubtful if a large stony meteorite could survive passage through the atmosphere to produce a crater of this size; rather, the sudden

Figure 2. Aerial view of the Hole-in-the-Ground looking to the northwest. Road in foreground leads from Oregon Highway 31 to east rim viewpoint. Basalt flow visible in far wall of crater. White spot is small playa at bottom of crater. East rim viewpoint is about 500 feet vertically above this playa.

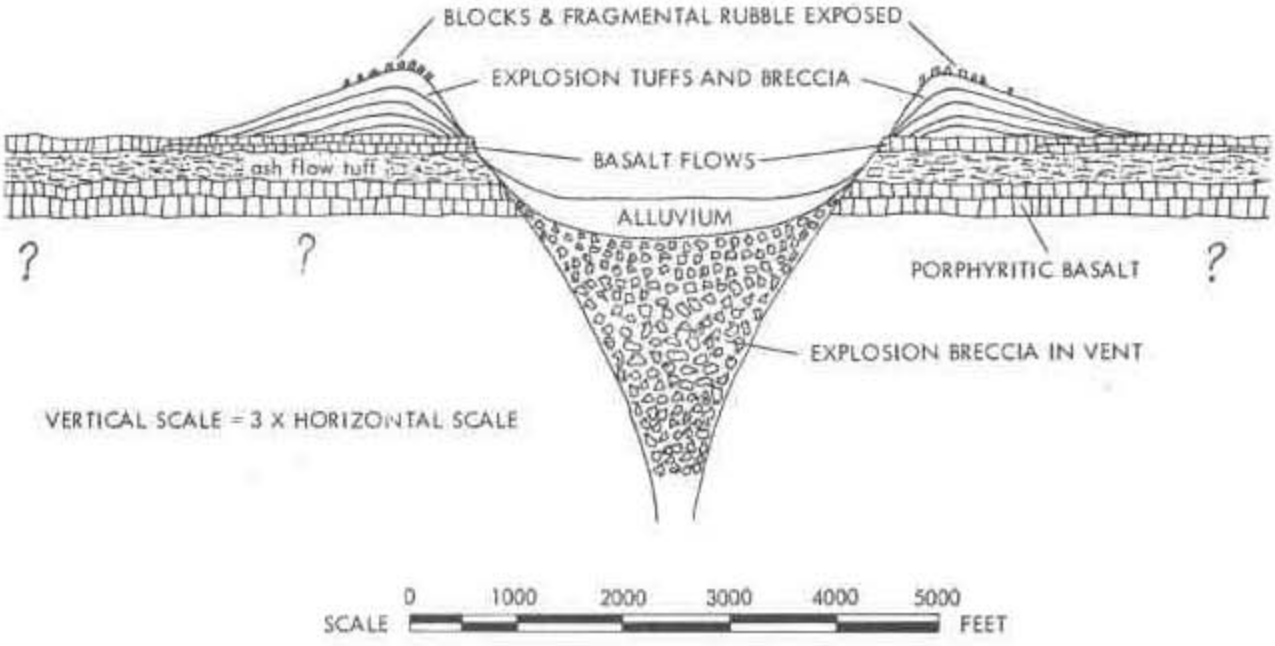

Figure 3. Generalized geologic cross section of the Hole-in-the-Ground.

Figure 4. Aerial view of Fort Rock looking to the northeast. Differential weathering has accentuated bedding in nearest wall. This wall is a sheer cliff about 200 feet high and more than 300 feet above the plain. Pleistocene lake terraces have been cut into both ends of "horseshoe".

heat and pressure evolved upon encountering the denser air mass would cause the meteorite to break into many fragments. Only small craters or pits would result when these struck the earth.

In the absence of any positive evidence for its formation by meteorite impact, the location of the crater in an area of known recent volcanic activity and the many associated volcanic features point to an abrupt volcanic explosive origin for the Hole-in-the-Ground.

It is believed that Hole-in-the-Ground resulted from a single or a very brief series of violent explosions caused when rising magma suddenly came in contact with water-saturated rock. The source of the water could have been the extensive lake that once existed in Fort Rock Valley. The explosion blew out large quantities of older rocks, together with pyroclastic material, and formed an embryonic tuff ring. Apparently the magma withdrew after this brief activity and did not continue or return to eject additional pyroclastic material in the quantity for the formation of a large tuff ring. A detailed description of this process is given in the discussion of Big Hole, a similar but more fully developed feature.

Big Hole

This large depression, as shown on the index map, is in secs. 5, 6, 7, and 8, T. 25 S., R. 12 E. It is a broad shallow crater with walls and rim made up of dark-gray and brown lapilli explosion tuffs and breccias. These rocks dip outward from the center of the crater. The rims are not quite as well defined as at Hole-in-the-Ground and a heavy stand of timber within and around the crater makes detail difficult to see. Big Hole, however, is a much better developed tuff ring than Hole-in-the-Ground in that a greater volume of pyroclastic debris has accumulated around the rim. Although both craters are young geologic features, Big Hole appears to be the older. In other respects the two craters are alike.

The Big Hole tuff ring is very similar to the well-known Diamond Head tuff ring on Oahu, one of the Hawaiian Islands. A tuff ring or tuff cone is a broad-floored ring-enclosed volcanic crater. Such features typically have steep inner walls that show the edges of both inward and outward dipping layers of explosion tuffs and breccias. The ejected fragments have been dropped directly into place after being hurled high into the air. The tuffs and breccias are composed of consolidated heterogeneous mixtures of vitric material from the parent magma and fragments of previously formed rocks.

There is a very definite association of tuff rings with water, and they are believed to occur where intrusive magmas have come into contact with water-saturated rocks at shallow depths. Tuff rings are thought to be formed in a very short period of time (a few days to a few months) by a rapid series of explosions that eject fine ash and rock fragments high into the air. Each explosion is followed by slumping of the crater walls and rock falling directly back into the crater to form a plug; then water rushing into the crater furnishes the steam for another explosion. Crude gravity sorting of the particles that are dropped directly into place accounts for the distinct layered structure of the tuff rings.

Big Hole, Hole-in-the-Ground, and the other tuff ring features in the area may have been formed as far back as Pliocene time, but more likely during the Pleistocene or even Recent epochs when large pluvial lakes occupied valleys formed by block faulting. At the time these lakes existed there was sufficient ground water in the area to affect the intruding magma in the manner that has been described.

Eroded Remnants of Other Tuff Rings

Fort Rock

In Oregon Geographic Names, Lewis McArthur described Fort Rock as follows: "The rock is an isolated mass, imperfectly crescent shaped, nearly one-third of a mile across and its highest point is about 325 feet above the floor of the plain on which it stands. It has perpendicular cliffs 200 feet high in places."

A brief inspection of this striking, well-known landmark (figure 4) in the broad Fort Rock Valley shows that it is an isolated erosional remnant of what was once a much larger tuff ring. The yellowish and brown tuffs with a variety of dark to light colored volcanic fragments are similar to the explosion tuffs at Big Hole.

A detailed study of the attitudes of the tuff layers would probably show whether or not the eroded central part of Fort Rock is actually the crater from which the tuff has been ejected. In general, the thin layers of airborne tuffs dip to the southeast and this would seem to put the center of volcanism to the northwest outside the present confines of Fort Rock. Similar layered explosion tuffs are known to occur beneath the soil zone a mile to the north.

The unusual shape of Fort Rock does not seem to be the direct result of its original volcanic form; rather it is more likely the result of later erosion by wave action in a large pluvial lake, as shown by terraces cut into the southern end of the horseshoe-shaped walls. Hole-in-the-Ground and Big Hole, on the other hand, were unaffected by wave erosion as they lay at an elevation above the level of the lake.

Moffit Butte

Moffit Butte is a bold erosional feature just to the north of State Highway 31 in sec. 7, T. 24 S., R. 11 E., about 10 miles southeast of Lapine. The steep cliffs and badlands type of erosional landforms can be seen from the highway.

The cluster of ridges and hills that makes up the butte appears to be composed of the remnants of one or more tuff rings. Thin to thick layers of yellowish to brown lithic explosion tuffs and tuff breccias occur in a roughly circular to elliptical pattern with the dips of the beds or layers toward the center. There is enough variation in the attitudes at different places so that this may be a cluster of tuff rings superimposed on one another.

Near the highway at the southern edge of the butte there is a small area capped by a thin, cindery, reddish-black basalt flow. A narrow dike or pipe-like mass that is probably the source of the flow cuts the tuffs nearby.

Ridge 28

This unnamed northeast-trending, low ridge in sec. 28, T. 24 S., R. 11 E., is also made up of yellow-brown lithic explosion tuffs that dip to the northwest, south, and southeast. This landform is also believed to be only an erosional remnant of a once larger tuff ring.

Flat Top

The eroded edges of the layered explosion tuffs are present as far north as Flat Top in secs. 13 and 14, T. 24 S., R. 14 E. Here again the lithic explosion tuffs have variable attitudes. Unlike most of the other features described, this one is capped by a thin flow of basalt. This basalt probably filled a shallow broad

crater soon after the explosive phase that was responsible for the layered tuffs and overflowed to the northwest. This basalt and the eroded tuffs are surrounded by Recent younger vesicular basalt flows in which original flow features like pressure ridges, lava tubes, and ropy crusts can still be seen.

Niggers Heel and Toe Butte (Cow Cave, Fort Rock Cave)

This small butte about 1½ miles west of Fort Rock is famous as the cave where some of the oldest Indian artifacts from Oregon were found. Sandals woven from shredded sagebrush bark were discovered beneath a layer of pumice that had exploded from Newberry Crater. Dating by the carbon-14 method shows that the sandals were made at least 9000 years ago.

The butte is made up of a variety of pyroclastic and flow rocks. The western part in which the cave (known locally as the Cow Cave) occurs is made up of reddish scoria fragments that are rather loosely cemented. The eastern part of the butte is capped by a thick reddish to black basalt flow that forms a steep cliff with large blocks at its base.

The waves from the large lake that once occupied Fort Rock Valley eroded the cave in the loosely cemented scoriaceous material of this butte, at the same time cutting the terraces at Fort Rock.

Summary

Hole-in-the-Ground remains a unique topographic feature of Oregon for its marked similarity to a meteorite crater, though its origin is volcanic. The meteorite crater of Arizona was produced by the explosion of an iron meteorite, estimated to have weighed between 20,000 and 60,000 tons, upon impact with the earth. The release of the colossal kinetic energy of a body this size, travelling at an estimated speed of around 10 miles per second at impact, blasted out the crater. For Hole-in-the-Ground the energy came from hot magma making contact with water or water-bearing rock, forming suddenly enormous steam and gas pressure which punched its way through the overlying rock to the surface in one or two bursts. The explosive energy needed to produce a crater this size with a buried nuclear charge would be over 5,000,000 tons, TNT equivalent, on the basis of a similar estimate for the Arizona meteorite crater. Thus can be realized the tremendous energy contained in volcanic forces that produced the Hole-in-the-Ground and the other volcanic explosion features described previously.

