The ORE BIN
Vol. 24, No. 1
January, 1962

OREGON'S MINERAL INDUSTRY IN 1961

By

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After staunchly surging upward each year for the past five years in spite of several nationwide economic reverses, Oregon's value of minerals produced dipped slightly in 1961. Preliminary estimates by the U.S. Bureau of Mines for last year's mineral production show a total of $48,089,000, a drop of approximately 12 percent. Reduction in the demand by industry for sand and gravel and cement accounted for the bulk of the decline. The long-range trend in Oregon's mineral economy is perhaps best reflected in the 50 percent increase of the state's contribution to the total United States mineral production since 1955. During the same period total United States mineral production increased about three percent.

Completion of a trans-state natural gas line and early construction of additional gas and products lines and distribution facilities in the state (see December 1961 Ore.-Bin) presage a new series of metallurgical developments which may well have widely ranging economic significance. Possible pattern for such a trend has been established at Albany, "exotic metals capital of the United States," where three space-age metals operations employ nearly 1,000 men. All of the raw materials other than power and water for these plants are shipped into the state. Exploration for oil in the state went forward on two fronts. Four major oil companies engaged in offshore investigations during the last half of the year and there was intensive leasing in the central Willamette Valley as the year ended.

METALS

Copper

The long-range study of copper mineralization in the state, started last year by the department, was continued actively during the year. The study includes geologic mapping, petrographic examinations, and geochemical prospecting. Field work was concentrated in a mineralized area a few miles north and east of Baker.

Late in the year the Golden Road Mining Co. began shipping lump copper ore from the Elmer Milton property 18 miles north of Rogue River in

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Jackson County. Small production of concentrates was reported from the Mount Bolivar property in Douglas County, where a 50-ton mill was erected during the summer.

Aluminum

Harvey Aluminum increased by approximately 25 percent the melting capacity at its primary reduction plant located at The Dalles in Wasco County. The new smelting facilities with integrated heat treating and billet casting were placed on the line during the first quarter. The enlarged plant has an annual capacity of approximately 75,000 tons of primary metal.

Two new reduction plants for the state were indicated when Cerro Corp announced plants for construction of a 55,000 ton smelter on deep water at Wauna, 40 miles upstream from the mouth of the Columbia, and Howe Sound Co. negotiated with the Port of Portland for a plant site at the confluence of the Willamette and Columbia rivers to erect a $25 million plant. The company announced that an electrolytic manganese plant would also be built on the same site.

Exploration for ferruginous bauxite by the department revealed the presence of ore on the north flank of the Chehalem Mountains near Newberg in Yamhill County. Minor exploration in northwestern Oregon was reported by two major aluminum companies.

Gold

Over two years of hard work and more than 1,500 feet of tunnelling finally paid off at the Buffalo Mine in Grant County. James P. Jackson, Jr., mine owner and manager, drove the 600 level in from a new portal and tapped the Constitution vein 253 feet below the last workings on the south end of the vein on the 400 level. The vein, as exposed by several hundred feet of drift, carries good values and has a width comparable to that on the upper level. The persistence of the vein at depth not only spells continued life for the Buffalo, which began producing in 1903, but pumps new hope into other mines in the district which have similar mineralization.

Sale of the Cornucopia gold mine in northeastern Baker County late in the year to an eastern investor served to recall the colorful past of this major gold producer in Oregon. Located in the late 1870's, the mine confounded the experts by producing over $3 million after it was reported to be mined out in 1930. The property has been idle since it was shut down during World War II by the ill-advised government order L-208.

The Warner mine in the Greenback District, Josephine County, was operated by Frank Gelhaus. It was the top producer among the 15 lode gold mines active in the state last year.

Placer mining activity was largely confined to southwestern Oregon, where 17 miners operated during high water periods only. Opposition to any form of placer mining, even skin diving, increased during the year.

Particular concern was expressed by various governmental agencies which are more concerned with pleasure than payrolls. Mining people were confused by the welter of conflicting testimony concerning certain fishing streams which have also had some placer mining on them. The Rogue River and its tributaries have been intensively placer mined for more than 100 years and yet the Rogue remains a top fishing stream known the world over, they pointed out. Skin diving for gold became a recreational activity for many people in the state in 1961. Equipment ranged from the simplest face mask and "snorkel" to complete SCUBA outfits plus gasoline-powered floating section pumps and lightweight underwater "dredges." Appraisal of the skin diver's luck is difficult, since only rarely does the successful operator tell about his discoveries for fear of attracting too much competition.

Exotic metals

The Wah Chang Corp. plant at Albany added the fabrication of tungsten and molybdenum to its list of products, thereby covering the entire heat spectrum of the refractory metals. The plant is fully integrated and processes columbium, tantalum, hafnium, and zirconium ores through to mill products. The corporation's research center developed a superconductive wire made from a columbium-zirconium alloy and was able to produce it in more than laboratory quantities for industry.

Oregon Metallurgical Corp., also at Albany, continues to be the only known commercial producer of tungsten or other refractory metal-cast shapes. Other products include titanium ingots and castings, zirconium alloy ingots, and high-purity vanadium. Experimental work was done on vacuum-melted ferrous and copper-base alloys and on specialties such as deep-drawn zirconium crucibles.

Sierra Metals Corp., a subsidiary of Martin Marietta Corp., started construction of a $750,000 metallurgical research laboratory near Beaverton. Sierra will employ 25 scientists to develop high-temperature processes and materials for space exploration, defense, and industry.

Mercury

Production of mercury in Oregon, once one of the leading mercury states in the Union, slumped to a mere 133 flasks. Bulk of production came from the Bretz mine in Malheur County operated by the Arentz Comstock Mining Venture of Salt Lake City. Small production was also reported from the Red Rock group of claims in Harney County and the Elkhead mine operated by Washington Mining Co. in Douglas County. Considerable core drilling at the Elkhead encouraged the company to drive a 200-foot crosscut 100 feet below the lowest workings. Several hundred feet of drifting exposed good low-grade ore and the company reportedly is planning on opening the mine for production. At the Nisbet mine in Clackamas County a deep drilling project in cooperation with the Office of Minerals

Some of Oregon's Minerals at a Glance
Preliminary Figures for 1961
(in thousands of dollars)

	1960	1961
Clays	$ 370	$ 310
Gold	29	23
Mercury	108	26
Sand, gravel	16,170	13,000
Stone	19,721	19,000
Misc.*	14,124	16,749
TOTAL	$ 54,520	$ 48,089

* Asbestos, carbon dioxide, cement, copper, diatomite, gem stones, lead (1961), lime, nickel, pumice, silver, uranium, zinc (1961).

Exploration was nearing completion at year's end. The Werdenhoff Mining Co. suspended exploration at the Mother Lode Mine in Crook County shortly after the erection of a Herreschoff furnace.

Nickel

The Hanna Mining Co. open-pit nickel mine and the Hanna Nickel Smelting Co. reduction plant at Riddle in Douglas County were in continuous operation throughout 1961. Hanna purchased the plant from the government during the year and began selling ferronickel, upgraded from 45 to 55 percent nickel content, to commercial customers. Approximately 1 million tons of ore were mined from the top of Nickel Mountain and aerial trammed down to the smelter below, where nearly 21 million pounds of contained nickel were produced.

Chromite

Although no chromite was mined in the state last year, there was considerable interest shown by miners and metallurgists in the possibility of establishing a local ferrochrome plant. A report "Ferrochromium From Western Metallurgical-Grade Chromite" issued by the U.S. Bureau of Mines (Report of Investigations 5897) in 1961 pointed out that all of the necessary raw material for the production of ferrochromium is available in the area and that the electrical energy requirements for the smelting of a 60 percent grade product are relatively low. The report relates that there appears to be sufficient metallurgical grade beneficiable ore in the western coastal states to sustain a 25,000-ton-a-year smelting schedule for 25 years.

Late in the year the California-Oregon Chrome Producers' Assn. announced plans for establishing a chrome depot at Crescent City, California. Under the plan a producer would get half of the market price for his ore upon delivery to the depot, with the balance to be paid upon eventual sale. The association hopes to accumulate approximately 10,000 tons of ore for shipment to the east coast by boat.

Uranium

Kermac Nuclear Fuels Corp. purchased the Lakeview Mining Co. uranium mill located at Lakeview in March. The mill has been idle since late in 1960, when ore mined from the White King mine open pit was exhausted.

Vance Thornburg began unwatering the White King pit in April and by year's end had shipped 15 cars of high grade ore to Vitro Chemical in Salt Lake City. Thornburg began erection of a headframe over the old No. 1 White King shaft in November. The Lucky Lass property near the White King shipped several cars of ore to Vitro and began underground mining in November.

INDUSTRIAL MINERALS

Building Stone

Interest in Oregon building stone continued at a high level during 1961. Increased use of ornamental stone in commercial buildings and private residences required quantities of local and out-of-state stone. The selection of such stone is based largely on its appearance, and individual taste with respect to color, texture, and shape vary widely. It is little wonder that shipments come from considerable distances to supply a definite demand and local stones travel far from home for the same reason. Oregon quarries, scattered over the state, produced a variety of colorful stones which spanned the color spectrum from green through yellow and brown to pink. Most were of volcanic origin with airborne and water-laid tuffs predominating. Some of the state's many lavas were also used, and although they tended to be less colorful they were more interesting texturally. A survey of building stones conducted by the department located a lava outcrop which emits a musical tone when struck. Lavas with warped fossil bubble holes and tuffs which can be carved, glazed, and fired are also available from Oregon quarries.

Although most building stone is produced commercially and placed professionally a growing trend was noted during the year towards more "do-it-yourself" stone masonry. Particular interest was indicated in homemade panels and slabs of exposed aggregate with either cut and polished or rough surfaces.

Lightweight aggregates

Production of the natural lightweight aggregates pumice, volcanic cinders, and scoria, continued at about the same rate as last year. Two operators produced expanded shale from quarries in northwestern Oregon and a considerable quantity of the bloated shale was fine ground and used as a pozzuolan substitute for portland cement in monolithic concrete poured at the John Day Dam. The pozzuolan lessened the heat produced by the setting of the concrete, lowered the cost, and reduced shrinkage. Lightweight concretes continued to invade the structural field traditionally dominated by lumber and steel, with the only limits in sight being the ability to handle the size of the piece produced and the imagination of the architect and engineer.

Sand and gravel

As it has for many years, the production of sand and gravel and crushed stone provided the largest value of all the mineral commodities produced in the state. Compared to the previous year there was a decline of approximately 18 percent from the 17.7 million tons reported in 1960. The decrease is directly related to dam and highway construction. Production of aggregates by commercial operators supplying industrial and domestic markets continued at about the same rate as previously. Growing concern was expressed by both sand and gravel operators and local and state government agencies over the rapid encroachment by urbanization which is paving over, building on, or zoning out existing and potential quarries.

Bentonite

Production of bentonite by Central Oregon Bentonite Co. more than doubled over the previous year. The bentonite is dug from shallow pits in eastern Crook County and is used for sealing stock ponds and irrigation canals, for facing foundry sand molds, for drilling muds in oil wells, and for binding feed pellets. Some bentonite was shipped to Hawaii for dusting pineapples.

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OIL AND GAS EXPLORATION IN 1961

By

Vernon C. Newton, Jr.*

This is the first year since enactment of the Oil and Gas Act in 1953 that the Department did not record a single new oil test hole. Some footage can be claimed for 1961 as Humble Oil & Refining Co. completed drilling in February on its second well, the "D.J. Leavitt No. 1", a short distance south of Lakeview. Total depth was 9,579 feet. At the end of 1961, Oregon was still one of the nation's nonproducing states. In spite of the low drilling record, 1961 was one of the most active oil exploration years in Oregon history. Thirteen major oil companies and one independent company made geological and geophysical surveys this past year.

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Offshore and coastal developments

In May 1961, the Oregon legislature passed an offshore lease law which allowed for exploration in coastal waters and resulted in application by three major oil companies for permits. These companies, namely the Gulf Oil Corp., Shell Oil Co., and Union Oil Co., were joined later in the summer by Standard Oil Co. of California. The main portion of the work consisted of seismic studies. No applications for offshore leases have been made to date. The law requires that leases for offshore parcels be granted to the person offering the highest cash bonus submitted in sealed bids. Size of each lease can be no greater than 3 by 6 miles in area, or approximately 13,200 acres, and the annual rental shall be 50 cents per acre.

R. J. Deacon, publisher of Northwest Oil Report, Portland, reported in a news release in November that nine oil companies had jointly contracted for aerial magnetic surveys along the Oregon and Washington coasts. The participating companies were: Standard Oil Co. of California, Humble Oil & Refining Co., Mobil Oil Co., Ohio Oil Co., Pan American Petroleum Corp., Phillips Petroleum Corp., Richfield Oil Corp., Superior Oil Co., and Texaco, Inc.

Willamette Valley leasing

In November news of a leasing play along the eastern side of the valley came into the Department in the form of telephone calls from landowners seeking information on leasing policies and development regulations. An estimated 100,000 acres were under lease in the Willamette Valley and adjacent area for oil and gas minerals by the end of 1961 and leasing was continuing in 1962. Oil companies reported to be putting acreage together in this area are: Humble, Gulf, Superior, and Reserve. A group headed by Wesley Bruer of Bakersfield, California, leased an area south of Salem in August for oil exploration, and Willard Farnham of Portland applied for leases on state and federal land along the east side of the valley.