The volcanism producing the landforms described in this article was but a small part of the activity going on in the region to the north at Newberry Crater and to the west in the High Cascades during the Pleistocene and Recent epochs. Much of this volcanism was the relatively quiet outpouring of fluid lavas, yet at the same time explosive activity ejected gigantic amounts of pyroclastics. The pumice falls of Mt. Mazama (Crater Lake) and Newberry Crater bear witness of this as two examples in Recent time alone.

Further study of this area will probably reveal more of these tuff cones or their eroded remnants. Doubtless others remain hidden, having been covered by later volcanic flows and lake sediments.

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SOVIET OIL FLOODS CENTRAL EUROPE*

During 1964 at the latest a pipeline will be ready to connect the Caucasus with the West

Duesseldorf. Oil from Soviet Russia started some time ago to play an increasingly important part in the economy of the world.** During all negotiations with partners from the West the Russians insist on finding buyers for their oil. The production is enforced with quickening speed. The transportation will be taken care of by a large pipeline, having three branches from the Caucasus to Europe, and which will be ready for use by 1964. At the same time a price-squeezing maneuver toward the big international enterprises is in the making.

The Eastern interests produced a total of 166 million tons of oil during 1960. The largest part was by the Soviet Union with 147 million tons as compared with only 38 million in 1950. Compared with the world production of more than 1 billion tons, the production of Soviet Russia need not cause much concern. Compared with the Eastern interests, which during 1960 produced only 16% of the world output, North America with 37%, the Near East with 25%, and South America with 17% are still larger producers. Of the proved global reserves of oil, the Near East has 60%, North America more than 13%, and the Eastern interests have only 11%.

Low Home Consumption

By 1965 the Soviet Union wants to increase her production to 240 million tons (7 barrels per ton. ed.), which means that the participation of Soviet oil in the world market will go up, even taking into consideration the increases in all other production centers. Far more to worry about is the fact that the consumption of oil in the Soviet Union is far below the standard in western countries. The Soviet Union may have consumed during 1960 barely 100 million tons, compared with approximately 500 million tons consumed by the U.S.A. As the home consumption in Soviet Russia very unlikely will rise during the next few years, as it will in the West, there will be increasingly larger quantities available for export. No doubt the Satellites of the Soviet Union will demand more oil, but despite that there will be an increasing export offensive of Soviet oil to be noticed during the coming years. An increase of the share of supply, especially to Western Europe, has to be reckoned with. During 1955 only 4 million tons of Soviet oil reached Western Europe, but by 1958 there were 11 million tons. At the present the Russians are supplying between 8 and 9% of the West European consumption. The whole of Iceland and Finland are already consuming only Russian oil, Greece a good fifth, Italy 15%, Sweden and Austria each 14% and the German Federation (Western Germany) a little under 10%.

West Not Competitive

Behind that thrust into Europe stands a policy against which the western oil companies have no equivalent counter weapon. It counts in that connection that the Russian production is not burdened with duties and taxes which the western enterprises have to pay to their countries for concessions and which amount to nearly one-half of the income. On top of that, the Soviet oil is offered to the West far cheaper than behind the Iron Curtain. This is done with the special purpose and goal of using oil as payment for important industrial goods, by which we mean steel pipes for the pipelines and precision installations for the planned refineries.

Italy has overstepped with her oil imports the negotiated obligations considerably. That procedure has caused considerable criticism, as the Eastern oil can reach Western Europe much easier through the Italian refineries and as the Italians are eager through new pipelines to divert that heavy stream into southern Germany. Finally, it has to be taken into consideration that the 4,000 km pipeline with its terminal at Pressburg, which is under construction, will end just in front of the entrance to all big West European consuming centers. The second branch will end in Schwedt on the Oder, where a great petrochemical project will be constructed, and the third branch will end in Memel with Scandinavia the export goal.

(Sueddeutsche Zeitung, September 19, 1961)

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* Translated by R. P. Zobl, Accountant, State of Oregon Department of Geology and Mineral Industries.

**According to a news release from the U.S. Bureau of Mines, the Soviet tanker fleet has been nearly doubled in the past 10 years by the addition of 108 ships, and even though the carrying capacity of the present fleet represents only 2 percent of the world capacity, this accomplishment indicates the intensity with which Russia is entering the oil market. Included in the 7-year plan (1959-65) is the construction of another 140 tankers. The Russians expect to obtain 49 of these from the Free World yards of Finland, Yugoslavia, Japan, and Sweden.

* * * * *

WESTERN GOVERNORS MINING ADVISORY COUNCIL ELECTS OFFICERS

The Western Governors Mining Advisory Council, at its meeting held September 12 at the time of the American Mining Congress in Seattle, elected the following as officers for the coming year: James A. Williams, State Geologist, Alaska (Chairman); J. B. Pullen, Assistant General Manager, Phelps Dodge Corp., Douglas, Arizona (Vice Chairman); and Hollis M. Dole, Director, State of Oregon Department of Geology and Mineral Industries (Secretary). Retiring Chairman Al Teske, Executive Secretary of the Idaho Mining Association, reviewed the activities of the council during the year, noting that one of the council's recommendations on the Wilderness Bill had been incorporated in the Senate-passed bill. This recommendation requires consultation with the Governor of the State when an area is to be included in a Wilderness withdrawal. Other recommendations of the Council pressed for by the Western Governors included a statement on gold and policy stands on the nonferrous metals.

* * * * *

WILDERNESS BILL HEARINGS SCHEDULED IN WEST

The House Interior Committee's Subcommittee on Public Lands will hold hearings on proposed Wilderness legislation at McCall, Idaho, on October 30 and 31; at Montrose, Colorado, on November 1; and at Sacramento, California, on November 6. All aspects of the several wilderness bills pending before the House are expected to be studied. The field hearings will enable people in the states that would be materially affected by wilderness legislation to make their views known to the Committee, and those who are interested are urged to respond and appear or submit their views to the Subcommittee. Representative Al Ullman, Oregon, states that witnesses from Oregon are welcome at the McCall meeting or any of the other sessions. Chairman of the Subcommittee is Representative Pfost, Nampa, Idaho. (See August, 1961, Ore.-Bin for location of 750,000 acres of National Forest land in Oregon included in Wilderness Bill.)

* * * * *

VINYL ACETATE EXHIBIT IN DEPARTMENT MUSEUM

Pacific Carbide & Alloys Co., Portland, has placed an exhibit in the departmental museum showing by small-scale model the basic steps for producing vinyl acetate. Also in the exhibit are some of the many manufactured products utilizing the adhesive and binding qualities of this material, such as safety glass, Durwood, floor tiles, tubing, phonograph records, glues, and paints. The company has been producing calcium carbide and acetylene at its Portland plant for a number of years, but the production of vinyl acetate (the results of chemical research on acetylene) is a new West Coast industry. The exhibit will be on display to the public through November.

* * * * *

OIL TEST RECORDS RELEASED

The Department released Ross Mitchell "Bliven No. 1" well records from the confidential files on September 25, 1961. The drilling was begun in August 1959 and reached a depth of 1347 feet before it was abandoned. The well was located in sec. 15, T. 8 S., R. 5 W., Polk County.

* * * * *

MORE PUBLIC LANDS SLATED FOR WITHDRAWAL

The Bureau of Land Management has announced (September 28, 1961) the proposed withdrawal of a total of 1,702.5 acres of National Forest lands from all forms of appropriation under the general mining laws only. Largest segment is 1,565 acres in the Bachelor Butte Recreation Area (within T. 18 S., R. 9 E.) in the Deschutes National Forest. Other areas, totalling 137.5 acres(within Tps. 39-41 S., Rs. 1-5 W.), lie in the Rogue River National Forest. They include the Wrangle, Thompson Creek, and Sturgis Campgrounds,and the lands embracing the Star Ranger Station and the Squaw Peak and Whiskey Peak Lookout Stations. The lands involved in the withdrawals are described in the notice as needing "strengthened security of tenure."

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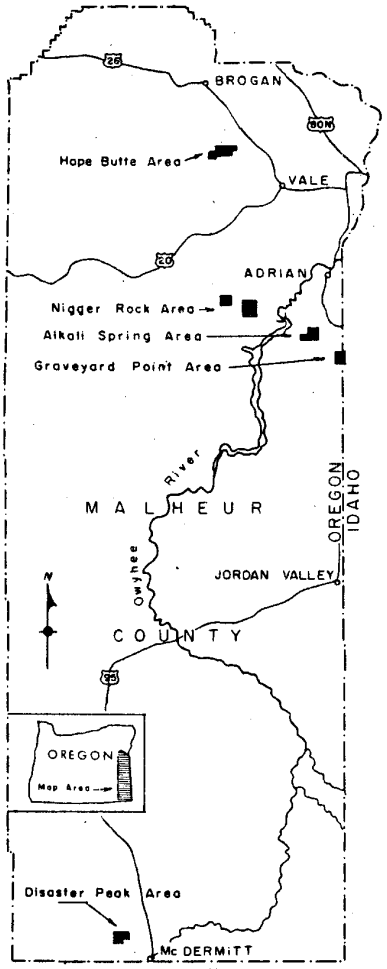
ATTENTION ROCKHOUNDS - THIS WITHDRAWAL AFFECTS YOU

Something new in withdrawals is being initiated by the U.S. Bureau of Land Management. The Bureau, in filing application for withdrawal No. 62-7, Serial Number Oregon 011886, is taking nearly 20,000 acres in Malheur County from location under the mining laws for the nonmetallic minerals (see accompanying index map). The reason given for the withdrawal is ". . . to preserve these lands for the use and enjoyment of the public for recreational pursuits pertaining to petrified materials." However, the notice states that the withdrawal covers all "nonmetalliferous minerals." The leasing laws whereby material can be extracted under lease arrangements with the Bureau still apply and the lands will still be ". . . open to exploration, discovery, occupation, and purchase under the mining laws so far as the same apply to metalliferous minerals."



All this means that land will still be open for location of mining claims for the metalliferous minerals, such as gold, silver, copper, and quicksilver, but the lands will not be open for mining claim location of materials such as limestone, diatomite, pumice, building stone, and semiprecious gem minerals, including petrified wood. However, the nonmetalliferous minerals can be leased from the Bureau of Land Management - the withdrawal just prevents mineral location, that is, mining of the nonmetalliferous minerals can continue but under the direction and control of the Bureau and only upon lease arrangements.

For a period of 30 days from October 13, persons having cause may present their objections in writing to Russell E. Getty, State Director, U. S. Bureau of Land Management, 710 N.E. Holladay Street, Portland 12, Oregon. If circumstances warrant it, a public hearing will be held at a convenient time and place which will be announced. The areas of withdrawal include the following: Hope Butte area, Nigger Rock area, Alkali Spring area, Graveyard Point area, and Disaster Peak area. The total area of withdrawal is 19,496.11 acres.

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McCOLLOCH APPOINTED TO GOVERNING BOARD

Frank C. McColloch, Portland attorney, was appointed September 28, 1961, to the Governing Board of the Department of Geology and Mineral Industries by Governor Mark Hatfield. McColloch succeeds William Kennedy, Portland, whose term expired March 16, 1961.