It appears that the attraction behind the present leasing along the east side of the Willamette Valley is based upon a projection of Tertiary marine sediments and possibly Mesozoic sediments, beneath the volcanic rock which borders the Western Cascades. Subsurface geologic information in this region is essentially nonexistent and therefore it appears likely that some of the present interest might stem from results of the drilling northeast of Lebanon by the Linn County Oil Development Co. in 1958. Shows of oil and gas in this well were reported in the press by company officials.

Leasing in Coos and Douglas Counties

Activity reported thus far in northern Coos and southern Douglas Counties has been scattered with no particular concentration. One party, however,

Willard Farnham of Portland, Oregon, awakened interest by filing application in June 1961 for a lease on the Elliott State Forest consisting of about 80,000 acres. Action on the application is still pending.

Eastern Oregon drilling

Two-State Oil & Gas Co. of Boise, Idaho, began drilling a well near Vale, Oregon, in September, but terminated work at a depth of 250 feet when unable to meet the requirements of the state Oil and Gas Act.

Records and statistics

Footage drilled by years	
1954	20,509
1955	41,920
1956	9,458
1957	29,024
1958	17,113
1959	5,192
1960	22,802
1961	6,479

Up to the present, 162 oil and gas tests have been drilled in the state without a single commercial discovery. Of this number, however, not more than 30 wells were drilled with what is generally considered as adequate supervision and only about 18 were drilled as a result of reliable field studies. In western Oregon the Tertiary marine basin covers an area of about 12,000 square miles, in which only about a dozen wells have penetrated enough section to be helpful in projecting subsurface conditions. In eastern Oregon, where less drilling has been done, an area of 6,000 to 8,000 square miles of Mesozoic-Paleozoic marine basin offers prospect for production.

Well Records Released from Confidential Files in 1961

Company	Well Name	Location	County	Depth	Records*
Miriam Oil Co.	Elliott No. 1-deepening	SW¼ sec. 9 T.8 S., R.5 W.	Polk	1,822'	Driller's log, cuttings
V.V.Erntson	Schermacher No. 1	NE¼ sec. 27 T. 9 S., R.2 W.	Marion	2,426'	Electric log, driller's log, cuttings
Ross Mitchell	Bliven No. 1	NW¼ sec. 15 T. 8 S., R. 5 W.	Polk	1,347'	Driller's log, gas analysis, cuttings
Ross Mitchell	Paige No. 1	SW¼ sec. 11 T. 8 S., R. 5 W.	Polk	600'	Driller's log, cuttings
Sunnyvale Oil Co.	Federal-Mitchell No. 1	SE¼ sec. 14 T. 16 S., R. 29 E.	Grant	1,168'	Petrographic description, cuttings

*Cuttings available for study at Portland.

GEOLOGIC MAP OF WESTERN OREGON NOW AVAILABLE

The long-anticipated geologic map of the western half of Oregon has been received by the United States Geological Survey and the State of Oregon Department of Geology and Mineral Industries and is now available for general distribution. The map is entitled "Geologic Map of Oregon West of the 121st Meridian" and bears the U.S. Geological Survey designation of Miscellaneous Geologic Investigations Map I-325. It was prepared under the direction of Francis G. Wells and compiled by Dallas L. Peck of the federal agency.

More than 80 geologic units are shown on this multicolored map and are briefly described in the legend. The scale of the map is 1:500,000 or approximately 1 inch = 8 miles. The map sheet, which measures 48 by 66 inches, also includes four geologic cross sections, a small tectonic map of the area, and an index map of sources of geologic data together with numerous references to literature.

Publication of this map represents the culmination of a century of geologic investigation in western Oregon, beginning with that of the pioneer geologist, Dr. Thomas Condon. The first geologist to do detailed mapping in this part of the state was J. S. Diller of the federal survey. Diller's work began in the 1890's and continued almost uninterruptedly until 1907. The results of his studies in southwestern Oregon were published by the Survey in four folios: Roseburg, Coos Bay, Port Orford, and Riddle.

Since Diller's time many geologists have done field mapping in western Oregon, working on state or federal assignments or as graduate students gaining master's or doctoral degrees. Their findings have contributed significantly to the present map.

Beginning in 1951, the reconnaissance mapping in unsurveyed areas was carried out on a cooperative basis between this department and the U. S. Geological Survey. Several oil companies gave generous support to this project. Field work was completed in the fall of 1956 and compilation of the final map and its publication were performed by the Geological Survey.

Geologic mapping of the eastern half of Oregon to complete the state geologic map is in progress but is not expected to be ready for compilation for a number of years.

Four major geomorphic provinces lie within the mapped area, as follows: Coast Range, Klamath Mountains, Willamette Valley, and Cascade Range. Small portions of the Basin-Range, High Lava Plains, and Deschutes-Umatilla Plateau flank the Cascades along the eastern margin.

The northern Coast Range is composed of Eocene submarine volcanic rocks, mainly pillow lavas and palagonitic tuffs and breccias flanked by later Tertiary marine sandstones, tuffaceous shales, and mudstones. The southern part is underlain almost entirely by Eocene marine sandstones and shales.

The Klamath Mountains have a core of Paleozoic schists which underlie a thick sequence of interbedded marine and nonmarine Mesozoic volcanic and sedimentary rocks. The entire section has been tightly folded, faulted, and intruded by ultramafic to acid plutonics. Slightly deformed Upper Cretaceous marine sediments occur in troughs and grabens within the mountains and along the coastal border.

The Willamette Valley is a flood plain with isolated hills, lying in a structural trough between the Cascade and Coast Ranges. The unconsolidated Quaternary sands and gravels which blanket most of the valley are underlain by marine Oligocene and Eocene sandstones and shales. Miocene lavas cap marine sediments in the northern part of the valley, and in the Portland area consolidated sands and gravels of Pliocene age fill local structural basins.

The Cascade Range is divisible into the Western Cascades and High Cascades and is best described as a great pile of volcanic rocks. The section underlying the Western Cascades ranges in age from late Eocene to early Pliocene and is composed mostly of pyroclastics with interbedded lava flows and lenses of continental waterlaid sediments. These sediments intertongue with or grade westward into the marine Eo-Oligocene sediments that lie beneath the Willamette Valley.

The High Cascades are the majestic volcanic peaks, cinder cones, and relatively undissected lavas along the summit of the range. Most peaks are Plio-Pleistocene in age. Recent flows and cinder cones are common. The lavas are dominantly basaltic andesites and olivine basalts with some scattered outcrops of rhyolite and obsidian. Mt. Hood, one of the extinct volcanoes that cap the range, rises to an elevation of 11,245 feet, the highest point in Oregon.

Copies of Map I-325 may be purchased from the U.S. Geological Survey, Denver Federal Center, Denver, Colorado, at a price of $2.00, or from the Oregon department's offices in Portland, Grants Pass, and Baker for $2.00 at the counter, $2.15 mailed folded in an envelope, or $2.50 mailed unfolded in a map tube.

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LESTER CHILD DIES

Lester Child, member of the department's Governing Board from 1957 to 1960 (see July 1957 "Ore Bin"), died in Grants Pass January 23 at the age of 75. He was very active in the fields of business and geology, with special interest in petroleum exploration. In recent years he was a member of the Western Governors Mining Advisory Council and the Interstate Oil Compact Commission.

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MORE THESES ON OREGON GEOLOGY AVAILABLE

The master's theses on Oregon geology listed below represent those completed by graduate students at Oregon State University during 1959, 1960, and 1961. A similar list of University of Oregon theses was published in the November 1961 Ore Bin, and the two lists supplement the department's Miscellaneous Paper No. 7, "Bibliography of Theses on Oregon Geology." Those theses marked with an asterisk may be consulted in the department's library in Portland.

Greene, Frank F., Geology of the northeast corner of the Sparta quadrangle and vicinity, Oregon. 1960

* Johnson, George D., Geology of the northwest quarter Alvord Lake Three quadrangle, Oregon. 1960

* Jones, Robert W., Lower Tertiary foraminifera from Waldport, Oregon. 1959

Lauritsen, Don A., Humphreys spiral beneficiation of sulfide ores from the Bohemia district Musik mine (Oregon). 1961

* Maloney, Neil J., Geology of the eastern part, Beaty Butte Four quadrangle, Oregon. 1961

* Pilcher, Stephen H., Rock alteration and vein mineralization at the Buffalo mine, Grant County, Oregon. 1959

* Taylor, Edward M., The geology of the Clarno basin, Mitchell quadrangle, Oregon. 1960

* Wetherell, Clyde E., Geology of part of the southeastern Wallowa Mountains, northeastern Oregon. 1960

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HIGH PURITY METALS EXHIBITED

An exhibit of high purity metals from Cominco Products, Inc., Electronic Materials Department, Spokane, Washington, has been on display for the past month in the Portland office of the Department of Geology and Mineral Industries. Metals of 69 grade (99.9999 percent pure), including antimony, arsenic, bismuth, cadmium, indium, lead, silver, tin, and zinc, and also various alloys comprise the exhibit. These ultra pure materials are protected against contamination by special packaging in plastic, inert atmosphere, or vacuum. They are made in forms such as ingots, bars, sheets, ribbon, wire, shot, powder, and a variety of preforms for specific applications in the electronics industry.

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NEHALEM WAX GETS CARBON 14 DATE

A redetermination on the age of the Nehalem beeswax has been made in the laboratory of the Shell Oil Co. by the carbon 14 method. The new results, obtained late in 1961, agree favorably with the belief, based on historical data, that a Spanish galleon bringing beeswax from the Philippines to Mexico was wrecked on the Oregon coast in the early 1700's. Previous carbon 14 tests on the beeswax by Shell's laboratory, using modern wood as a standard, resulted in a date about 200 years older than expected. The new determination used a sample of modern beeswax collected in 1937 prior to possible contamination by products of nuclear explosions as a comparative standard. The laboratory report is as follows:

> "The age which we now obtain is 280$^{\pm}$ 110 years with a 95 percent confidence level for the measurement. This places the date of formation of the beeswax between 1570 A.D. and 1790 A.D."

Over the years, more than 12 tons of beeswax has been dug from the sand spit near the mouth of the Nehalem River, giving rise to much speculation regarding its origin. One of the theories that evolved, and which continues to crop up despite evidence to the contrary, is that the wax is a natural deposit of ozocerite (or ozokerite) and indicates the presence of oil. Ozocerite is a plastic waxlike paraffin sometimes found in veins and believed to result from the drying out of a paraffin-base oil. The Nehalem "deposit", however, occurs in the form of molded slabs of uniform dimensions bearing trade marks and even candle wicks. Moreover, chemical tests of the Nehalem wax present conclusive evidence that the material is real beeswax. The carbon 14 dating by Shell's laboratory precludes any possibility of the wax being the residue of a fossil oil field and gives Oregon unquestioned claim to a unique cargo from the Orient.

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PHILIPPINES PRODUCE GOLD

Benguet Consolidated, the largest gold producer in the Philippine Islands, produced 20,693 ounces of gold in September 1961, for which it received 3,517,000 pesos - equivalent to 724,250 American dollars. The Philippine Central Bank purchased the output at 170 pesos per ounce. Formerly, Benguet received 70 pesos per ounce. The higher price represents a subsidy by the Philippine Government to Philippine gold mines. (From "News Letter", Nevada Mining Association, January 15, 1962.)

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PACIFIC STONEWARE PRODUCTION EXPANDS

As many companies move to faster, automatic production, Pacific Stoneware, Inc., has found that the market for handmade items is growing. For this reason the company is increasing its inventory of old pottery items with modern adaptations. In some cases the original molds, unused since grandmother's day, are being brought back into production. A partial list would include:

1. Original butter churns - for lamp bases.
2. Hand decorated planters and vases.
3. Patio sand jars.
4. Cast stone cooking ware.
5. Hand-thrown pottery cups, bowls, mugs, bean pots, jugs, and casseroles.
6. Foot warmers - squat jugs which were filled with hot water.

Pacific Stoneware, Inc., was organized in Portland in 1870, and since 1923 has been at the same location at 9217 N. Peninsular Avenue. It has been owned by the Welsh family for the past two years, with Bennett Welsh in charge of the plant. Sales are handled by Fred Cheek. Bennett Welsh operated a pottery in Gresham from 1947 to 1953 and later was head of ceramic production at Tektronix, Inc. In days before the modern cannery appeared, the production at this plant was divided about equally between flower pots and such items as stoneware crocks, tubs, and jugs. Flower pots of all sizes still form a major portion of the plant production. To eliminate packing for shipment, all orders to dealers are delivered by company truck throughout most of Oregon, Washington, and Idaho.

The present production of flower pots and glazed pottery is made primarily from a combination of local alluvial clays and black ball clay purchased from Willamina Clay Products Co. The raw clays are washed and refined during the blending process. The clay from Mica, Washington, which had been used in making stoneware, has been exhausted, and full-scale stoneware production cannot be resumed until another source is found. Clay brought in from Tennessee or Livermore, California, carries such a high freight rate that it can not be used for local production, even for local distribution. Mr. Welsh needs a refractory, stoneware-type clay. It must be self-slaking, since the wet process of refining is used, and should burn to a buff or light-brown color.

An exhibit of some of the products made by Pacific Stoneware will be on display in the department's museum in Portland beginning in February. Samples of raw clays, refined clay, molds, unfired pieces, and an assortment of glazed pottery will be shown.