Following World War I, McColloch practiced law in Baker, Oregon, where he specialized in mining and water law. In succeeding years he was a member of the State Mining Board, served as State Public Utilities Commissioner, and was on the interim committee which authored the present State Water Resources Act and Ground Water Code. Since 1937, he has practiced law continuously in Portland as a member of the firm of Koerner, Young, McColloch, & Dezendorf and its predecessor firms. His appointment to the Department's Governing Board continues until March 16, 1965.

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AMC WESTERN GOVERNORS FOR OREGON ELECTED

Members of the Western Governors of the American Mining Congress for Oregon were elected at the annual meeting in Seattle September 10 to 13. These members are: Frank E. McCaslin, President, Oregon Portland Cement Co., Portland; Fay I.Bristol, President, Bristol Silica Co., Rogue River; and Hollis M. Dole, Director, State of Oregon Department of Geology and Mineral Industries, Portland.

It was announced that the 1962 meeting of the American Mining Congress will be in San Francisco September 24 to 27; the 1963 meeting in Los Angeles September 15 to 18; and the 1964 meeting in Portland September 13 to 16.

* * * * *

NORTHWEST MINING ASSOCIATION TO MEET

The 67th annual meeting of the Northwest Mining Association will be held in Spokane on December 1 and 2. Approximately 900 mining men from the Northwest and Canada are expected to be in attendance. Chairman for the meeting is Frank N. Marr and the program will be developed under the leadership of David E. Watson. Details are to be announced shortly. Those interested can obtain the full program by writing to: Program Chairman, 67th Annual Convention, Northwest Mining Association, 522 West First Avenue, Spokane 4, Washington.

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GEOLOGIC MAP OF THE LOWER UMPQUA RIVER AREA

The U.S. Geological Survey has recently issued Oil and Gas Investigations Map OM-204, "Geological map of the lower Umpqua River area, Oregon", by Ewart M. Baldwin. The map includes the Reedsport, Scottsburg, and Elkton quadrangles in Coos and Douglas counties, and covers a large gap in the geologic mapping of southwestern Oregon. The map area is underlain by the Eocene Tyee and Coaledo formations and by lesser amounts of Pleistocene and Recent alluvium and dunes. Descriptive text and cross sections are included on the map sheet. Map OM-204 may be purchased for 75 cents from the Geological Survey, Denver Federal Center, Denver, Colorado.

* * * * *

November, 1961

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* *

ANGULAR UNCONFORMITY MARKS TRIASSIC-JURASSIC BOUNDARY IN SNAKE RIVER AREA OF NORTHEASTERN OREGON

By

R. F. Morrison*

Introduction

A well-defined angular unconformity between Triassic and Jurassic strata is exposed along the valley of the Snake River about 40 miles south of Lewiston, Idaho. The Triassic rocks below the hiatus consist of poorly sorted clastics derived from a volcanic terrain; contemporaneous extrusive rocks; and well bedded, fossiliferous, impure limestones. Above the unconformity is more than 1000 feet of black shale which encompasses conformable beds of chert-pebble conglomerate and lenses of protoquartzite. Thick sills of quartz diorite have been intruded into the black shales.

During the summer of 1961, an examination was made of the pre-Tertiary rocks which crop out along the canyon of the Snake River between Cache Creek and the mouth of the Imnaha River. The accompanying sketch map shows the approximate extent of pre-Tertiary rocks surrounding the area of interest. Further extent of pre-Tertiary rocks in northeastern Oregon has been shown by N. S. Wagner in the July 1958 issue of The Ore.-Bin.

Previous Work

The existence of significant exposures of pre-Tertiary rocks underlying the Columbia River basalts along the canyons of the middle Snake and lower Salmon Rivers has been known for more than 60 years. Russell (1901) described the rocks in this area as follows:

> The stratified rocks are much disturbed, but in general the beds strike about northeast and southwest, or directly across the Snake River. The dip of the beds shows great variation, indicating the beds were disturbed, largely perhaps on account of the intrusion of porphyry beneath and among them, forming dikes....Certain layers are exceedingly coarse, being in reality conglomerates, containing water-worn pebbles six or more inches in diameter....The variety of rocks at the locality referred to (Cottonwood Creek) and the abundance of good exposures make it a favorable place for a detailed study of the geology and the topography of the old land over which the Columbia River lava was outpoured.

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* Graduate student in geology, University of Oregon.

The age of the strata at these particular exposures was not determined by Russell. Lindgren (1900, Plate IX), however, tentatively dated similar slates, schists and old effusive rocks along the canyon of the Salmon River south of Grangeville as Carboniferous in age. Sediments of definite Triassic age were also reported by Lindgren (1904) from the mining districts in the Seven Devils.

More recent examination of some of the pre-Tertiary rocks exposed along the Snake and Salmon River canyons has been made by W. R. Wagner (1945). In discussing exposures in the vicinity of Riggins, Idaho, he points out (page 3):

> The oldest group of rocks includes a thick succession of flows and pyroclastics which have been named the Seven Devils volcanics and which in adjacent areas carries a Permian fauna of Phosphoria age. The Pittsburg formation rests unconformably on the older rocks and is composed largely of sandstone and conglomerate which has been derived by erosion of the Seven Devils volcanics....Younger than the sandstones and conglomerates is another group of rocks called the Lucile series, which consists of crystalline limestone, phyllites, and slates which are believed to be of Triassic age.

The Seven Devils volcanics of the lower Salmon River country have been tentatively correlated by Cook (1954) with the Clover Creek greenstone, named by Gilluly (1937) for exposures in the vicinity of Baker, Oregon. Cook, however, emphasizes the preponderance of sediments in the Seven Devils volcanics and suggests that this formation is "largely the result of submarine volcanism and sedimentation near the source of volcanic debris." He suggests that these sediments range in age from Permian to Triassic.

Jurassic sediments associated with the Permo-Triassic "greenstones" of northeastern Oregon and adjacent areas of Idaho have been reported by Livingston (1932, p. 34) who found "excellent fossil ammonites...of upper Jurassic age" in shales at Dennet Creek near Mineral, Idaho.

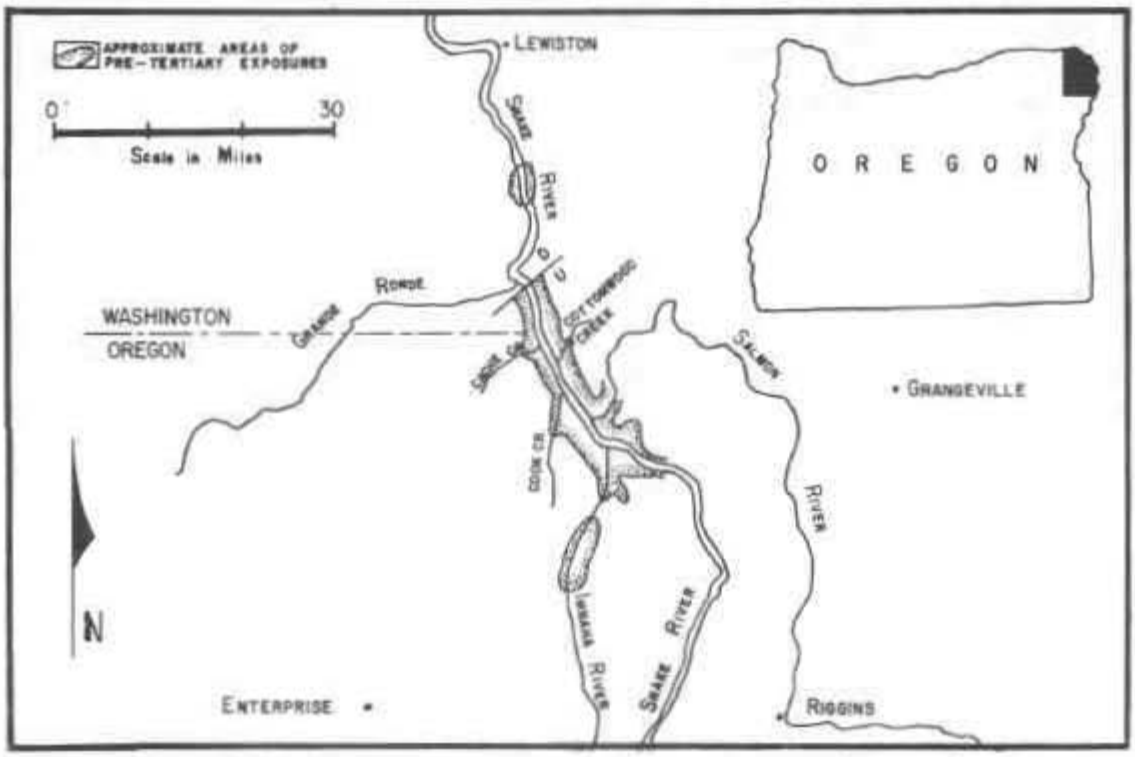
Stratigraphy of Layered Pre-Tertiary Rocks

It has proved unfeasible to construct a single detailed stratigraphic column which is accurate for all locations even within the limited area of pre-Tertiary exposures between Cache Creek and the mouth of the Imnaha River. Precise correlation of various units is complicated by:

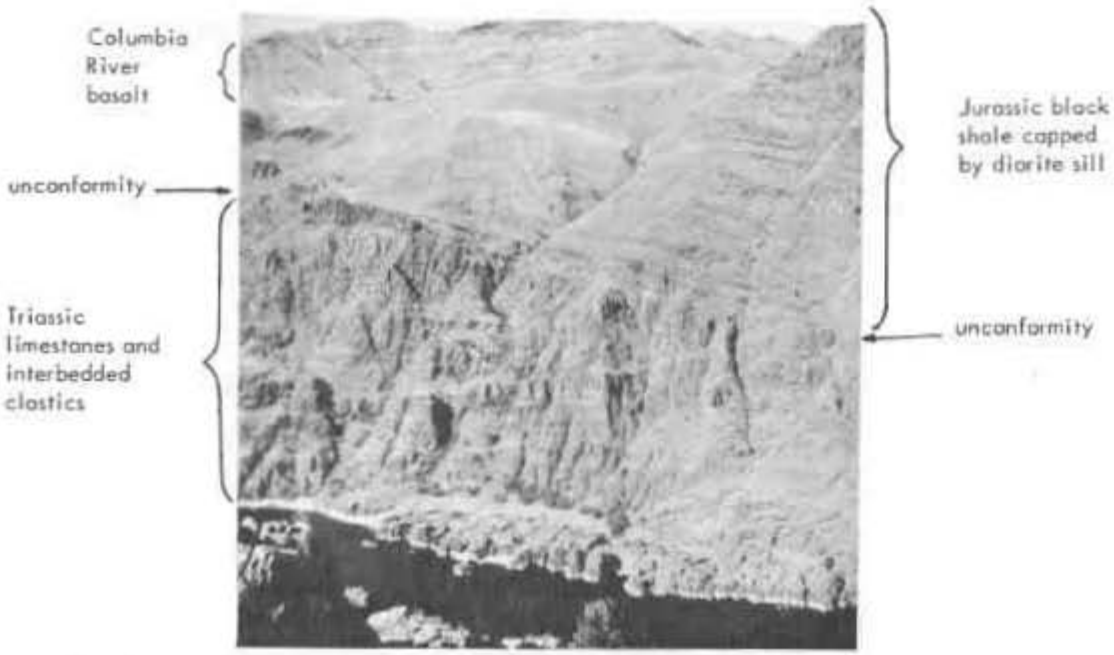
a) Intricate structure which includes numerous local faults (100 to 500 feet displacement) and an undetermined number of larger faults.
b) Rapid facies changes. Although specific examples of facies changes have not been demonstrated, extensive continuity of extremely coarse, angular rudites (which are often among the most distinctive units) seems improbable.
c) The abundance of dikes and sills of varying composition and age. These occur very typically between individual layered units and tend to mask the original nature of many of the sedimentary contacts.

Despite the uncertainties introduced by these factors, a representative stratigraphic column has been constructed. The upper part of this column has been drawn from sections measured with a plane table and alidade. These were correlated with the aid of certain limestone units which are sufficiently continuous to serve as good marker beds. The lower part of the column was for the most part based on estimates. In this portion of the section, the best marker horizon is a well-bedded chert which extends across the area of pre-Tertiary outcrop.

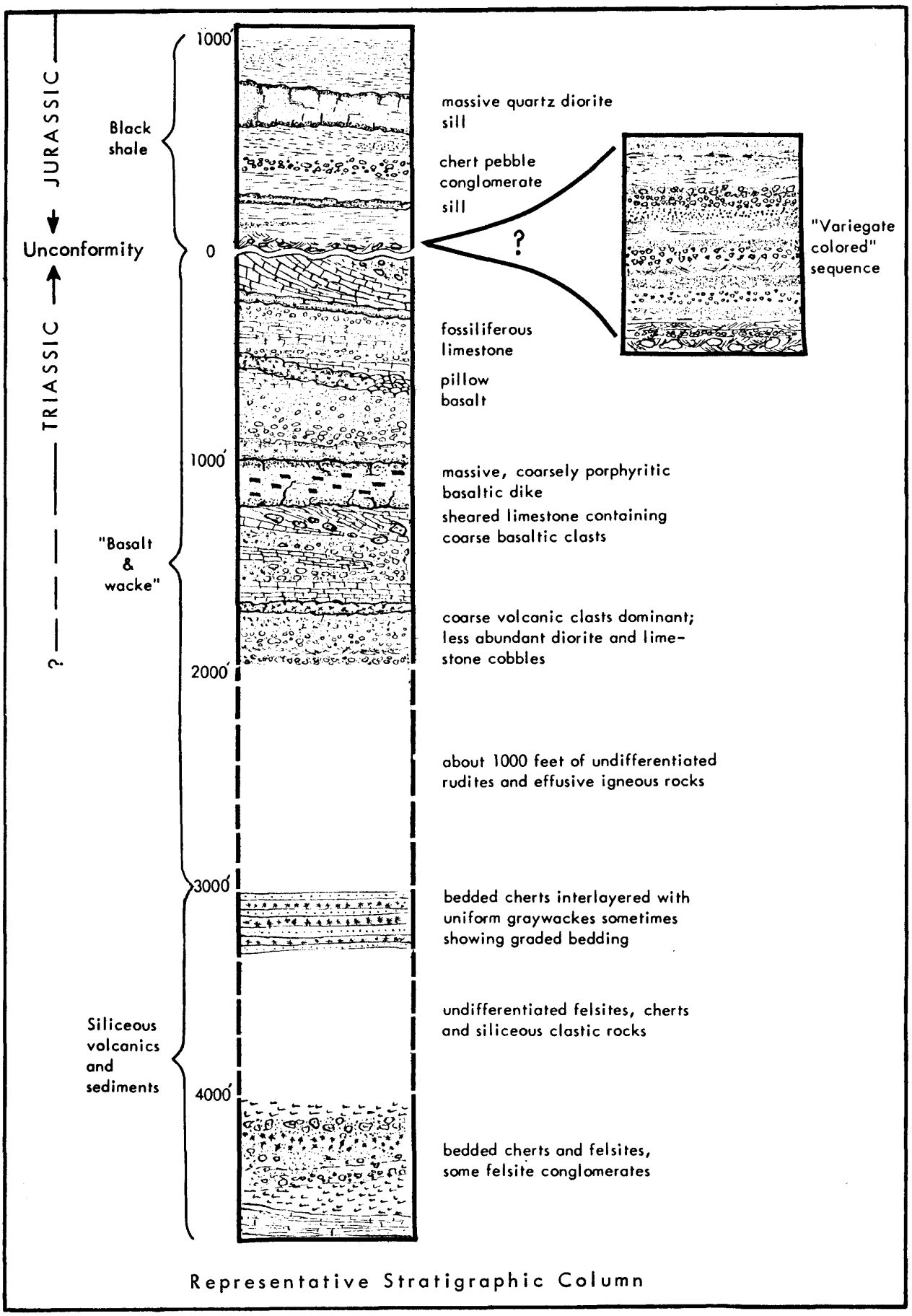
Regardless of variations in detail which would undoubtedly occur in stratigraphic columns measured at different locations, it does seem valid to divide the pre-Tertiary rocks in this area



Sketch map showing approximate extent of pre-Tertiary rocks in specific area of interest.



Angular unconformity between Triassic limestones and conglomerates and overlying Jurassic black shales. Location of photograph is 1 mile north of the mouth of Cottonwood Creek, looking west across the Snake River, which is in the foreground.



Representative Stratigraphic Column

into four major units. Among the oldest rocks, cherts, felsites, and possibly fine-grained silicified tuffs are predominant. Overlying these with unknown contact relations is a series of more mafic rocks, among which are abundant quartz-poor rudites, composed mainly of angular fragments of vesicular basalt or andesite in a chlorite-rich matrix. This is designated the "basalt and wacke"* unit. These are, in turn, separated by an angular unconformity from the youngest sediments which consist of black shales containing interbedded protoquartzites and chert-pebble conglomerates. The fourth major unit is of uncertain stratigraphic position. It consists of clearly defined conglomerate beds, variegate-colored shales, and current cross-bedded sands which are in part lithologically similar to the basal conglomerate of the black shale unit. Field mapping, however, has not established positive correlation.

Each of these four major rock units represents the product of a distinctive sedimentary, or volcano-sedimentary environment. The oldest rocks were formed during a phase of relatively siliceous volcanism. Sediments of this period show dominantly deep water characteristics. Many have fine-grained texture; bedding tends to be thin and clearly defined; graded bedding occasionally occurs, but there is a lack of cross-bedding; and there is almost a total absence of carbonates.

In contrast, the deposition of the overlying "basalt and wacke" unit occurred in a somewhat shallower marine environment with associated volcanism of basaltic or andesitic composition. Beds of clastic rock in this unit are massive, containing angular fragments as much as several feet in diameter. A moderately shallow water environment is also suggested by the presence of impure bedded limestone, particularly in the upper part of the unit. Interbedded pillow basalts, as well as the abundance of volcanic clasts in the water-laid material, is conclusive evidence of contemporaneous volcanism.

The black shale unit, at the top of the stratigraphic column, has been deposited in an environment which lacks significant volcanic contribution. Thin uniform bedding, which characterizes the fine-grained portions, suggests a relatively stable depositional basin. Even the subordinate coarser fractions of this unit are mature sediments composed of rounded and well-sorted chert pebbles or relatively clean quartz-sand lenses.

A near-shore, rapidly changing, shallow water environment is postulated to explain the well-bedded unit of uncertain stratigraphic position. Rounded conglomerates alternating with variegate-colored shales and quartz sands which display clear current cross-bedding indicate deposition under variable conditions, characterized at times by moderately strong currents. The conglomerate, in addition to containing quartz grains, clasts of dense volcanics, and pumiceous particles, also includes coarse fragments of diorite and an occasional limestone cobble.

The truncation of almost horizontal Triassic limestones and conglomerates by gently dipping Jurassic shales is illustrated in the accompanying photograph. In addition to the evidence provided by the angular discordance, the unconformity can be traced in the field by a distinctive basal conglomerate. The unit immediately above the break consists of a clean, current cross-bedded sand which contains rounded limestone boulders as much as 4 feet in diameter. These boulders are lithologically identical to the impure limestone beds that occur in the upper third of the "basalt and wacke" sequence which crops out below the unconformity.

A time hiatus in the depositional history, which coincides with the lithological and structural features that define this unconformity, can be demonstrated on the basis of fossil evidence. Specimens of limestone from the upper part of the "basalt and wacke" sequence beneath the unconformity have been dated as Middle to Upper Triassic by Dr. David Bostwick of Oregon State University.

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* The term "wacke" is used as part of a field name to designate a poorly sorted rudite deposited in an aqueous environment. Clastic fragments include a mixture of rock types, mainly volcanic in origin.

The Triassic fauna includes Thamnastraea sp. and Halobia sp., as well as a variety of other colonial corals, brachiopods, and pelecypods.

The black shale above the unconformity has yielded a well-preserved ammonite specimen, belonging to the subfamily Cardioceratinae, which is probably a species of the genus Amoeboceras. According to Dr. S. Muller, who identified the specimen, this genus is restricted to the Oxfordian stage of the Upper Jurassic.

Plutonic Rocks

The coarse-grained plutons, which are exposed within the area of pre-Tertiary layered rocks, are summarized only briefly because they have not been examined in detail. The largest continuous exposures are along the lower canyon of the Imnaha River and immediately adjacent portions of the Snake River canyon. Although the intervening area is masked by flows of Columbia River basalt, this Imnaha Valley intrusive body can be extended 5 miles to the northwest, to the upper end of Cook Creek where exposures of similar intrusive rock occur. A few miles north of Cache Creek, beyond the boundaries of the immediate area of interest, are additional outcrops of plutonic rocks.

Variable composition characterizes the Imnaha Valley intrusive body. Unaltered gabbro, containing less than 3 percent quartz, is included near the center of the mass along the Imnaha River, but closer to its margins there is found abundant quartz diorite in which the plagioclase has been strongly saussuritized. Within a wide marginal zone along the border of the intrusive are pods of sheared granite and numerous felsitic, as well as basaltic, dikes.

A well-developed primary fabric, defined by parallel orientation of plagioclase and pyroxene crystals and by uniformly aligned xenoliths and schlieren, occurs at many localities within the igneous body. Wherever observed, these features have a consistent attitude of about N. 65° W., dipping approximately 60° N. It is the orientation of this internal fabric which suggests that the Imnaha Valley intrusive body may be elongated in a generally northwesterly direction, justifying its hypothetical extension to include the exposures of diorite near the upper end of Cook Creek.

The age of the Imnaha Valley intrusive body has not been established. Sills of quartz diorite more than 200 feet thick are included within the black shales, indicating that there has been post-Oxfordian igneous activity in this area, but the relation which these sills may bear to the Imnaha Valley intrusive body is not known.