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H.R. 1960 NEEDS ACTION

H.R. 1960, which was introduced by Rep. Poff (Virginia) and passed the House last July 10, is still in the Senate Judiciary Committee. This bill would permit a ruling of the Secretary of the Interior as to the validity of any mining claim to be challenged in the U.S. District Court for the area in which the claim is located. The Senate Judiciary Committee deferred action until this session of Congress. If passed into law, judicial review of hearings officers would be greatly simplified and be less costly. The American Mining Congress, in its meeting last September, urged the passage of this type of legislation with the following policy statement:

"The prevailing rule that the validity of administrative rulings of the Secretary of the Interior with respect to mining claims can be challenged only in a proceeding brought in the District Court of the District of Columbia places an undue burden on owners of such claims. We favor legislation conferring jurisdiction to review such determinations on the U.S. District Court in the district in which the mining claims are situated.

"We believe the executive agencies should administer the General Mining Laws, as amended, in accordance with the terms of those laws and the intent of Congress as expressed at the time of their enactment or amendment. Such Congressional intent should not be thwarted or distorted by administrative rulings or determinations.

"We urge upon the Department of Agriculture and its Forest Service, and upon the Department of the Interior and its Bureau of Land Management, that their regulations be administered uniformly to the end that the development of our natural resources may be prosecuted without undue burden."

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AIME CONFERENCE IN SEATTLE

The AIME - ASM will hold the Pacific Northwest Regional Minerals and Metals Conference at Seattle on April 26-28; headquarters will be at the Benjamin Franklin Hotel. The meeting dates will coincide with the opening week of Century 21, Seattle's World Fair.

A total of eight sessions is anticipated, the number being kept to a minimum to avoid conflicting papers. A series of presentations is planned in the following fields: mining, geology, mineral beneficiation, industrial minerals, extractive metallurgy, and physical metallurgy. Details on programming will follow at a later date.

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OREGON LAND WITHDRAWALS - 1961

During 1961, federal bureaus made application for the following land withdrawals in the State of Oregon. The total acreage applied for was 28,849. This compares with 4 withdrawals and 1,287 acres in 1960; 12 withdrawals and 20,737 acres in 1959; 5 withdrawals and 44,323 acres in 1958; and 17 withdrawals and 20,402 acres in 1957.

Agency requesting withdrawal	Acreage	County	Reason
U.S. Bureau of Reclamation	240	Malheur	Bully Creek Reservoir
U.S. Corps of Engineers	730	Linn	Green Peter Reservoir
U.S. Forest Service	824	Josephine Jackson Curry	Recreation use
U.S. Forest Service	975	Grant Curry	Recreation use
U.S. Forest Service	4,872	Crook Wheeler	Consolidate national forest land for administrative purposes
Bonneville Power Administration	10	Deschutes	Hampton Substation
U.S. Dept. of Agriculture	1,702	Josephine Jackson Deschutes	"Strengthened security of tenure"
U.S. Bureau of Land Management	19,496	Malheur	"For recreational pursuits pertaining to petrified materials"

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TECTONIC MAP OF UNITED STATES AVAILABLE

A new edition of the Tectonic Map of the United States has been published by the U.S. Geological Survey and is for sale for $4.50 by the Distribution Section, U.S. Geological Survey, Denver Federal Center, Denver 25, Colorado. The map is published in two sheets, each about 41 by 54 inches, and has a scale of 1:2,500,000 (1 inch equals 40 miles).

The purpose of the map is to show the major structural features (faults and folds) resulting from deformation of the earth's crust. These features are shown by symbols, patterns, and contour lines. Various color patterns on the map delineate regions of Precambrian, Paleozoic, and Mesozoic rocks, intrusive igneous and volcanic rocks, and selected areas of Cenozoic sedimentary rocks having broad tectonic features.

The map was prepared as a joint project of the U.S. Geological Survey and the American Association of Petroleum Geologists and is of special interest to economic geologists engaged in search for petroleum, natural gas, and ore deposits.

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MARINE MINING DEVELOPED

Dr. Hiroshi Niino, marine geologist of Tokyo University, in a recent statement, said that Japan has dredged about 7 million tons of iron ore from the ocean floor of Tokyo Bay from a depth of 90 feet. Dr. Niino said that the ore is very high grade and is one of the major deposits of iron ore in Japan. It is also reported that the Soviet Union is actively engaged in the investigation of marine mining and to have a fleet of 6000-ton research vessels at work in the Arctic, Atlantic, and Pacific Oceans. (From "News Letter", Nevada Mining Association, January 15, 1962.)

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NOTED PALEOBOTANIST DIES

Dr. Roland W. Brown, eminent paleobotanist formerly with the U. S. Geological Survey, died in Pennsylvania December 21, about three years after his retirement. Dr. Brown, known affectionately as "Brownie", spent some of his last field summers in Oregon in connection with the state geologic map project. His identification and dating of fossil plants in the Western Cascades and in various parts of central and eastern Oregon aided materially in the mapping of continental sediments.

As attested by the long list of his works, published in Professional Papers by the Survey and in scientific journals, his studies were varied and spread widely over the western United States. Among his papers are numerous additions to and revisions of Oregon paleobotanical material from such localities as Bridge Creek, Sucker Creek, and Mascall Ranch.

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The ORE BIN
Vol. 24, No. 2
February, 1962

OREGON ACADEMY OF SCIENCE ABSTRACTS
Geology and Geography Section - 1960 and 1961

The 15 abstracts published in this issue of the ORE BIN are from papers presented before the Geology and Geography Section of the Oregon Academy of Science at its 1960 and 1961 meetings.

Between 1943 and 1954, all abstracts submitted were published in one of the three volumes of the "Proceedings of the Oregon Academy of Science." Since 1954, however, it has not been feasible for the Academy to publish its proceedings and as a result the abstracts have not appeared in print.

Many of the papers that have been presented in the Geology and Geography Section are of lasting value because they reveal areas of geologic interest, progress of studies, and new discoveries. Thus, in order to make this information available to the public, the Department of Geology and Mineral Industries is printing the abstracts in the ORE BIN with permission ot the Academy. It is planned that as space permits selected sbstracts from meetings prior to 1960 will also be published. Publication of abstracts for the 1962 Oregon Academy of Science meeting will rest on the decision of the Academy.

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SOME ASPECTS OF THE REGIONAL GEOLOGY OF SOUTH-CENTRAL OREGON

By George W. Walker
U. S. Geological Survey, Menlo Park, California

Abstract

Reconnaissance geologic mapping of south-central Oregon is being done by the U. S. Geological Survey, in cooperation with the State of Oregon Department of Geology and Mineral Industries, as part of a larger program to prepare a geologic map of the eastern half of the state. Current work in south-central Oregon is limited geographically to the eastern half

of the Klamath Falls 2-degree quadrangle and to the western part of the adjoining Adel quadrangle.

Rocks exposed in this region are all of Cenozoic age, and include local thick prisms and thin attenuated sheets of basalt that intertongue with or are separated by units of tuff and tuffaceous sedimentary rock which are subaerial, fluviatile, and lacustrine in origin. Late Cenozoic lake deposits are widespread.

The age of the oldest Cenozoic rocks, which include volcanic materials largely of andesitic and dacitic composition as well as some altered basalt, is unknown; they are overlapped, however, by acid tuff and tuffaceous sedimentary rocks that contain fossils of probable John Day age. Fossil vertebrates, plants, and diatoms indicate that the stratigraphic section also contains rocks of middle and late Miocene age as well as rocks of Pliocene and Pleistocene age.

Structurally, the area is characterized by broad anticlinal and synclinal warps that are highly modified by block faulting and by constructional volcanic features. Concurrent warping and block faulting were active at least by middle Miocene time; they were dormant, or nearly so, at the time of formation of high-level pluvial lake terraces, possibly as late as 11,000 years ago. By mid-Pliocene time, and perhaps considerably earlier, separate depositional basins had formed that affected the distribution of the Pliocene and younger eruptive and sedimentary rocks. (1961)

GEOCHEMICAL PROSPECTING FOR COPPER IN THE BAKER, OREGON, AREA

By Richard G. Bowen
State of Oregon Department of Geology and Mineral Industries

Abstract

Field testing of streams and soils for their copper content was done during the summer of 1960 in an area near Keating, Baker County, Oregon. Prospecting was restricted to the Clover Creek Greenstones, a formation in which small amounts of copper have been found in the past.

Streams draining the area were sampled using dithizone. Soil samples were taken and tested with 2, 2' biquinoline. Several traverses were made in order to determine the background content of readily available copper in the various rock units of the Clover Creek Greenstones.

An anomaly having a minimum size of 7 acres was found during the soil sampling program. (1961).

HISTORY OF LATE TERTIARY MAMMALIAN FAUNA OF THE NORTHERN GREAT BASIN

By J. A. Shotwell
Museum of Natural History, University of Oregon

Abstract

In the late Tertiary, mammalian faunas of the Northern Great Basin show dramatic changes. Many groups of mammals are lost. Numerous mammals from Eurasia, South America, and other regions of North America appear as new members of the fauna in the Pliocene. The beginnings of the modern fauna are in this segment of time. These mammals may be assigned to communities by using careful quantitative techniques. The investigation of the resultant fossil mammalian communities has provided essential information concerning the origin and diversity of communities. It provides a basis for the study of faunal change as it concerns environmentally related mammals. A review of vegetational change indicates that a close correlation exists between these two histories. These two areas of investigation point out significant facts which allow a basic understanding of the history of our fauna. (1961)

THE ROLE OF WEATHERING IN GEOMORPHOLOGY

By Ira S. Allison
Department of Geology, Oregon State University

Abstract

In the development of major land forms, weathering is primarily the preparation of material for removal by such erosional agents as wind, streams, glaciers, and waves. The term weathering properly encompasses only the physical disintegration and chemical decomposition of rocks. It is sometimes confused with the more inclusive term erosion. Weathering does not ordinarily include removal, except perhaps in solution or by gravity.

The direct effects of weathering, except talus piles, are comparatively small-scale features. Because of this smallness of scale and the possible assistance of other factors in origin, we may be inclined to minimize the role of weathering.

The indirect effects of weathering, however, are extensive. Rocks that weather readily become easily erodable. Conversely, rocks resistant to weathering generally resist erosion also. Hence erosion remnants commonly endure, not simply because of their hardness or massiveness, but mainly because of their resistance to weathering.

Weathering reduces hard massive rocks to a more easily erodable state, although fresh, unweathered rock can be eroded directly, as by abrasion or glacial plucking. The materials first prepared by weathering are then ready for easy wear by streams, glaciers, and waves. Weathering is, therefore, an important preliminary step in the degradation of the land. (1960)

GEOLOGY OF THE SPRUCE MOUNTAIN AREA, ELKO COUNTY, NEVADA

By George R. Harlow

Humble Oil & Refining Co., Eugene, Oregon

Abstract

Spruce Mountain is located in southeastern Elko County, Nevada, approximately 55 miles southeast of Elko and 95 miles north of Ely. The range is an elongate, north-south trending anticline modified by normal faulting. Two major periods of structural deformation are apparent: (1) a period of large-scale overthrusting accompanied by minor northeast-trending high-angle reverse faulting and northwest-trending tear faulting, and (2) a period of gentle folding with contemporaneous or slightly later high-angle normal faulting.

The overthrust separates the rocks into two distinct successions. Strata from the Pogonip Formation (Lower Ordovician) to the Ely Formation (Pennsylvanian) crop out in lower plate exposures, and the upper plate contains the Oquirrh Formation (Pennsylvanian-Permian) to the Dinwoody (?) Formation (Triassic). Most of the strata of the lower plate succession, lithologically and faunally, seem to correlate best with formations exposed west and south of Spruce Mountain, whereas the upper plate succession most closely resembles rocks exposed to the east and northeast.

Late Tertiary conglomerates, siltstones and tuffs flank the range and are overlain on the east by Quaternary (?) ignimbrites. Large granite porphyry dikes and numerous small diorite dikes crop out in the central part of the area. (1960)

OCCURRENCE, DESCRIPTION, AND ORIGIN OF "OREGONITE"

By Len Ramp
State of Oregon Department of Geology and Mineral Industries

Abstract

"Oregonite" is an attractive variety of gem-quality spherulitic jasper found in the Illinois River district, Josephine County, Oregon. It occurs as lenses in a weathered zone between flows of amygdaloidal metabasalt of the Upper Jurassic Rogue Formation and probably formed as cavity fillings of silica gel. The silica spherulites have radiating, concentric structure and are colored by hematite, which occurs as dust-like inclusions in the fibrous quartz. Source of the hematite may have been from weathered basalt in the interflow zone. Relatively late deposition under a low temperature environment is suggested by the limited crystal growth and relatively unfractured condition of the rock.

The occurrence has been worked occasionally since the early 1900's. A total of about $1\frac{1}{2}$ tons has been mined and marketed as uncut gem stone and finished hand-made jewelry. Uncut material is selling for as much as $5.00 per pound. (1961)

TERTIARY AND QUATERNARY FAULTING IN SOUTHWESTERN HARNEY COUNTY, OREGON

By Neil J. Maloney
Department of Geology, Oregon State University

Abstract

The northern part of the Basin and Range physiographic province extends into southwestern Harney County. Tertiary and younger volcanic rocks and terrestrial sediments are exposed throughout the area. Horsts, grabens, and tilted fault blocks are the most common topographic features.