Conclusions

1) Four major units which are believed to correspond to distinctive sedimentary or volcano-sedimentary environments can be differentiated on the basis of lithologic variations. Detailed mapping, however, which is necessary to define accurate relations between some of these units, is complicated by rapid facies changes, intricate structures, and abundance of dikes and sills that tend to mask original contacts.

2) Careful examination of the stratigraphy of layered rocks within a limited area along the canyon of the Snake River does not reveal an excessive thickness of either sediments or volcanics. The area of interest extends about 10 miles at roughly right angles to the northeasterly trend of much of the bedding; the total stratigraphic thickness, including both measured and estimated portions of the column, is probably in the neighborhood of about 6,000 feet.

3) An angular unconformity, which can be bracketed by fossil evidence, indicates that a period of tilting, erosion, and uplift occurred in northeastern Oregon some time between the Upper Triassic and the Upper Jurassic.

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CARBON 14 TEST DATES LOON LAKE

Ewart M. Baldwin, professor of geology at the University of Oregon, reports that a sample of wood taken from a standing tree in Loon Lake, Douglas County, and sent to Dr. Willard Libby for age determination by the carbon 14 method, was found to be 1,460 years, plus or minus 80. The sample was sent to Dr. Libby by Miss Harriet Ward, resident on the shore of the lake, who recognized that a dating of the outer part of the tree would give the date the lake was formed. According to Dr. Baldwin, Loon Lake was caused by a landslide in which a large mass of Tyee sandstone slipped down from the western slope of the valley of Lake Creek, forming a dam behind which the water was quickly impounded.

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CORNUCOPIA GOLD MINE SOLD

A Spokane investor (Nov. 20) bought for $11,100 the famed Cornucopia Mine, which once yielded an estimated $15 million in gold.

Craig Stolle purchased the long-abandoned Eastern Oregon mine property for his father, Carl M. Stolle, a partner in Stolle Investment Co., at a bankruptcy sale.

The assets include 1,000 acres of land, half a dozen old mine buildings, and part of the abandoned townsite of Cornucopia.

The mine was opened about 1884. At one time, 350 persons worked and lived at Cornucopia. Stolle said his father hopes the price of gold will increase so that some day it may be profitable to reopen the mine, which has not been worked for 20 years.

Possibility of developing the area as a resort also was mentioned. (The Oregonian, Nov.22, 1961)

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THE HOUSE THAT MINERALS MADE

by

R. S. Mason*

The day has nearly arrived when you can build a house entirely from minerals. Such a house would be fireproof, termiteproof, soundproof, and weatherproof. Depending on the owner's choice of materials the structure would be almost paintproof too. Just what will this house use to provide all these wonderful benefits?

Starting with the basement, walls and floor will be of concrete blocks or of reinforced concrete poured into metal forms which have neither cracks nor knotholes. Some houses may even use steel cables for horizontal and vertical post-tensioning to give greater strength and to prevent cracks. Sand and gravel under the floors and a petroleum-base emulsion on the outside of the walls will insure that the basement is dry. The ceiling joists over the basement and the first floor sub-floor will be single pre-cast lightweight concrete units which will be delivered to the job ready for laying, with openings for heating ducts, plumbing, and electrical conduits already provided. The steps up from the basement will arrive in one piece and will be pre-cast lightweight concrete with metal railing already installed.

Exterior walls now offer a wide variety of choice. Traditional brick in many colors, textures, and sizes; building stone either sawn, split, or rubble in numerous colors and textures; concrete block in unit sizes, half high, ashlar, or random, with plain or textured surfaces and in many colors; and monolithic concrete with any one of many surface textures, are some of the possibilities for the solid wall areas of the modern house. Recent perfection of tilt-up wall construction methods has lowered the cost of laying rubble building stone to the point where it is competitive with many other materials. Exterior walls of prefabricated modular-sized panels of coated steel or aluminum sheets fastened to metal frames are available in a variety of colors.

Steel or aluminum joists and rafters will be assembled at the plant and the trusses delivered to the job ready for installation. The ceiling joists will have metal clips for attaching plasterboard. Roof construction will be a far cry from the methods used since man moved out of a cave. Depending on conditions and the owner's preference, the roof could be made of clay or concrete tile or slate attached to metal sirips, or large, pre-fabricated roof sections of aluminum or ceramic-coated steel shingles could be used. Built-up roofs, using colorful crushed rock poured over asphalt-coated lightweight concrete slabs are also possible. Chimneys of traditional brick or concrete blocks will be competing with multi-wall steel and aluminum stacks which can be erected rapidly.

Inside the house-made-with-minerals, walls of gypsum board or plaster laid over perforated gypsum lath would find increasing competition from wall panels of ceramic-coated metal, plastic, or foamed concretes. Interior walls of translucent glass or plastic would be lighter than those made of the traditional materials and could be installed or removed readily. Exposed aggregate concrete block with smoothly sanded surfaces is a new development which should find its way into the interior walls of many homes.

Floor coverings of vinyl acetate linoleum and similar plastics in work areas would contrast with all-mineral rugs of tough glass fibers or plastic yarns. Furniture of steel, aluminum, fiberglass, and plastic would be lightweight and durable. Windows, set in steel or aluminum sash, would have draperies or curtains made of glass fibers, plastics, or metallic yarn.

Utilities would use quantities of pipe made of cast iron, steel, and copper; sheets of galvanized steel for air ducts, vents, and louvers; and pounds of miscellaneous metal fasteners such as nuts and bolts, screws, clips, and rivets. Insulation from heat and cold would be provided by rock wool, glass fibers, or asbestos. Light may come from regular fixtures or entire wall or ceiling panels may be phosphor-coated glass or plastic which glow at the flip of a switch.

For the home owner whose house has a steel or aluminum frame with metal exterior and interior wall panels there are certain bonus features. Changes in floor plan are simple operations of unbolting clips and moving unit sections to a new place. Should the owner of a metal house wish to move he can, if he desires, take it with him, after unbolting the sections and dismantling them with the aid of a small lift truck.

Heated electrically or by fossil fuels such as coal, oil, and gas, the mineral-made house also will pick up extra thermal energy from the sun through double-glass windows which trap the radiant heat inside. If, for old time's sake, the owner wants a cheerful fire on his hearth, he will have to bring in a log or two, but that is the only time wood will be used.

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*Mining engineer, Oregon State Department of Geology and Mineral Industries.

Materials for the House Made of Minerals

Use	Material	Mineral or Rock
Basement walls and floor	Reinforced concrete, concrete block	Sand, gravel, limestone, clay, gypsum, hematite, chromite
Walls	Brick and tile concrete block natural stone steel, aluminum	Clay, sand, limestone limestone, clay, gypsum, sand, gravel volcanic tuff, sandstone hematite, bauxite, feldspar
Sash and doors	Aluminum or steel	Bauxite, hematite
Windows	Glass	Soda ash, quartz
Ceiling joists (basement)	Pre-cast concrete	Expanded shale, cinders or pumice limestone, clay, gypsum
Rafters and joists	Metal trusses of steel or aluminum	Bauxite, hematite
Roof	Tile slate aluminum shingles ceramic coated steel aggregate concrete tile	Clay slate bauxite hematite, feldspar dolomite, quartz, opalite, chert, limestone, sand and gravel, clay
Chimneys	Brick and tile steel or aluminum pipe concrete block	Clay, limestone, sand hematite or bauxite limestone, sand and gravel, clay
Draperies, rugs	Plastic, metallic or glass fibers	Halite, coal, limestone, hematite chromite, soda ash, quartz
Linoleum	Vinyl asbestos	Coal, limestone, asbestos
Plumbing	Iron, steel, copper pipe lead caulking fixtures	Hematite, chalcopyrite galena chalcopyrite, hematite, zinc, nepheline syenite, chromite, garnierite
Heating	Oil or gas furnace electric panels radiant floors	Hematite, chalcopyrite, sheelite chalcopyrite, garnierite, chromite chalcopyrite
Electrical	Wiring, switches, fixtures	Chalcopyrite, platinum, galena, sphalerite, hematite, chromite, cinnabar, sheelite
Cupboards, cabinets	Stainless steel aluminum	Hematite, chromite, garnierite bauxite

LIST OF THESES ON OREGON GEOLOGY GROWS

The following master's theses were completed in 1959, 1960, and 1961 by graduate students of geology at the University of Oregon. The list supplements "Bibliography of Theses on Oregon Geology," by H. G. Schlicker, published by the department as Miscellaneous Paper No. 7, 1959. Theses marked with an asterisk may be consulted at the department library in Portland.

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PORTLAND EXTENSION CENTER SCHEDULES NEW CLASS

Portland Extension Center has scheduled Course ChE 405, Reading and Conference: Assaying (OSU) for the winter term at Portland State College. It is an evening class and is planned to cover the fundamentals of assaying and geochemical prospecting, which should be of interest to chemistry students, geologists, prospectors, mining engineers and others. The enrollment is limited to 25. Registration only made be made by application to the instructor after December 11. The instructor may be reached at BE5-0043 daily after 5:30 p.m.

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* *

TRENDS IN INTERPRETATION OF THE MINING LAWS

Since 1957 every major meeting of the mining fraternity has included on its program a session on mining laws. The continuing interest stems from the passage of Public Law 84 - 167 (the Multiple-Use Mining Law), which gave authority to Government bureaus to manage the surface of mining claims located prior to the act if, upon examination, it was found that the claims were invalid. This authority had long been wanted by the U.S. Forest Service and the U.S. Bureau of Land Management and they were quick to realize that the interpretation of what constituted validity was the key to the examinations. Interpretations by the Government bureaus on validity therefore became very important to the miner contemplating a prospecting program, spending money to develop a mine, or considering the patenting of his claim.

Most people in mining today grew up under the "prudent man" test for determining if there was a valid showing of minerals in order to locate and hold a claim. This test, as set forth by the Supreme Court of the United States, states: ". . .where minerals have been found and the evidence is of such a character that a person of ordinary prudence would be justified in the further expenditure of his labor and means, with a reasonable prospect of success, in developing a valuable mine, the requirements of the statute have been met. . ." The bureaus have added to this long-standing test another and more stringent one: "marketability." They have been successful in this on claims located for the nonmetallic minerals and now cite as their authority the 1959 case of Foster v. Seaton (271 F. 2d 836) where it was held that "with respect to widespread nonmetallic minerals. . . the Department (of Interior) has stressed the additional requirement of present marketability. . . . Thus, such a mineral locator. . . must show that by reason of accessibility, bona fides in development, proximity to market, existence of present demands, and other factors, the deposit is of such value that it can be mined, removed and disposed at a profit. . . ." Recently (U.S. v. Altman and Russell, A-28478, July 17, 1961) the Interior Department ruled, in effect, that the holder of a mining claim for the metallic minerals must prove the existence of an ore body of such size and quality as to permit profitable operation if the claim is to be considered valid. This ruling has not been tested by the courts.

Apparently the interpretation of marketability by the bureaus as an additional test for a valid claim is based upon the lack of court definition for "valuable" as used in the mining law. This law reads "All valuable mineral deposits in lands belonging to the U.S.. . . are . . . declared to be free and open to exploration and purchase. . . ." (Sec. 2319, Revised Statutes). A bureau spokesman stated: "Now what is, or is not, a 'valuable' deposit may be a matter of opinion . . . . But the fact remains that a mineral deposit must be valuable if it is to be validly appropriated." (From a speech of K. S. Landstrom, Director, Bureau of Land Management, at the 1961 American Mining Congress meeting in Seattle.)