Three stages of faulting are recognized. The first stage was during the upper Miocene, when faulting occurred along fractures striking N. 0-10°E. and N. 40-60° E. The rhombic nature of the faults, their near vertical dips, and the steep but highly varied dips of the Miocene volcanics, all

indicate that the fractures formed as a result of north-northeast, south-southwest horizontal compression and are conjugate wrench faults. However, there is no evidence indicating extensive strike-slip displacements.

The second stage of faulting occurred during the middle Pliocene, when a set of normal faults, striking N. 40-60° W., was formed.

The third stage of faulting occurred after the emplacement of the most recent basalt flow but prior to the deposition of the alluvium. Therefore, this stage of faulting probably occurred during the Pleistocene. The north- and northeast-striking fractures developed during the first stage were refaulted by the normal faulting of the third stage.

The major topographic features of the area are a result of normal faulting during the second and third stages of deformation. However, the rhombic pattern shown by many of the fault blocks was inherited from first stage of faulting. (1961)

THE HIGH CASCADES GRABEN AND THE "MYTHINTERPRETATION" OF MOUNT MULTNOMAH

By John Eliot Allen
Department of Earth Sciences, Portland State College

Abstract

Recent papers by several authors have suggested a genetic relationship between grabens, calderas, and ignimbrites. It is suggested that mappable and inferred faults formed an early Pliocene High Cascades graben, similar to the present Rio Grande graben of New Mexico, whose northern end in Oregon is the Hood River valley and whose southern end is the Klamath Valley. Crater Lake caldera (like Valle Grande caldera) lies within this down-dropped block, as does the Three Sisters volcanic complex. Although the ring of peaks which Hodge once called the remnants of the caldera wall of Mount Multnomah have been shown to be individual necks of Pliocene volcanoes, it is believed that they may well also represent the trace of a more ancient caldera or ring-structure, and Ur-Mount Multnomah of lower Pliocene age, now buried and concealed (along with its explosive debris) by the extensive lavas from the volcanoes erupting through the ring-structure fractures. The early Pliocene Rattlesnake-Danforth ignimbrite sheet of central Oregon may represent the explosive activity of Ur-Mount Multnomah, or it may be derived from a possible similar buried caldera at Big Summit Prairie. (1961)

SANDSTONE INTRUSIONS AT ASTORIA, OREGON: THEIR ORIGIN AND STRUCTURAL IMPLICATIONS

By R. Kenneth Dodds
U. S. Army Corps of Engineers

Abstract

Sandstone intrusives have been known to exist at Astoria, Oregon, since 1849, when they were reported by J. D. Dana. Since that time three other writers have offered theories as to their origin. Dana postulated an origin by infiltration from above; Diller thought that they were forcefully injected from below; Washburne and Seitz, in general follow Diller's explanation. The writer, as a result of a mapping project in Clatsop County, Oregon, discovered many inadequacies in all previous explanations, and so here proposes a theory which will satisfy the field evidence.

It is proposed that the sandstone intrusions as exposed at Astoria, Oregon, were implaced by the forceful injection of sand downward from the overlying sandstone beds. The force of the intrusion logically relieved itself along the path of least resistence during folding. For intrusions from above, this would be along the crests of the anticlines. It is then possible broadly to locate the anticlinal crests by mapping sandstone intrusion concentrations. (1960)

HISTORICAL REVIEW OF ASTORIA TYPE LOCALITY

By Betty Rae Dodds
Portland, Oregon

Abstract

James Dana published a description of the Miocene fossils found in 1841 in Astoria, Oregon, thereby making Astoria the type Miocene of the West Coast. Subsequent writers have referred to this area. The location of a type section in a populous town has brought many difficulties, among which are the masking of the originally described exposures and the impermanence of reference points, thus making it difficult to locate oneself

according to previous authors. The physical plan of Astoria at his time and the relocation of his reference points are given for each of the following: James Dana, 1841; Thomas Condon, 1880; W. H. Dall, 1890; John S. Diller, 1896; Chester Washburne, 1910; H. V. Howe, 1921; Ewart M. Baldwin and R. E. Stewart, 1945. It is suggested that the present-day geologist use other than cultural objects as reference points and that they be aware of the difficulties of establishing important locales in an area which some day may be densely populated. (1960)

WELDED TUFF IN THE DANFORTH FORMATION

By Ernest H. Lund
Department of Geology, University of Oregon

Abstract

The Danforth Formation, described and named during the investigation of the groundwater resources of the Harney Basin by Piper, Robinson, and Park in 1939, is a heterogeneous accumulation of sedimentary and volcanic rocks. The sedimentary rocks are largely of pyroclastic material and include tuff, siltstone, sandstone, and conglomerate. The volcanic rocks are mainly silicic, but some are basaltic. The formation is capped by a widespread welded tuff, and it is this member with which the present study is concerned.

A series of specimens from near the Silvies River locality described by Piper and others was examined microscopically. At this locality the welded tuff member is about 45 feet thick and rests upon well sorted and stratified volcanic sedimentary rock.

At the base of the welded tuff unit is non-sorted, non-laminated, weakly lithified tuff that grades upward through a thickness of about 5 feet into a dense black glass. About 30 feet of the member is perlitic, spherulitic glass. The glassy material grades into a pinkish gray lithic rock about 10 feet thick at the top of the member.

The rock throughout the entire sequence is characterized by shard structure. At the base the shards are somewhat randomly oriented but become progressively flattened, stretched, and oriented into a planar structure through the transition zone. The upper 10 feet has been largely devitrified, which accounts for its lithic appearance. (1961)

MARINE JURASSIC OUTLIERS IN THE JUNIPER MOUNTAIN AREA OF NORTHERN MALHEUR COUNTY, OREGON

By N. S. Wagner and Howard C. Brooks
State of Oregon Department of Geology and Mineral Industries

Abstract

An investigation of some magnetic iron prospects in the vicinity of Brogan, Oregon, led to the mapping of several previously un-mapped exposures of rock of pre-Tertiary age in an area otherwise occupied by predominantly Tertiary volcanics and continental sediments. Study of the pre-Tertiary exposures led in turn to the discovery of fossiliferous graywackes and shales of mid-Jurassic age. The discovery of these Jurassic strata is geologically important in two ways. One is that these strata constitute a link in a chain of exposures which now serve to show that the Jurassic seas extended from central Oregon into western Idaho. Secondly, recognition of this Jurassic section will undoubtedly be of ultimate value in resolving some of the stratigraphic problems connected with the correlation of the pre-Tertiary strata exposed in the neighboring portions of Baker and Malheur Counties where some lithologic units are thought to be Jurassic yet lack the fossil control needed to prove the correlation with certainty. (1961)

OIL AND GAS EXPLORATION IN OREGON

By Vernon C. Newton, Jr.
State of Oregon Department of Geology and Mineral Industries

Abstract

The search for oil in Oregon began 43 years after Edwin L. Drake discovered oil in his well near Titusville, Pennsylvania, in 1859. Two wells were drilled by Churchill & Associates during 1902 in the vicinity of Newberg in Yamhill County. No shows were obtained while drilling these wells.

Since Mr. Churchill's venture, 153 test holes have been drilled and though some have reported shows, not one produced oil or gas in commercial amounts. Only 15 wells have been drilled to depths below 5,000 feet

in Oregon so far, all by major oil companies. Stratigraphic information obtained in these drillings indicates a thick Tertiary marine section in western Oregon and presence of marine sediments below the Clarno Formation in central Oregon.

No large seeps of oil or deposits of residual hydrocarbons have been found in the state, but writers have reported several small questionable seeps in western Oregon and two petroliferous sand outcrops in southeastern Oregon. Traces of oil have been detected in the drill cuttings and cores in several recent drillings both in western and central Oregon.

Gas has been encountered by drillings in many locations throughout the state, but so far in quantities too small to be commercial. Gas production for Oregon during the years 1907, 1908, and 1909 is reported in U. S. Geological Survey "Mineral Resources of the United States", 1909, Part II. This gas was used domestically by several ranchers in eastern Oregon. Petroleum fractions have been reported in analyses of gas samples from Oregon suggesting that oil is associated with the gas. (1960)

THE FOSSIL FLORA OF THOMAS CREEK

By Wallace Eubanks
Salem, Oregon

Abstract

The purpose of this study was to identify the fossil flora of the Thomas Creek drainage, Linn County, Oregon, and to attempt to determine the age of the rocks at the upper Thomas Creek locality on the basis of the fossil flora. This paper describes the fossil flora from two localities in this drainage. The lower area had been previously dated by use of fossil leaves and geology. This study makes use of fossil leaves, fruits, flowers, and wood and describes the methods and problems involved in identifying fossil wood.

The lower Thomas Creek locality occurs in the SE¼ sec. 2, T. 10 S., R. 1 E., at an elevation of about 575 feet. The upper locality is in the NE¼ sec. 16, T. 10 S., R. 2 E., at an elevation of about 1,300 feet, about 5 miles east of the lower locality.

The rocks cropping out in Thomas Creek in the vicinity of the lower locality are the Mehama Volcanics of Oligocene to lower Miocene age. The total thickness here is unknown, but the uppermost 650 feet is exposed

along the valley walls of Thomas Creek. These rocks are composed of tuffs and breccias, in places partly opalized. The Mehama Volcanics are capped by basalt named the Snow Peak Lavas of middle Miocene age. These lavas thicken toward the source at Snow Peak. North of Thomas Creek, the Snow Peak Lavas are capped by Fern Ridge Tuff considered to be Pliocene in age by Smith. These rocks are composed of tuffaceous siltstone and sandstone and are capped by a unit of pumice breccia containing appreciable basaltic fragments.

The lower leaf location occurs in the bed of Thomas Creek. Adjacent to the creek bed the Mehama Volcanics are overlain by Quaternary alluvium, but it is again exposed in the valley walls. Leaves from this locality have been identified as follows:

Castanopsis	Lindera	Platanus
Cercidiphyllum	Magnolia	Prunus
Ficus	Metasequoia	Taxodium
Fraxinus	Nyssa	Tilia
Laurophyllum	Phoebe	

The woods from this locality have been identified as Platanus and Sequoia among others.

The upper Thomas Creek flora occurs in an indurated tuff which has been partially opalized. The best exposures occur in ground scars from logging operations. Direct tracing of the Mehama Volcanics from the mapped area to the west is difficult because of a cover of erosional material and dense vegetation. The following leaves, flowers, and fruits occur in the upper Thomas Creek locality.

Leaves:	Platanus	Flowers:	
Acer	Pterocarya		Hydrangea
Gingko	Prunus		Porana
Magnolia	Rhus	Fruit:	
Metasequoia	Taxodium		Betula

The following woods among others were found in this locality:

Cinnamomum	Sequoia	Tsuga
Fagus	Platanus	Reptonia

The occurrence of Porana indicates the flora of the upper Thomas Creek locality to be lower Miocene, since this flower has not been found in beds younger than upper Oligocene to lower Miocene. (1960)

INDIAN MOUNDS IN BENTON COUNTY

By John E. Smith
Corvallis, Oregon

Abstract

Mounds, mostly of unknown origin, have been found along or near the Willamette River and several of its tributaries, including the Yamhill, the Luckiamute, the Calapooia, and the Long Tom Rivers. The most prevalent type, generally circular in shape (diameter, 30 to 50 feet, height, 1 to 4 feet) occurs on the natural levees some distance from the present channel of the stream.

Many of another type, elliptical in shape (30 to 80 yards long and half as wide or less) are built on small islands among the flood-plain distributaries of an aggrading river, their longer axes lying nearly parallel to the stream when the islands were formed. Some of the elongated elliptical mounds along the Willamette seem to be low, gravelly ridges formed by deposition from flood waters.

Mounds opened in Benton County have produced the following: mortars and pestles, knives, arrow points, spearheads, beads, part of an ax blade, skull and fragments of skeleton, part of a flintlock rifle, a brass kettle, and other things. The Yamhill mounds also gave up parts of a flintlock rifle in 1896 and Spanish coins in 1938.

Comparing in detail the sizes, shapes, and contents of these black-soiled hummocks and their locations respectively with regard to the nearby streams, one finds them so nearly identical as to necessitate the conclusion that the groups of mounds mentioned above for the Willamette Valley were the work of contemporaries, and that some of them were used by the Indians for burial grounds until after the arrival of the white settlers in 1846. Of their earliest use, we have no record. (1960)

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NOTICE: MINING SAFETY CODE HEARING

The State Industrial Accident Commission announces that a public hearing will be held on May 16 at 9:30 a.m. in Room 203, Labor and Industry Building in Salem to consider the proposed safety code for mining, tunneling, and quarrying.

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DEPARTMENT RECEIVES GIFT OF LAW VOLUMES

The department has received a five-volume set of the American Law of Mining as a gift from the George Nisbet Memorial Library Fund. The set, published by the Rocky Mountain Mineral Law Foundation in 1960, represents the most up-to-date and comprehensive compilation of American mining law available. The volumes are bound in loose-leaf form and can be modernized as changes in the law occur. The five volumes cost $150.

George Nisbet, a prospector who lived for many years on the upper reaches of the Clackamas River, died in his cabin August 13, 1958 at the age of 80. He was one of the region's last old-time prospectors. Born in Scotland, he caught the mining fever in the diamond mines of South Africa, participated in gold rushes in Canada and the United States, and located the quicksilver deposits along the Clackamas which bear his name.

The memorial fund committee, headed by A. O. Bartell, felt that its selection should reflect, if possible, the interest that George Nisbet expressed during his lifetime and furthermore that the volumes chosen should be a worthwhile addition to the department's library and one which the library, in all probability, would not be able to acquire otherwise.

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AEROMAGNETIC ALBANY-NEWPORT MAP ON OPEN FILE

The U. S. Geological Survey has released "Preliminary Interpretation of an Aeromagnetic Map of the Albany-Newport Area, Oregon," by R. W. Bromery, as an open-file report. A copy of the report, consisting of map and text on one sheet, may be consulted at the Department's Portland office, or reproductions can be made from it at private expense.

The map, which has a scale of 1:62,500, covers approximately 1,200 square miles in western Oregon between 44° 30' and 44° 45' N. latitude, and 123° 00' and 124° 05' longitude. It is based on 34 east-west traverses flown approximately 750 feet above the ground using an airborne magnetometer.

Three distinct anomaly patterns reflect: 1) a central uplifted area of volcanic rocks (Siletz River Volcanic Series) bounded by major faulting; 2) sedimentary basin and intrusive rocks to the west; and 3) the Willamette basin to the east containing 10,000 to 15,000 feet of sedimentary rock.

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ECONOMIC IMPACT OF OIL INDUSTRY ON A NEW STATE

Both from the standpoint of development of natural resources, and from increased revenues to the treasury of a new state, seeking financing means for state improvements, the impact of Alaska's oil industry has made itself felt on all levels of public and private life.

Roscoe Bell, state Director of Lands, estimates that 20 per cent of the entire financial support for the state comes from oil and gas lease revenues and royalties.

Donald D. Bruce, chief of the petroleum branch of Alaska's Division of Mines and Minerals, predicted Alaska would realize in revenue, other than leasing, about $13 million in royalties and taxes from oil and gas production in the Swanson River and Kenai Gas Fields over a 6-year-period.

The state division of budget and management estimated income from oil and gas lease bonuses during the fiscal year 1961-1962 would amount to $5,161,376. Bonuses on competitive lease sales held during the 1961 calendar year alone total $22,184,380.16.

Alaska receives 90 per cent of the receipts from the mineral leasing of federal lands within the state, including oil and gas royalties. Alaska's gross production tax amounts to one per cent of the well-head value of the oil and/or gas, and the conservation fund tax is based on 5 mills per barrel of oil, or 50,000 cubic feet of natural gas.

For the first six months of 1961, Alaska received $2,474,228.63 from oil and gas leases on federal lands within the state.

The Mines and Petroleum Bulletin in July estimated that 600 people were directly employed in exploration and development categories of Alaska's petroleum industry, representing an annual payroll of over five million dollars. It also estimated that the petroleum industry has expended between 100 and 125 million dollars in Alaska in exploration and development during the past 10 years, with 18 companies active in the state in July, and the possibility of 3 more entering state activity before the end of the year. These estimates include the Navy's Pet 4 program north of the Arctic Circle.

Expenditures by oil companies for 1961 alone are expected to exceed $53 million, as compared with $35 million in 1960 and $30,654,000 in 1959.

The growing importance of the industry in Alaska is demonstrated by the increased numbers of local businesses and companies who are assigning full time sales and service representatives for oil field equipment in the state, building new stores in Anchorage, and in Soldatna and Sterling in proximity to producers on the Kenai Peninsula.

Air carriers, land consultants, geologists and engineers, supply and service companies from shipping to trucking to map-making and publishing

have all been directly affected by Alaska's growing oil industry. Indirectly there is no doubt that the industry touches on the lives of all residents in the state. (Alaska Construction, Dec.-Jan.-Feb., 1962, republished by permission of Robert W. Benson, Editor.)

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"DISCOVERY" TEST

Citing the growing concern of the mining industry over administrative interpretations of the rules of discovery as they apply to mining claims, Rep. Wayne Aspinall (Colo.) recently announced that the House Interior Committee has been aware of this problem and has been watching it closely. He said that the Interior Department secretariat has assured him that those directing the Department's actions do not subscribe to the thesis "that the law should or can be revised by administrative action."

He went on to say that in the event the intent of Congress is lost, or if administrative interpretation of the law results in its subversion, "the Congress will be responsive to the demands of the national interest and enact laws necessary to assure that the basic Congressional policy is carried out fully."

Aspinall also said the Interior Committee is "watching with interest the efforts of industry and Government representatives to formulate legislation to provide a safeguard for pre-discovery claims in view of the large expenditures required to conduct exploration work." He expressed the view that Congress will look sympathetically on the principle of this legislation. (American Mining Congress Bulletin Service, February 9, 1962)

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AMENDED OIL AND GAS LAWS PUBLISHED

Changes in the oil and gas laws by the 1961 Oregon Legislature made it necessary for the Department of Geology and Mineral Industries to revise again Miscellaneous Paper No. 4, "Rules and Regulations for the Conservation of Oil and Natural Gas." The publication contains the new unitization law and amended definitions to ORS 520. In addition to the oil and gas laws, Miscellaneous Paper No. 4 now contains sections from ORS 274 and 275 dealing with oil and gas leasing on state lands, including the Tide and Submerged Lands Act of 1961. Price for the second revised edition is $1.00.

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SEATTLE AIME CONFERENCE DETAILED

The announcement in the January ORE BIN about the forthcoming conference of the AIME-A.S.M. has been enlarged upon by the following news item from Donald L. Anderson, general chairman.

Plans are being completed for the AIME-A.S.M. Pacific Northwest Minerals and Metals Regional Conference scheduled for April 26 and 27 at Seattle. A total of nine sessions will be held in geology, mining, industrial minerals, mineral processing, extractive metallurgy, and physical metallurgy. The program is essentially complete and papers to be presented will emphasize progress and growth of the Pacific Northwest.

The British Columbia Section, C.I.M.M., has been invited to attend and has been included on the mailing list along with AIME-A.S.M. A good attendance is expected from Canada and it is believed that closer cooperation with C.I.M.M. will benefit both institutes.

For Thursday, April 26, the luncheon speaker will be Professor Emeritus Joseph Daniels, who will speak on the growth of the metallurgical industry in the Northwest.

On Friday, April 27, the guest speaker will be Roger V. Pierce, President-Elect of AIME, whose topic will be "The Countdown and You."

The conference is headed by Donald Anderson and Earl Roberts of the University of Washington, and Robert Shinkoskey of the Tacoma Smelter is the program chairman.

Convention headquarters will be the Benjamin Franklin Hotel in downtown Seattle and the World's Fair, which opens April 23, will be only a few minutes away by high-speed monorail.

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OAS MEETS AT LEWIS AND CLARK COLLEGE

The 1962 meeting of the Oregon Academy of Science was held on Saturday, March 3, at Lewis and Clark College in Portland. Papers were presented both morning and afternoon at the four sections: biology, chemistry, mathematics-physics, and geology-geography. Luncheon and business meetings were also on the program. A new aspect of the 1962 meeting was the distribution of abstracts of papers presented. Ten papers were scheduled for the geology-geography section, with Dr. Jon C. Cummings as chairman.

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The ORE BIN
Vol. 24, No. 3
March, 1962

GRAVEL DEPOSITS IN THE WILLAMETTE VALLEY BETWEEN SALEM AND OREGON CITY, OREGON

By

J. L. Glenn*

Introduction

The Willamette Valley sand and gravel project was initiated in the summer of 1960 by the State of Oregon Department of Geology and Mineral Industries. The project was undertaken because increased development of the sand and gravel resource is a necessary prerequisite for continued industrial and urban growth in this area. The purpose of this report is to indicate some of the characteristics and the distribution of present or potential sand and gravel deposits in the lower Willamette Valley between Salem and Oregon City. Because the report is a preliminary review of the deposits, its use should be followed up by more extensive and thorough geologic investigations in any area where the need for sand and gravel may arise. Trimble (1957) has outlined the characteristics and distribution of similar deposits to the north in the adjacent Portland area.

Schlicker (1960) investigated the gravel resources in the Salem area. As a result of his report, it was recognized that further investigation of selected areas should be postponed pending the accumulation of basic data on the overall occurrence, characteristics, and origin of Willamette Valley sand and gravel deposits. This report summarizes data collected during the summer of 1961.

The area studied lies between the cities of Salem on the south and Oregon City on the north, the Cascade Mountains on the east, and the Salem-Eola Hills on the west (figure 1). Parts or all of the Salem, Stayton, McMinnville, Mount Angel, Molalla, Yamhill, Tualatin, and Oregon City quadrangles are included in this region.

The Cascade Range and to a lesser extent the Coast Range are the provenance areas for the majority of the sand and gravel deposits in the

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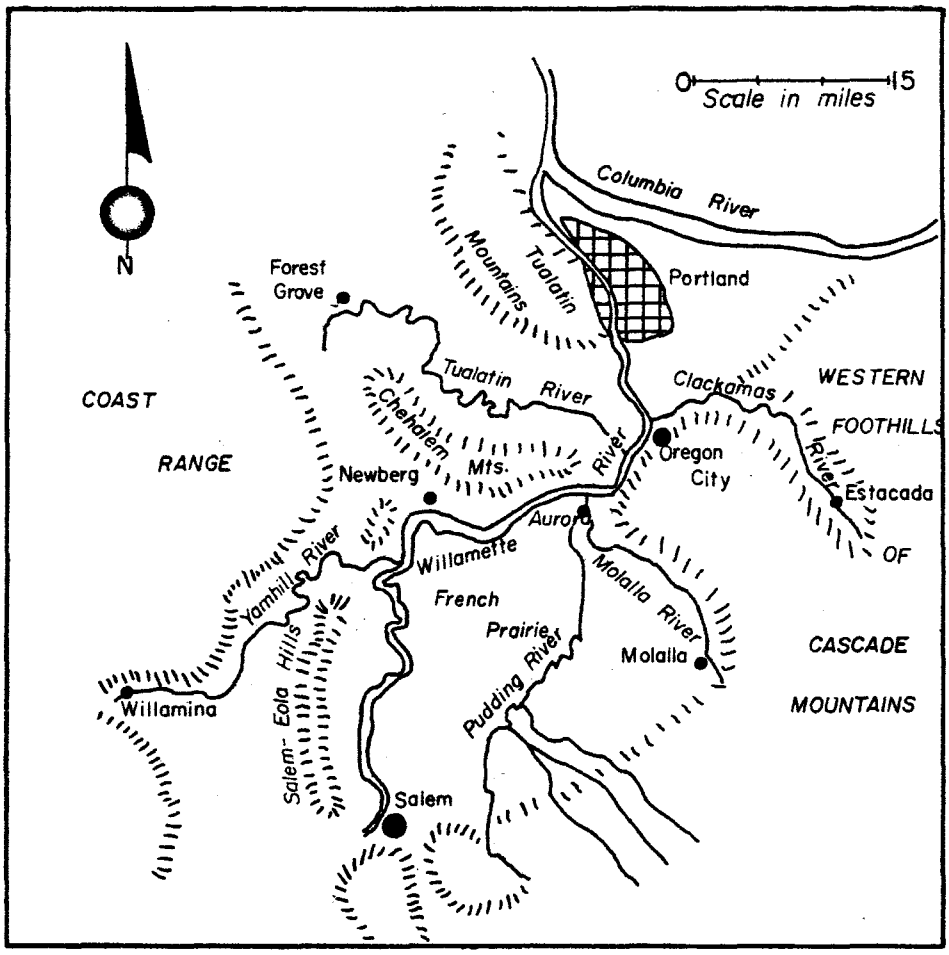


Figure 1. Sketch map of the lower Willamette Valley.

territory. The Cascades are composed chiefly of Tertiary continental volcanic rocks with some interfingering sedimentary rocks of both continental and marine origin. The Coast Range consists of marine sedimentary and volcanic rocks of older Tertiary age, with a scattering of basic dikes and sills. Basalts, andesites, and rhyolites, in that order of abundance, form the majority of the volcanic rocks in the gravel deposits.

The Willamette River, a major tributary of the Columbia River, roughly bisects the lower Willamette Valley in its northward course to a confluence with the Columbia north of Portland. The major tributary streams of the Willamette in the area of this report are the Yamhill River, which flows eastward from the Coast Range, and the Molalla River, which flows northwestward from the Cascade Mountains. The Pudding River drainage

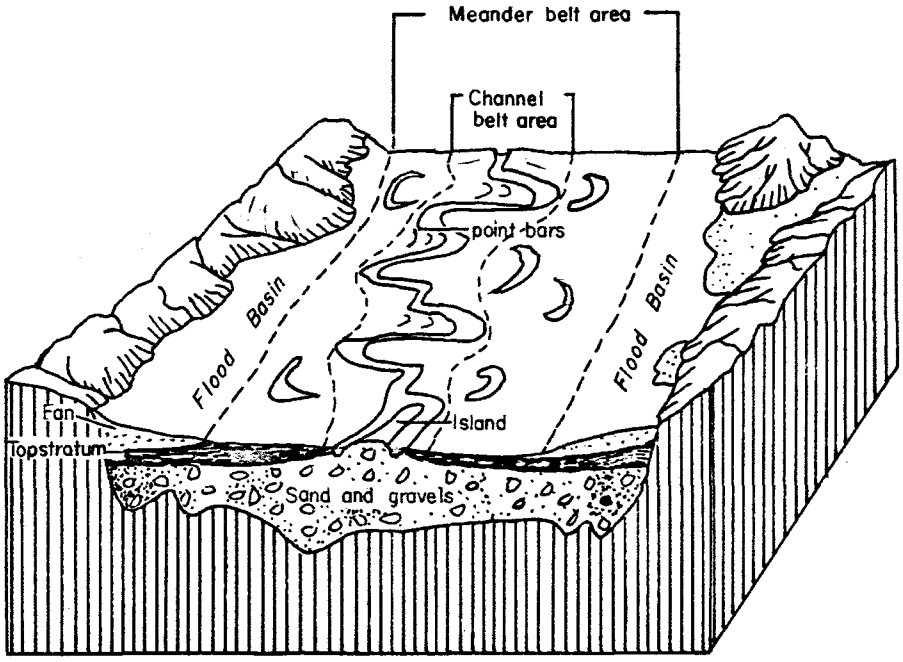


Figure 2. Sketch showing the stratigraphic and aerial relationship between channel belt, meander belt, and flood basin deposits.

system, including Silver, Abiqua, and Butte Creeks, is the only other important stream system in the area.