That a claim holder must prove valuable mineral in place at all times is borne out by a recent Department of Interior hearings officer decision, where he upheld the recommendation of bureau examining engineers that the claim was invalid because drifts were caved and the ore at the face could not be sampled. Similar decisions have been applied to some properties that actually had a past history of modest production. The contention by the examining engineers was that the vein could have been mined out and that because it was unavailable for sampling there was not definite proof that there was valuable mineral in place. In some instances these were gold mines that had been closed during the war as the result of War Production Order L-208.

Another innovation in the interpretation of the mining laws that has miners wondering "what next" is an adopted policy on houses, long considered a legitimate assessment expense. This policy is found in the brochure "The BLM at Work in Oregon and Washington, 1961", where the statement is made that "The mining laws also allow a miner to live on his claim when this is necessary for the prudent development of the claim. . . . Today, a miner can often live in a nearby town and commute to his mining operation. Where this is possible, residence on the claim is

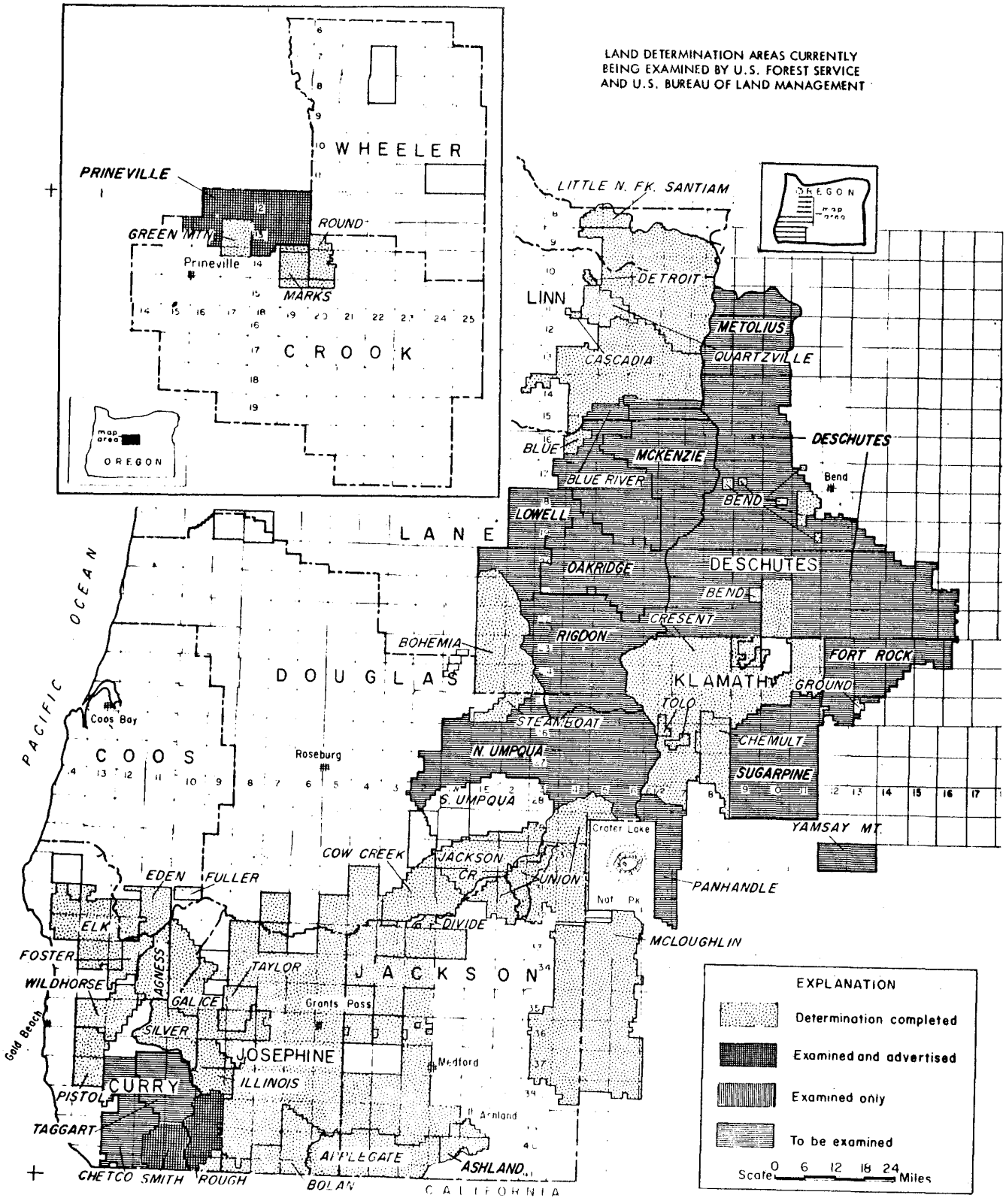
(Continued on Page 120)

NATIONAL FOREST AREAS APPROVED FOR DETERMINATION OF SURFACE RIGHTS

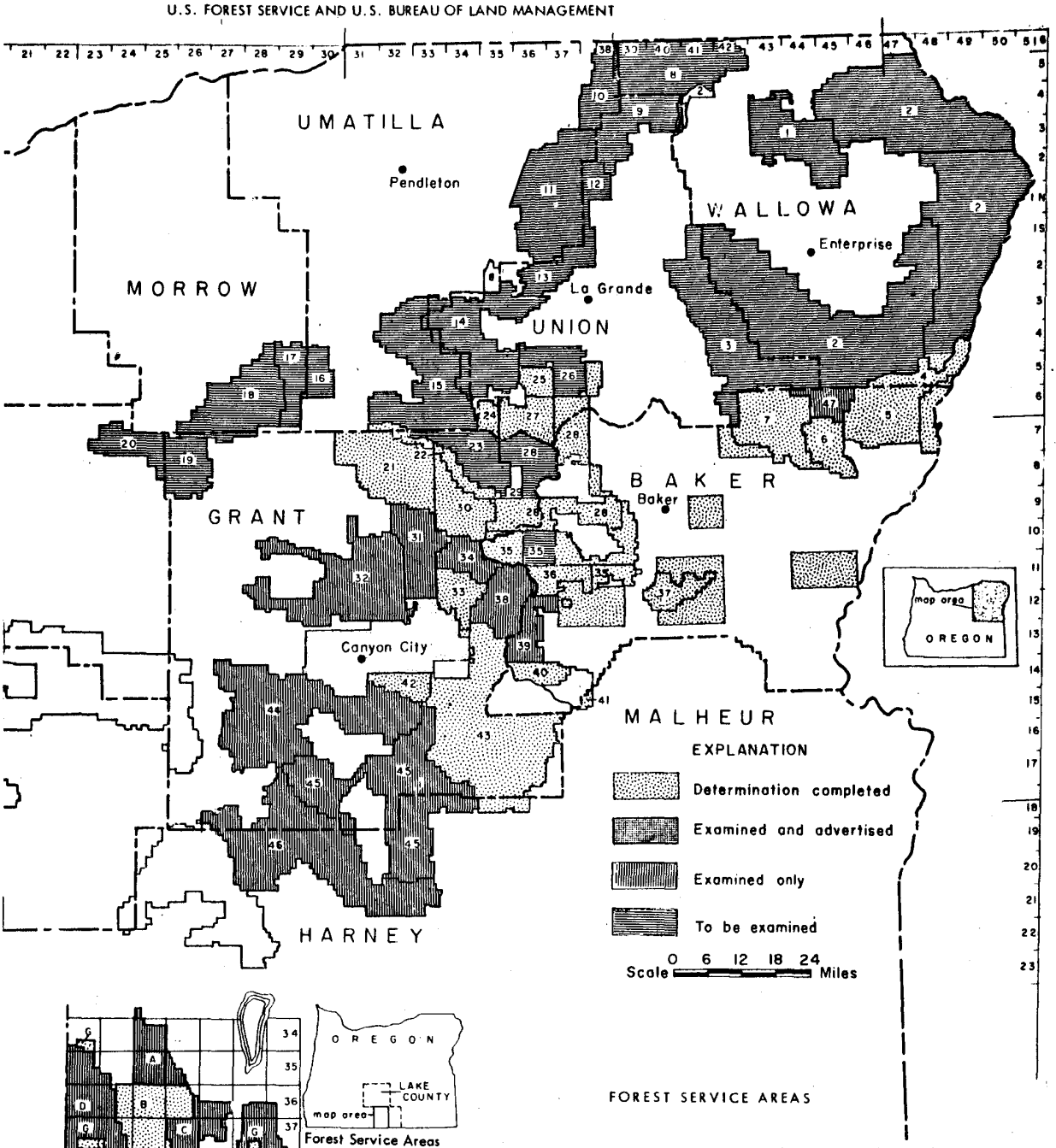
Forest	Name of Area	Forest Acreage	Acres Examined	Approved for Examination	Date of First Publication	150-day Period*
Deschutes	Chemult	45,500	45,500	5- 4-56	2-27-57	7-29-57
	Bend	29,760	29,760	5- 1-57	12-24-59	5-23-60
	Tolo	9,750	9,750	5- 1-57	12-24-59	5-23-60
	Ground	1,120	1,120	5- 1-57	12-24-59	5-23-60
	Crescent	300,000	300,000	6-21-60	6-14-61	11-13-61
	Fort Rock	171,000		3-14-61		
	Deschutes	937,000		3-14-61		
	Metolius	157,800		3-14-61		
Fremont	Chemult	8,500	8,500	5-17-56	2-27-57	7-29-57
	Fremont	31,200	31,200	3-25-59	12-24-59	5-23-60
	White King-Thomas Cr.	50,000	90,000	8-11-59	5-18-60	10-17-60
	Mill Flat	29,000	29,000	7-28-60		
	Drews	114,924	114,924	4-20-60		
	Brattain Butte	44,541		4-20-60		
	Yamsey Mtn.	44,520		5- 3-60		
	North Warner	45,750		5- 3-60		
	Bly-Lake	70,000		5-25-60		
Malheur	Twin	39,600	39,600	7- 5-56		
	Dixie	36,070	36,070	7- 5-56	9-25-58	2-23-59
	Canyon	22,680	22,680	4-25-57	12-24-59	5-23-60
	Drewsey	247,366		4- 6-60		
	Clear Creek	60,160		4- 6-60		
	Long Creek	180,382		4- 6-60		
	Burns	502,500		4- 6-60		
	Prairie City	297,429		4-21-60	6- 1-61	10-30-61
	Bear Valley	246,000		4-21-60		
	River	110,400	110,400	4-21-60		
Ochoco	Round "A"	10,440	10,440	7- 5-56	11-20-57	4-21-58
	Round "B"	14,015	14,015	7- 5-56	9- 4-58	2-23-59
	Marks	21,900	21,900	7-31-57	12-31-59	5-31-60
	Green Mtn.	22,920	22,920	7-31-57	12-31-59	5-31-60
	Prineville	101,240	111,970	5- 3-60	1-11-62	6-11-62#
Rogue River	Applegate "A"	17,785	17,785	7- 5-56	9-24-58	2-23-59
	Applegate "B"	35,660	35,660	7- 5-56	12-23-59	5-23-60
	Applegate "C"	55,449	55,449	7- 5-56	3- 1-61	7-31-61
	Union "A"	39,295	39,295	4-25-57	9-17-58	2-16-59
	Union "B"	191,105	26,033	4-25-57	1- 4-61	6- 8-61
	Union "C"	148,248		4-25-57		
	Ashland "A"	28,184	28,184	4-25-57	12-23-59	5-23-60
	Ashland "B"	946		4-25-57		
	McLoughlin	368,640	368,640	9-21-59	3- 1-61	7-31-61
Siskiyou	Wildhorse	53,000	53,000	2- 2-56	2-21-57	7-22-57
	Elk "A"	17,920	17,920	7-11-56	9-12-57	2- 9-58
	Elk "B"	120,300	120,300	7-11-56	9-11-58	2- 9-59
	Elk "C"	4,487	4,487	7-11-56	2-26-59	7-27-59
	Elk "D"	8,457		7-11-56		
	Fuller	8,800	8,800	7-11-56	2-21-57	7-22-57
	Taylor	35,000	35,000	7-11-56	9-11-57	2- 8-58
	Illinois "A"	26,880	26,880	7-11-56	3- 4-59	8- 3-59
	Illinois "B"	22,400		7-11-56		
	Pistol	39,950	39,950	7-11-56	3- 5-59	8- 3-59
	Galice "A"	27,280	27,280	7-16-58	12-17-58	5-16-59
	Galice "B"	111,440	111,440	7-16-58	6-29-60	11-28-60
	Foster	23,220	23,220	9-11-58	5-25-61	10-23-61
	Agness	45,007	45,007	3-25-59	3- 2-61	7-31-61
	Smith	55,278	55,278	4- 6-60	1- 4-62	6- 5-62#
	Rough	58,718		4- 6-60	12-27-61	5-28-62#
	Chetco	133,321		3-25-59		
	Eden	32,618	32,618	3-25-59	6-29-60	11-28-60
	Bolan	76,793	76,793	3-25-59	6-29-60	11-28-60
	Silver	94,234	94,234	4- 6-60	4- 6-61	9- 5-61
	Taggart "A"	55,680		7-10-60		
	Taggart "B"	34,500		4- 6-60		

Forest	Name of Area	Forest Acreage	Acres Examined	Approved for Examination	Date of First Publication	150-day Period*
Umatilla	John Day "A"	12,240	8,942	7-11-56	9-25-57	2-23-58
	John Day "B"	20,255		7-11-56	6-30-60	11-28-60
	Desolation	94,640	94,640	4-16-59	10-27-60	3-27-61
	Olive Lake	63,700	63,700	4- 4-61	11-9-61	7-21-62'
	Silver Butte	62,960		5- 5-59		
	Wheeler	37,900		4-20-60		
	Umatilla	152,720		6-15-61		
	Phillip Creek	26,320		6-15-61		
	Ellis	35,320		4-20-60		
	West Ukiah	31,960		4-20-60		
	East Ukiah	160,000		6-15-61		
	Tollgate	48,620		4-20-60		
	Grant	64,320		4-20-60		
	Jarboe	71,720		4-20-60		
	Morrow	96,565		4-20-60		
	Wenaha	121,860		4-20-60		
Umpqua	Bohemia	157,460	157,460	7- 5-56	9-17-58	2-16-59
	Steamboat	22,080	22,080	7-31-57	12-23-59	5-23-60
	Cow Creek	67,000		4- 6-60	6- 7-61	11- 6-61
	Jackson Creek	86,000		4- 6-60	6- 7-61	11- 6-61
	Divide	9,400		4- 6-60	6- 7-61	11- 6-61
	South Umpqua	161,616		12-13-60		
	North Umpqua	486,264		4- 4-61		
Wallowa-Whitman	Dooley Mtn-Buffalo	44,000	44,000	6- 1-56	2-27-57	7-29-57
	Pine	82,230	82,230	7- 5-56	2-27-57	7-29-57
	Woodley	35,250	35,250	7- 5-56	2-27-57	7-29-57
	Unity	37,500	37,500	7- 5-56	2-27-57	7-29-57
	Baker "A"	79,120	79,120	3-22-57	5-28-58	10-27-58
	Baker "B"	63,557	63,557	3-22-57	12-24-59	5-23-60
	Baker "C"	10,600	10,600	3-22-57	10-27-60	3-27-61
	Bull Run	22,200	22,200	3-22-57	4-26-61	9-25-61
	Whitney "A"	17,570	17,570	3-22-57	3- 2-61	7-31-61
	Whitney "B"	38,020				
	Starkey	117,120		11-16-60		
	Cornucopia	25,713		1-10-61		
	Cove	186,480		1-10-61		
	Joseph	984,063		1-10-61		
	Eagle	89,600	89,600	3-22-57	3-15-61	8-14-61
	Limber Jim-Sheep Cr.	39,780	39,780	3-22-57	5-21-58	10-20-58
	Snake River	31,750	31,750	3-22-57	5-22-58	10-20-58
	Summit	35,720	35,720	3-22-57	12-24-59	5-23-60
	Sheephead Mtn.	3,200		5- 3-60	6- 1-61	10-30-61
	Imnaha	280,000		12-13-60		
	Chesnimnus	287,972		12-13-60		
	Sled Springs	106,200		12-13-60		
	Mt. Emily	49,280		12-13-60		
	Beaver	43,640		12-13-60		
	Burnt River	64,720		12-13-60		
	Baker "D"	38,400	38,400	3-22-57	1-11-62	6-11-62'
	Baker "E"	8,320		7-12-60		
Willamette	Little North Fork Santiam	22,600	22,600	2-21-56	2-27-57	7-29-57
	Quartzville	28,000	28,000	2- 2-56	11- 1-56	4- 1-57
	Blue	17,600	17,600	7- 5-56	9-25-57	2-22-58
	Blue River	178,700		7- 8-57		
	Cascadia	162,000	162,000	12-13-60	3-15-61	8-14-61
	Detroit	281,950	224,000	7- 8-57	5-25-61	10-23-61
	McKenzie	243,300		8- 8-61		
	Lowell	146,700		7-25-61		
	Oakridge	241,600		8- 8-61		
	Rigdon	300,100		8- 8-61		
Winema	Sugar Pine	146,145		4-24-61		
	Panhandle	74,880		9-14-59		
	TOTAL	12,622,314	3,452,661			

*Determination completed (time expired for submitting verified statement), except where noted by '.


LAND DETERMINATION AREAS CURRENTLY BEING EXAMINED BY U.S. FOREST SERVICE AND U.S. BUREAU OF LAND MANAGEMENT
WHEELER
PRINEVILLE
GREEN MTN.
ROUND
Prineville
MARKS
CROOK
OREGON
map area
LITTLE N. FK. SANTIAM
DETROIT
LINN
METOLIUS
CASCADIA
QUARTZVILLE
DESCHUTES
BLUE
MCKENZIE
BLUE RIVER
Bend
BEND
LOWELL
LANE
OAKRIDGE
DESCHUTES
BEND
CRESENT
RIGDON
BOHEMIA
FORT ROCK
KLAMATH
GROUND
TOLO
STEAMBOAT
CHEMULT
N. UMPQUA
SUGARPINE
S. UMPQUA
YAMSAY MT.
Crater Lake
Nat Pk
PACIFIC OCEAN
DOUGLAS
Coos Bay
COOS
Roseburg
COW CREEK
JACKSON CR
UNION
PANHANDLE
EDEN
FULLER
ELK
DIVIDE
MCLOUGHLIN
FOSTER
WILDHORSE
AGNESS
TAYLOR
JACKSON
GALICE
Grants Pass
Gold Beach
SILVER
JOSEPHINE
Medford
CURRY
ILLINOIS
PISTOL
TAGGART
Ashland
APPLEGATE
ASHLAND
CHETCO
SMITH
ROUGH
BOLAN
CALIFORNIA
EXPLANATION
Determination completed
Examined and advertised
Examined only
To be examined
Scale 0 6 12 18 24 Miles

LAND DETERMINATION AREAS CURRENTLY BEING EXAMINED BY
U.S. FOREST SERVICE AND U.S. BUREAU OF LAND MANAGEMENT



Forest Service Areas

A. Brattain Butte
B. White-King Thomas Creek
C. Mill Flat
D. Bly Lake
E. Drews
F. North Warner
G. Fremont

FOREST SERVICE AREAS

1. Sled Springs
2. Joseph
3. Cove
4. Snake River
5. Pine
6. Summit
7. Eagle
8. Wenaha
9. Jarboe
10. Tollgate
11. Umatilla
12. Phillip Creek
13. Mt. Emily
14. Starkey
15. East Ukiah
16. West Ukiah
17. Ellis
18. Morrow
19. Grant
20. Wheeler
21. Desolation
22. John Day
23. Silver Butte
24. Sheep Creek
25. Limber Jim
26. Beaver
27. Woodley
28. Baker
29. Buffalo
30. Olive Lake
31. River
32. Long Creek
33. Dixie
34. Twin
35. Whitney
36. Unity
37. Dooley Mt.
38. Clear Creek
39. Burnt River
40. Bull Run
41. Sheephead Mt.
42. Canyon
43. Prairie City
44. Bear Valley
45. Drewsey
46. Burns
47. Cornucopia

RESUME OF U. S. BUREAU OF LAND MANAGEMENT PUBLIC LAW 167 WORK*

Areas Examined and Advertised

Jackson County
May 31, 1961

T. 34 S., R. 2 W.
T. 36 S., R. 2 W
T. 37 S., R. 2 E.
T. 39 S., R. 4 W.
T. 37 S., R. 4 W.
T. 38 S., R. 4 W.
T. 38 S., R. 3 W.
T. 39 S., R. 3 W.
T. 34 S., R. 4 W.
T. 36 S., R. 4 W.
T. 39 S., R. 2 W.
T. 34 S., R. 3 W.
T. 35 S., R. 3 W.
T. 38 S., R. 3 W.

Lane County
March 30, 1961

T. 23 S., R. 1 W.

Josephine County
May 24, 1961

T. 33 S., R. 5 W.
T. 36 S., R. 5 W.
T. 33 S., R. 6 W.
T. 36 S., R. 7 W.
T. 39 S., R. 7 W.
T. 34 S., R. 8 W.
T. 35 S., R. 9 W.
T. 34 S., R. 9 W.

Douglas County
March 30, 1961

T. 24 S., R. 1 W.
T. 33 S., R. 1 W.

Areas Examined and Not Advertised

Douglas County

T. 30 S., R. 9 W.
T. 29 S., R. 9 W.
T. 28 S., R. 8 W.
T. 29 S., R. 8 W.
T. 28 S., R. 6 W.
T. 28 S., R. 7½ W.
T. 28 S., R. 7 W.
T. 28 S., R. 8 W.
T. 28 S., R. 3 W.
T. 28 S., R. 4 W.
T. 28 S., R. 5 W.
T. 28 S., R. 2 W.
T. 28 S., R. 3 W.