Origin and Occurrence of Deposits

Sand and gravel deposits in the lower Willamette Valley are related to present or past stream activities. The characteristics and distribution of these deposits are in large part controlled by the nature of the material available to the stream which deposited them, the time of deposition, and the manner in which they originated. With this in mind, one may divide the sand and gravel deposits in the lower Willamette Valley into the following types: (1) modern stream deposits, (2) flood-plain deposits, (3) fan deposits, (4) terrace deposits, and (5) abandoned channel deposits of the Labish lowland.

Modern stream deposits: Modern stream deposits are found principally in proximity to the Willamette and Molalla Rivers. Locally smaller, high-gradient Cascade Mountain streams such as Silver, Abiqua, and Butte

Creeks, may be important sources of gravel. The smaller streams deposit their loads as a result of gradient reduction in alluvial aprons apexing at the point where they flow out of the mountains and into the valley proper.

Both the larger and smaller streams presently transport gravel only during flood stage. During the major period of gravel transportation and deposition, which presumably coincided with the waning stage of the last period of mountain glaciation, these streams carried and deposited the greater bulk of the present deposits. Modern stream activity has resulted in the deposition of a thin veneer of younger gravels or in the reworking of older deposits. The upper Molalla River and Silver, Abiqua, and Butte Creeks all extend into the glaciated area. The Pudding River, which heads at a lower elevation in the Waldo Hills, never had access to glacial water and debris, which accounts for its relative unimportance as a source of sand and gravel.

Modern stream deposits of the Willamette and Molalla Rivers are either point bar or in-channel deposits. Neglecting for the moment petrographic differences, deposits of this manner of origin in both rivers vary principally in aerial extent with the maximum dimensions controlled by the size of the parent stream. Willamette deposits are hence larger and more extensive than those of the Molalla.

Point bar deposits are accretion deposits on the inside or concave banks of modern and abandoned stream channels. They may be recognized by their relationship to the channel and by their surface expression of alternating ridges and swales with a horizontal radius of curvature similar to that of the associated channel. On aerial photographs point bar deposits appear as alternating light and dark bands, the lighter areas marking ridge tops, the darker areas, swales.

In-channel deposits are represented by the various types of bars which may or may not have "above water" expression. They include many islands found along the course of the modern stream. These are characterized by extreme variability in size and form. They may be as large as Grand Island (3 by 5 miles) or as small as a few tens of feet in length. Islands generally are elongate bodies with the long axis parallel to the course of the stream. The upstream end of an island is ordinarily blunt while the lower end tapers gradually to a point. The maximum breadth normally occurs near the center portion of the island, where the maximum relief also occurs.

The reason for island formation is often obscure. Frequently islands originate by high-water scouring through a point bar swale and subsequent diversion of part of the stream's flow down the swale during lower

or normal river stages. The establishment of vegetation on an island helps to stabilize the island and to further promote its growth. Large islands, such as Grand Island, are the result of diversion of all but a small part of a stream's flow from an old to a new course of greater gradient.

Common in-channel sand and gravel deposits with little or no above-surface relief include so-called "blanket bars." These are relatively flat-topped tabular bodies which widen downstream and gradually decrease in elevation until they merge with deposits of the channel floor. These are most commonly found in the modern streams below impingement points and between the deflected channel thalweg (deepest portion of the channel) and the outer bank.

Flood-plain deposits: Point bar and in-channel deposits are characteristic of the channel belt or belt of active stream erosion and deposition. With continued migration of a stream, channel-belt deposits may become separated from the belt of active erosion and deposition. If this occurs, a fine-grained top stratum or overburden is laid down over the sands and gravels during flood stages of the stream. In this position, they become part of the meander-belt deposits. Between the area of recognizable meander-belt deposits and the valley margins, that is, the area of thickest top stratum, the deposits are said to be part of the back-swamp or flood basin environment of deposition. Channel belt, meander belt, and flood-basin deposits are actually types of flood-plain deposits and differ principally in the amount of masking fine-grained top stratum (fig. 2).

Terrace deposits: Terrace deposits are older stream deposits which have been dissected but not completely removed by later stream activity. These deposits are wide spread in the lower Willamette Valley and are included in this report because they represent a potential sand and gravel resource in the study area.

The importance of the terrace deposits to the sand and gravel resources in the lower Willamette Valley is twofold. First, where streams impinge against them, as at River Bend (sec. 1, T. 5 S., R. 3 W.), they serve as local sources for modern stream deposits. Secondly, the sand and gravel which occur beneath the terraces may extend and be encountered at depth beneath the modern stream gravels. Production from these gravel deposits in place is limited because of the thickness of overburden or because of their relatively more weathered character.

Fan deposits: Alluvial fans are stream deposits built up by streams of higher slope extending into a valley with lower slope. They are low,

cone-shaped areas which broaden down valley from a narrow head to a maximum width at the lower margin of the fan. The principal area of fan deposits occurs along a line between the Mill Creek Gap and Salem. These deposits are attributed to a former course of the Santiam River across the outlined area.

Abandoned channel deposits of the Labish lowland: The Labish lowland is an abandoned channel of the Willamette River extending northeast from Keiser to near Canby. The channel varies from one-half to 1 mile in width, with the maximum width in the center and lower portion. The Pudding River and Silver, Abiqua, and Butte Creeks enter and occupy the center and lower reaches of the abandoned channel. Deposits characteristic of this channel interfinger with Molalla River deposits in the Aurora-Canby area.

Description of Selected Deposits

Sand and gravel deposits in the lower Willamette Valley have been shown to have a variety of origins. On the basis of differing origin and characteristics, six types of sand or gravel deposits may be delineated. These are (1) Willamette River deposits, (2) Molalla River deposits, (3) Salem-Santiam fan deposits, (4) Silver-Abiqua-Butte Creek deposits, (5) Labish lowland deposits, and (6) terrace deposits. The accompanying map shows the distribution of each in the regions studied.

Willamette River deposits: The deposits of the Willamette River flood-plain are the most widespread and easily exploited in the area. In general, these deposits coarsen with depth. Fragments as large as 10 inches in diameter are common in most gravel pits at depths below 18 to 20 feet. The maximum thickness of gravel is not known. Water-well logs commonly report sand and gravel thicknesses in excess of 40 feet; at least one well penetrated 229 feet of "sand and gravel." Present operations seldom produce from depths greater than 20 feet.

Willamette flood-plain gravels are fairly uniform in composition and quality from Salem to the mouth of the Yamhill River. Below the Yamhill, the quality of the gravel decreases somewhat due to progressive dilution by poorer grade materials from the Coast Range flow. The quality improves below the mouth of the Molalla River, principally in response to the load supplied by this stream. In general, materials derived from streams flowing from the Coast Range are of a poorer quality than similar materials from Cascade Mountain streams. This is primarily a reflection

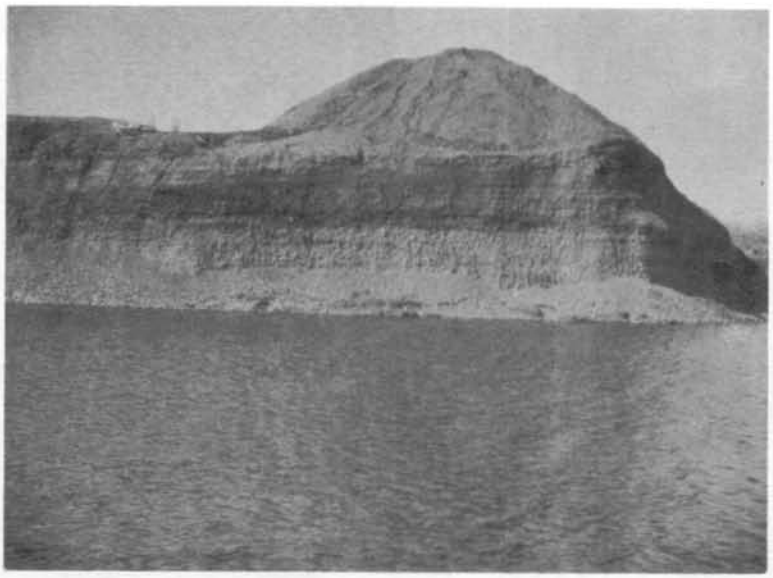


Fig.3. Typical Willamette River flood-plain deposits in the meander-belt area. The darker band near the center of the photo is an iron oxide cemented zone which is characteristic of those deposits farther removed from active stream erosion and deposition.

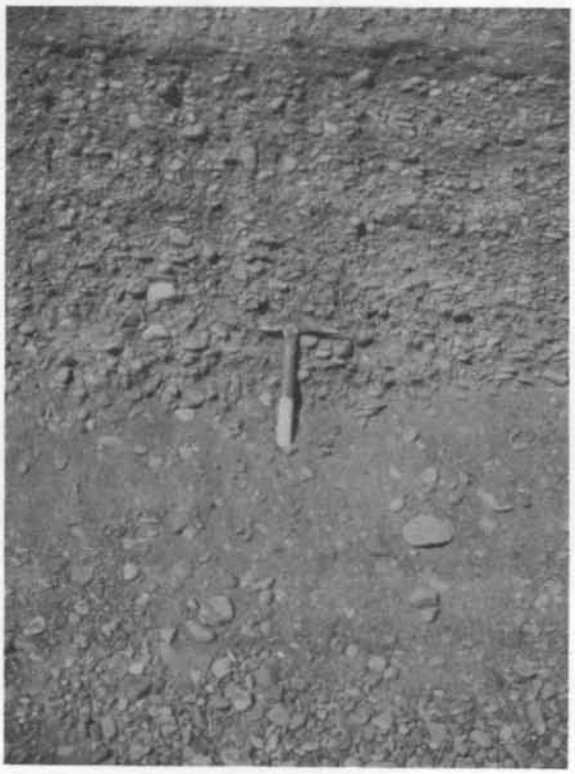
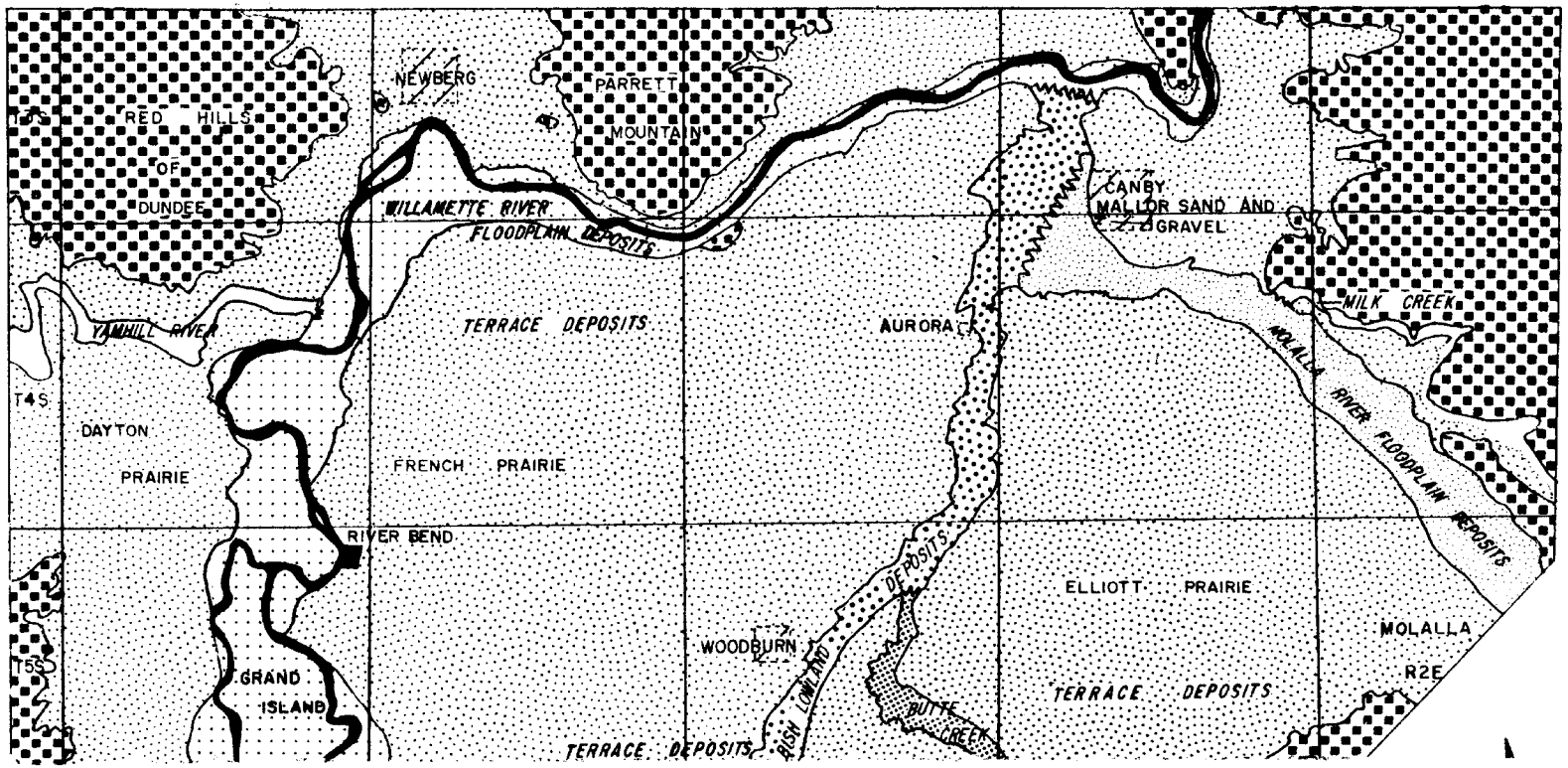


Fig.4. Typical Willamette River flood-plain deposits in the channel-belt area. Note the absence of cemented layers and the relatively greater amount of fine-grained (sand)matrix.