Columbia County

T. 5 N., R. 3 W.
T. 4 N., R. 2 W.
T. 5 N. R. 2 W.
T. 4 N., R. 3 W.

Jackson County

T. 38 S., R. 3 E.
T. 39 S., R. 3 E.
T. 40 S., R. 3 E.
T. 36 S., R. 3 W.
T. 38 S., R. 2 W.
T. 34 S., R. 4 W.
T. 30 S., R. 9 W.
T. 37 S., R. 2 W.
T. 36 S., R. 3 W.
T. 34 S., R. 4 W.

Josephine County

T. 35 S., R. 5 W.
T. 35 S., R. 6 W.
T. 34 S., R. 7 W.

Washington County

T. 3 N., R. 3 W.
T. 4 N., R. 3 W.
T. 2 N., R. 2 W.
T. 3 N., R. 2 W.
T. 4 N., R. 2 W.
T. 2 N., R. 3 W.
T. 3 N., R. 3 W.

*In most instances only part of township has been examined. Information as to exact areas examined can be obtained from U. S. Bureau of Land Management.

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(Continued from Page 115)

unnecessary . . ." This policy has resulted in bringing trespass action against claim holders where the bureaus are not convinced the dwelling is necessary. In Oregon many trespass actions have been taken and the claim holder ordered to remove his house or have it torn down.

It is quite plain that mining people can expect a continuation of this "administrative legislation", since for every case that finally reaches the courts for judicial revue there are probably 1,000 cases ruled on by Department of Interior hearings officers. Thus it would appear wise for the mining industry to make a concerted effort in Congress to have such terms as "discovery", "valuable", "assessment work", and "mineral in place", clearly defined. Such legislation would perhaps leave something to be desired, as far as the mining industry is concerned, but at least it might establish rules of the game that could not be changed at the whim of some bureau solicitor. Another objective the mining industry might wish to shoot for would be a quicker and less costly procedure for getting appeals from hearings officers into a court of law, preferably a court within the state where the claim in dispute is located. If such laws could be passed, legislation by administrative procedure would be reduced measurably with the result that prospecting and mining would be less chancy. As any miner can tell you, Nature has made prospecting risky enough without adding man-created uncertainties.

Hollis M. Dole, Director

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CANADIAN GAS FLOWS THROUGH CENTRAL OREGON

On December 3, 1961, the Pacific Gas Transmission Co. began supplying the San Francisco Bay region with natural gas from fields in the Edmonton, Alberta, area through its recently completed pipeline. Construction on this line, which is the world's longest 36-incher, began last January and cost about $350 million. The pipeline enters Oregon northeast of Hermiston and follows a route through the central part of the state, passing near Madras, Redmond, and Bend. It leaves the state near Malin on the California-Oregon border (see map).

Ralph Nabors, general superintendent for the Pacific Gas Transmission Co., said the compressor plant now under construction at Gilchrist would be completed in January 1962. The plant will have two 5,000 hp. compressors and plans call for five more compressor stations in Oregon, with 10-15,000 hp. capacity per plant. Total compressor push in the system will be around 270,000 hp.

At the present time it is expected the system will deliver 450 million cubic feet of gas a day to northern California and 150 million a day to Washington, Idaho, Montana, and Oregon. Gas for the northwestern states is taken off the line at Spokane, Washington, and delivered to El Paso Natural Gas Co., which is the distributor for the northwestern states.

The El Paso system is unique as far as natural gas delivery systems are concerned, since gas is delivered at both ends of the line. Now, with the new central Oregon pipeline in operation, it is possible to send gas into the northwestern states from three sources (see map). Pacific Gas Transmission Co. expects to be shipping one billion cubic feet of gas through the Alberta-California line by 1967.

Natural gas and petroleum products pipelines are new to the Pacific Northwest. El Paso's line from New Mexico was put into operation in 1955, and Canadian gas entered Oregon and Washington in 1956. It was announced this summer that Texaco, Inc., Shell Oil Co., and Magnolia Pipeline Co. will construct a 324-mile line to ship liquid petroleum products from refineries in northwestern Washington to points south, terminating at Portland. The pipeline will cost an estimated $17.5 million. Olympic Pipeline Co., a subsidiary of the three companies, will operate the system. Southern Pacific Co. is planning to start construction of a 123-mile petroleum products pipeline from Portland to Eugene early in 1962. Laying of the line will be done by Southern Pacific Pipelines, Inc., a subsidiary of Southern Pacific Co. Estimated cost of the project is $6.5 million. This new pipeline will carry products from tankers docked at Portland, and will follow the railroad right-of-way. Terminals will be built at Albany and Eugene. The pipeline will have a capacity of 13,000 barrels per day.

Plans to build a natural gas pipeline from Eugene to Grants Pass were agreed upon by officials of El Paso Natural Gas Co. and California Pacific Utilities Co. in December of this year. Cost of the project will be $8 million. California Pacific will extend its distribution system to carry gas to Medford and Ashland. Final approval of the project lies with the State Public Utility Commissioner and the Federal Power Commission.

The introduction of natural gas and petroleum products transmission lines in the state offers incentive to industrial growth, since manufacturers looking for prospective sites in Oregon will be able to find an energy supply suitable for any operation with electricity, liquid petroleum, and natural gas available in large quantities.

* * * * *

CORNUCOPIA PROPERTY GOES TO HIGHER BIDDER

A higher bid for the Cornucopia property resulted in refusal by the Referee in Bankruptcy to confirm the November 20 sale to Carl M. Stolle, Spokane (see November 1961 Ore.-Bin). The referee called the sale for December 12 after receiving a bid of $13,500. The property went to Morris Weisberg, a Pittsburgh investor, who closed the bidding at $50,250. An Oregon group, headed by Arthur V. Olson of Eugene, is seeking to acquire the property for recreational development.

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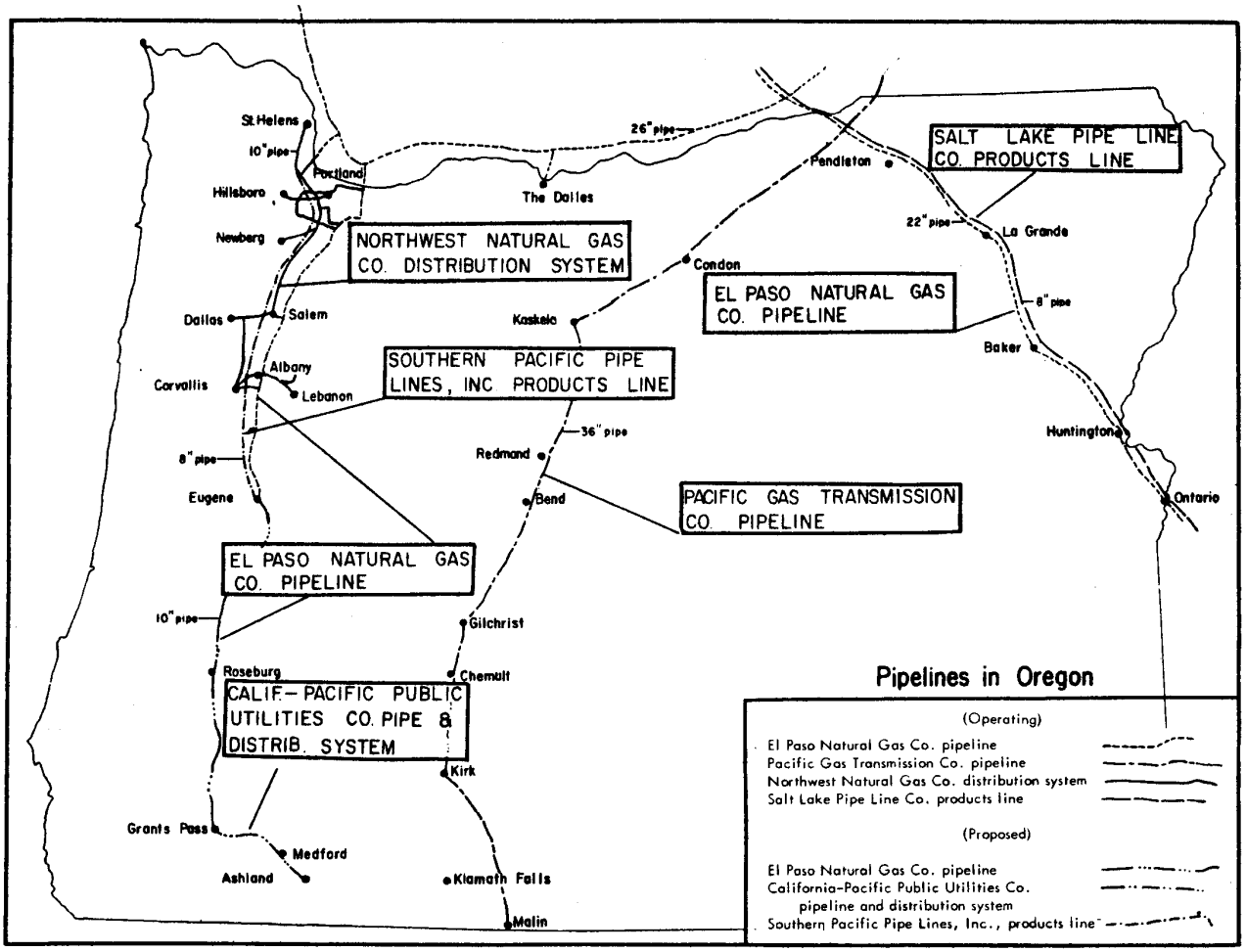

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FERRUGINOUS BAUXITE FOUND IN CHEHALEM HILLS

Exploratory drilling in the Chehalem Hills near the town of Newberg has revealed the presence of an apparently thick section of high-iron bauxite on the north slope. The hills are a homoclinal block tilted to the northeast, capped by flows of Miocene basalt deeply weathered on the upper surface. The discovery hole is situated on the top of a northeast-trending ridge in the SE¼-NW¼ sec. 3, T. 3 S., R. 2 W. at an elevation of approximately 1,014 feet.

The bauxite zone in this hole lies beneath 6 feet of reddish silty clay. Samples were taken from a depth of 19 feet. Test holes to the north and east of this locality on some of the lower ridges indicate an increasing thickness of silty clay overburden downslope. More work will need to be done before the area can be evaluated properly.

The analyses given below show the composition of the ore taken at 2-foot intervals beginning near the surface at the clay-bauxite interface.

Sample No.	Depth	L.O.I.	Al_2O_3	SiO_2	Fe_2O_3	TiO_2
26825	5' - 7'	21.12	35.05	12.34	29.33	2.20
26826	9' - 11'	21.16	30.70	4.40	43.10	0.63
26827	13' - 15'	19.32	16.25	3.64	58.63	2.20
26828	17' - 19'	19.60	34.10	4.64	37.70	3.80

* * * * *

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