DISTRIBUTION OF SAND AND GRAVEL DEPOSITS IN THE WILLAMETTE VALLEY

BETWEEN SALEM AND OREGON CITY, OREGON



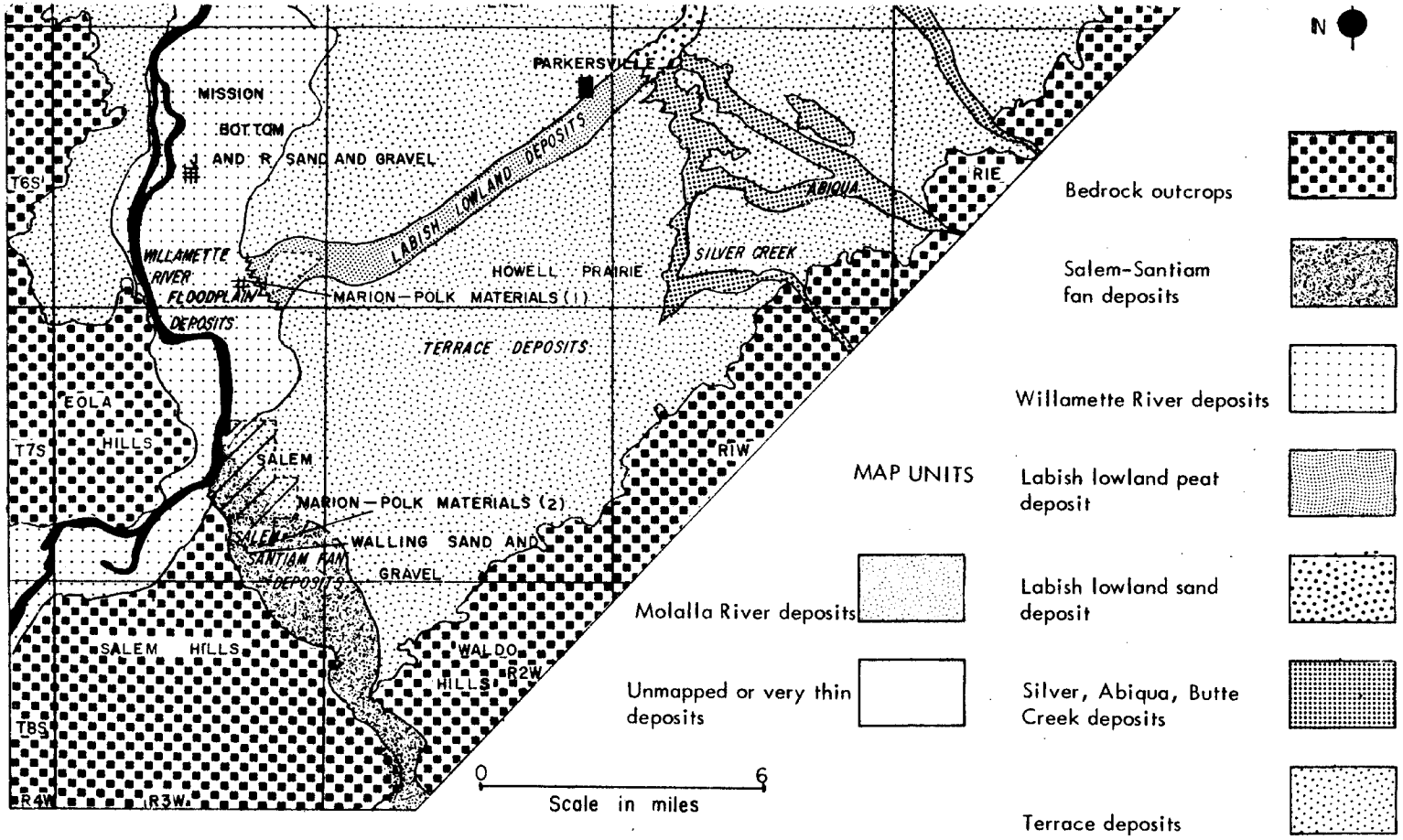

N
PARKERSVILLE
MISSION
BOTTOM
AND R SAND AND GRAVEL
T6S
LABISH LOWLAND DEPOSITS
ABIQUA
RIE
SILVER CREEK
WILLAMETTE
RIVER
FLOODPLAIN
DEPOSITS
HOWELL PRAIRIE
MARION—POLK MATERIALS (1)
TERRACE DEPOSITS
EOLA
HILLS
T7S
SALEM
R1W
MARION—POLK MATERIALS (2)
SALEM
SANTIAM FAN
DEPOSITS
WALLING SAND AND
GRAVEL
SALEM HILLS
WALDO
HILLS
R2W
T8S
R4W
R3W
MAP UNITS
Molalla River deposits
Unmapped or very thin deposits
0
6
Scale in miles
Bedrock outcrops
Salem-Santiam fan deposits
Willamette River deposits
Labish lowland peat deposit
Labish lowland sand deposit
Silver, Abiqua, Butte Creek deposits
Terrace deposits

Fig.5. Typical Salem-Santiam fan deposits at the Walling Sand & Gravel operation. The pick head is approximately 2 feet below the upper weathered zone.

Fig.6. Typical Silver Creek stream gravel deposit near Silverton, Oregon. Bedrock is only about 2 feet below the surface here and gravels beneath the flood plain are only 6 to 7 feet thick.

of the type of bedrock materials found in both areas and of the fact that Cascade streams normally have a higher gradient and are more vigorous in their action.

Willamette River gravels typical of meander belt and channel belt are shown in figures 3 and 4. Figure 3 delineates the Marion-Polk Materials No. 1 pit in sec. 35, T. 6 S., R. 3 W., and figure 4 is at the J & R Sand and Gravel pit in sec. 21, T. 6 S., R. 3 W. The first of these produces from a meander-belt point bar, the second from an in-channel bar.

The gravels in each of these pits consist of rounded gray to black basalts and gray andesites with minor amounts of light-colored volcanics, mostly rhyolites, and siliceous fragments (chert, jasper, chalcedony). The basalts are uniformly fine grained with a thin white to red surface coating or weathering rim. The andesites are of two types, depending on the size of the phenocrysts.

The matrix material is principally sand-sized, angular rock fragments and minerals, quartz and dark minerals being especially noticeable among the latter. It is usually evenly distributed throughout the gravel deposit. However, occasionally, as in the J & R Sand and Gravel pit, lenses of variable thicknesses of essentially pure sand may be found. In general, those deposits in the channel-belt area have more sand-sized matrix and are less coarse than deposits in the meander-belt and flood-basin areas.

Cementation in these gravels is variable. In general, gravels of the channel belt area are loose and friable, at least in the upper production zone. Deposits in the meander-belt and flood-basin areas may be similar, or may show varying degrees of cementation produced by incorporated fines or by an iron oxide cementing agent. Cementation, and hence difficulty of production, increases with depth.

Molalla River deposits: Molalla River sand and gravel deposits are similar in origin to those of the Willamette. The major differences, such as coarseness, grade, and quality, are a reflection of the smaller, exclusively Cascade, drainage basin and higher gradient of the stream. Gravels interfinger with the deposits of the lower Labish lowland but in general are fairly uniform and wide spread adjacent to the Molalla River and beneath its flood plain.

The Mallor Sand and Gravel operation is typical of those in Molalla deposits. Production is from a number of shallow pits in the flood plain and from a bar in the modern river. The gravels are on the average more coarse than those of the Willamette and are principally dense, hard

basalts and andesites. The deposits appear to be more deficient in sand-sized matrix material than are similar deposits in the Willamette River. Molalla River gravels are probably the highest quality materials in the lower Willamette Valley although lacking somewhat in desirable grading characteristics.

The thickness of the gravels is not accurately known but well logs indicate that a maximum of 80 feet is present in the lower valley. The maximum thickness decreases upstream until only 2 to 4 feet are found near Molalla. Production from depths greater than 20 feet is seriously inhibited by the presence of large boulders and indurated clay-gravel lenses.

Salem-Santiam fan deposits: The Salem-Santiam fan deposits are the third most widespread and the second most intensively exploited in the southern part of the lower Willamette Valley. These deposits are found in a fan-shaped area extending from the head of Mill Creek Gap through the City of Salem, but they are equally widespread south and east of the study area, extending to the present Santiam River on the south and beyond Stayton on the east. The gravels are essentially uniform in composition along their entire mapped length and are overlain by a fine-grained top stratum of varying thickness, usually thin.

The gravels of the Salem-Santiam fan compare favorably in composition to those of the Willamette flood plain. Basalts and andesites in about equal amounts are the most prevalent gravel-sized fragments. These gravels differ from Willamette gravels in at least one important aspect. The gravels of the upper few feet are extensively oxidized and weathered. Almost all gravel-sized material has a weathering rim of varying thickness. This undoubtedly reflects the age of these materials and indicates that the Salem-Santiam gravels were deposited prior to the deposition or reworking of those in the modern Willamette flood plain.

The thickness of gravel in the Salem-Santiam fan is not accurately known, but production is developed to greater depths than in either the Willamette or Molalla deposits. Both the Marion-Polk Materials No. 2 and Walling Sand and Gravel operations, the two major producers from these deposits, operate to depths between 30 and 40 feet. Cementation is hence not a limiting factor at depth in the production of these gravels. Typical Salem-Santiam fan gravels at the Walling operation are shown in figure 5.

Silver, Abiqua, and Butte Creek deposits: The Silver, Abiqua, and Butte Creek gravels are the only significant deposits along the eastern

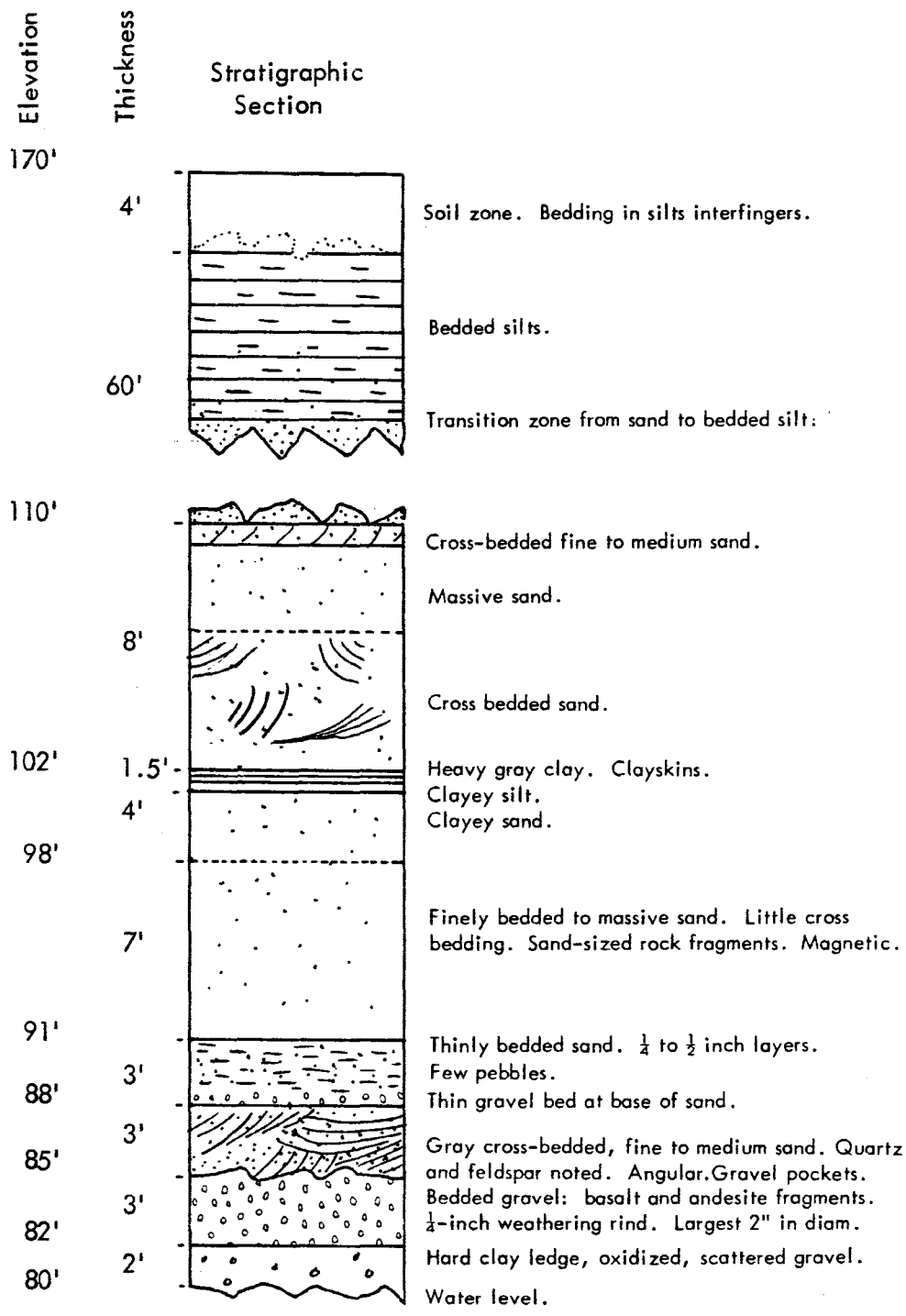


Figure 7. Stratigraphic section showing terrace stratigraphy at River Bend (sec. 1, T. 5 S., R. 4 W.) on the Willamette River.

valley margin between the Salem-Santiam fan deposits and the Molalla River deposits. In many respects, they are similar to the Molalla deposits, both in particle size and in composition. However, they are deficient in sand-sized matrix materials in comparison to other types of deposits in the study area.

The minor tributary stream deposits are the thinnest gravels in the lower Willamette Valley. Nowhere have they been found more than 20 feet thick and are usually 10 feet or less in thickness. Typical minor tributary stream deposits are shown in figure 6.

Labish lowland deposits: The diversion of the Willamette River from the Labish lowland course was accompanied by the deposition of a thick wedge of sand near the center reach of the abandoned channel. The damming of water above this sand deposit resulted in the formation of "Lake Labish", followed by the accumulation in the lake of a thick peat deposit (21 feet in the upper portion of the lowland). Downstream the sand deposit thins and is buried by younger fine-grained materials. Foundation excavations for the U.S.D.A. flood control project near Parkersville in the center portion of the Labish lowland (sec. 6, T. 6 S., R. 1 W.) revealed more than 18 feet of sand.

The sand in the center portion of the Labish lowland represents one of the two known relatively large pure sand deposits in the lower Willamette Valley. The significance of these deposits is in their potential use as a filler in conjunction with the gravels in the valley which lack desirable grading characteristics or in their exploitation when relatively pure sand-sized material is desired.

Terrace deposits: Terrace deposits are the most widespread but least exploited in the study area. This is attributed to their weathered character where they are near the surface, such as at Molalla, or to the depth of overburden, which may exceed 60 feet in the French Prairie area.

The typical terrace stratigraphic section (figure 7) begins at or near the present flood-plain level with a variable thickness of gravel which grades into a thick section of sand and then into silt. Most of the gravels are basaltic and andesitic in composition, although a higher percentage of acid volcanics is present than in previously discussed deposits. The gravels are moderately to well cemented, usually with a fine-grained (clay) matrix. Typical terrace sands may be seen near Pat's Acres, west of Canby, and at Aurora. The Aurora sand was investigated in the laboratory and found to consist of fine-grained rock fragments, feldspars, and quartz in that order of abundance. The heavy minerals are principally pyroxenes and amphi-

boles with minor amounts of magnetite, basaltic hornblende, garnet, sphene, and zircon.

Conclusions

On the basis of this reconnaissance survey of the sand and gravel deposits in the southern portion of the lower Willamette Valley, the following conclusions seem appropriate:

The Willamette flood-plain deposits are the most extensive. Their successful exploitation, however, is contingent upon recognition of the stratigraphic position of the pit site and of the limitations of each position. From this standpoint, channel-belt operations are the most promising, offering possible replenishment of the sand and gravel used. Flooding, however, may be a problem in this area. Both meander-belt and flood-basin deposits underlie a fine-grained overburden of varying thickness, and indurated layers may be encountered even within the upper production zone.

The Salem-Santiam fan deposits offer a potential source of sand and gravel to the Salem area for many years to come. Their production and exploitation offer few problems. The presence of an upper weathered zone of poorer quality material should be recognized.

Molalla River flood-plain gravels are the highest quality materials in the area studied. Production at depth is limited, and the grading characteristics are poorer than for other types of deposits.

Silver, Abiqua, and Butte Creek deposits as observed are thin and any exploitation for other than small local demands is limited.

The Labish lowland and terrace sand deposits offer a potential source of fine-grained material.

The economics of nonmetallic mineral resource production require that the deposits be close to the source of demand. Recognition of this fact is important if a continuing supply of sand and gravel in the lower Willamette Valley is to be insured. This is particularly true in or near metropolitan areas where conflicting interests often have resulted in the exclusion of sand and gravel operations from feasible areas. Adequate zoning is necessary for the protection of both civic interests and this important mineral resource.

References

Schlicker, H. G., 1960, Gravel resources in relation to urban development in the Salem area. State of Oregon Department of Geology and Mineral Industries.

Trimble, D. E., 1957, Geologic map of the Portland, Oreg.-Wash. area. U.S.G.S., GQ 104.

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OREGON MINING ASSOCIATIONS ELECT OFFICERS

The Eastern Oregon Mining and Minerals Association, at its February 14 meeting in Baker, reelected Calvin Suksdorf as chairman. Goff Smith, Ken Grabner, Lester Olson, and Cully J. Trickel were named to the board. Laurence Neault was elected treasurer and Jim Anderson was re-elected secretary. James Dickerson is the new vice-president.

The Northwestern Mining Council, Inc., with new headquarters at Jacksonville, held annual election February 1. Officers are as follows: Russell Mitchell, Medford, president; George Huffman, Talent, vice president; Dave Fraysher, Medford, treasurer; Irene Mitchell, Medford, secretary; W. H. Holloway, Medford, corresponding secretary; and Glenn Hall, Medford, George Brewer and Fred Adams, Jacksonville, and Cliff Green, Central Point, directors.

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SEISMOLOGICAL OBSERVATORY NEAR BAKER

The Department of Defense announced March 14 that it will build a seismological observatory near Sparta, to be known as the Blue Mountain Seismological Observatory. It will be built and operated under management and supervision of the Air Force Technical Applications Center under the Vela-Uniform Program, which is concerned with the development of techniques and equipment to detect and identify underground nuclear weapons tests. Construction plans call for the completion of the observatory by summer. It will be situated on a 2,000-acre site about 25 miles east of Baker, where 21 seismometers will be located in water-tight vaults and covered by about 2 feet of earth. Ten will be arranged in a geometrical pattern to form an array. All will be monitored by associated amplification and recording equipment.

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SMALL MINE BULLETIN AVAILABLE

The Idaho Bureau of Mines and Geology has issued an excellent publication, "Prospecting and Developing a Small Mine," which contains information useful to the prospector and small-mine operator. The bulletin was written by W. W. Staley, professor of mining engineering at the University of Idaho College of Mines and is available from the Bureau of Mines and Geology, Moscow, Idaho, for $1.00 a copy.

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The ORE BIN
Vol. 24, No. 4
April, 1962

KALMIOPSIS WILD AREA

By

Ralph S. Mason*

The Wilderness Bill has generated much public discussion, and many statements have been presented by individuals and organizations. Unfortunately there have been too many generalities and too few facts. Here is an inventory of the natural resources of an area which is to be included in the Wilderness system. The area is felt to be typical of many that are being considered for withdrawal. - Ed.

In 1930, Mr. and Mrs. John Leach of Portland, Oregon, discovered a low, flowering shrub with evergreen leaves and rosy purple blossoms along the Gold Basin trail in eastern Curry County. The unusual plant was eventually determined by botanists to be a rare monotypic genus relic of the Heath family and was given the name Kalmiopsis leachiani in honor of the discoverers and because of a close resemblance to the shrub Kalmia.

Widespread interest in the discovery was followed by large-scale collecting and removal of the plant by professional gardeners. At the urging of nature lovers, the U.S. Forest Service set aside the Big Craggies Botanical Area, covering approximately 10 square miles, in order to preserve the shrub. Since that time, Kalmiopsis leachiani has been found at many other localities in southwestern Oregon and northwestern California. Plants are now taken from the Steamboat district in Douglas County in preference to the original discovery site because of a higher incidence of success in transplanting.

In 1942, the Forest Service established the Kalmiopsis Wild Area southeast of the Big Craggies area. This new region is entirely separate from the Big Craggies Botanical Area and is much larger. It covers 78,850 acres or approximately 123 square miles and embraces the headwaters of the Chetco River west of the Josephine County line in Curry County (see map, pages 56 and 57). Pearsoll Peak, Canyon Peak, Vulcan Peak, Chetco Peak, Quail Prairie Mountain, Hayward Peak, and the Big

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Craggies surround and practically isolate the area. Elevations range from 300 feet on the Chetco River where it leaves the area to 5,098 feet above sea level at Pearsoll Peak. The country is very rugged and is characterized by deep canyons and narrow ridges. U.S. Geological Survey topographic maps covering the region include the Pearsoll Peak, Collier Butte, Mt. Emily, and Chetco Peak quadrangles. Access to the area is over rough Forest Service roads. None of these roads is suitable for modern passenger cars. The Forest Service has recently erected gates and signs which prohibit access to those not having official or authorized business.

In addition to being the "home" of Kalmiopsis, the Wild Area lies at the junction of the Oregon coastal and northern Californian floras. The Forest Service states that it is the merging of these two floras that makes the Kalmiopsis Area of such botanical interest. Listed as also growing there are Brewer's spruce, Sadler oak, and Port Orford white cedar, all of which have a limited geographical extent. Other forest tree types include Douglas fir, Ponderosa pine, sugar pine, Shasta fir, and various hardwoods. Shrubs include rhododendron, azalea, and poison oak. Wildlife is represented by blacktail deer, black bear, elk, mountain quail, blue grouse, raccoon, mink, otter, skunk, civet cat, weasel, ring-tailed cat, coyote, bobcat, cougar, and rattlesnake. In the streams there are steelhead and sea-run cutthroat, silver and Chinook salmon, native rainbow, and cutthroat trout.

Geologically, the Kalmiopsis Wild Area indicates a region of considerable economic importance. This is signified by the fact that both the U.S. Geological Survey and the State of Oregon Department of Geology and Mineral Industries have made many investigations in the region. J. S. Diller of the Federal survey, in reporting on the mines and mineral potential of southwestern Oregon, included this region in his description of mines in U.S. Geological Survey Bulletin 546, published in 1914. The geology and mineral resources of Curry County were reported on by the Oregon Bureau of Mines and Geology (Butler and Mitchell, 1916). The geology of the area has also been described by Wells (1948 and 1955). Descriptions of the more important mines and prospects in Curry County were published by the State of Oregon Department of Geology and Mineral Industries in 1940. A study of several chromite properties lying within and adjacent to the area is included in a department report (Ramp, in press 1962).

The Kalmiopsis Wild Area is underlain by some of the oldest rocks in Oregon. Although mineral concentration is not limited to the older rocks, it is much more common in them. Nearly 50 mines and prospects are known in the immediate district (see map, pages 56 and 57). Most of the rocks

in the area are of Jurassic age. They include the Dothan, Rogue, and Galice Formations and ultrabasic rocks such as peridotite and serpentine. The Dothan sediments have not been mineralized to any extent, but 7 gold placers are situated on streams flowing over Dothan rocks. The gold for these placers has presumably been derived from the intrusives of the Rogue Formation lying immediately to the east. The belt of Rogue volcanics, which has its southern termination in the Kalmiopsis Wild Area, has been long recognized by the miner as a better-than-average place to prospect, and numerous lode gold deposits have been discovered within the boundaries of the wild area. The mineralized band of the Rogue Formation extends northwards from the Kalmiopsis Wild Area for many miles. Included in this zone are some of Oregon's largest gold and copper mines, such as the Almeda, Benton, Robertson, and Pyx, plus dozens of smaller mines and prospects. The Galice Formation is a complex of many rock types, and, generally speaking, is much less mineralized than the Rogue series in this area. The ultrabasic rocks, including peridotite, dunite, and serpentine, have been prospected for chromite, and 18 mines are located in the area or immediately adjacent to it. In addition to gold and chromite occurrences, there are three copper deposits and one iron.

All of the mineral occurrences known in the area were discovered through surface outcrops. There has been no subsurface exploration.

Mineral production within the Kalmiopsis Area began early in the century, but no record was kept of much of the first gold and silver that was mined and placered. Available records (Shenon, 1933) indicate, however, that $117,000 in gold was mined at the Robert E. mine (or Peck) in two periods of operation totaling 9 years. First production at the mine was in 1919. Records indicate that the Frazier mine has produced at least $15,000 in free gold or gold combined with arsenopyrite. Chrome mines in the area have produced during World Wars I and II and during the Korean Crisis.

Recreational features in the area include hunting and fishing. Neither is practiced to any great extent by sportsmen because the area is relatively difficult of access and travel within the boundaries of the area is made arduous by the exceedingly rough terrain and lack of adequate trails. Scenically the area has little to offer which cannot be seen along other miles of Forest Service roads and trails in southwestern Oregon. The climate in the region is generally mild, with the heaviest rainfall during the winter and spring months. Snow can be expected to remain on the ground for several months in those areas having an elevation greater than about 4,000 feet. The summer and autumn months are commonly hot and dry, with temperatures in the 80's and 90's.

Timber resources listed by the Forest Service in the 1942 application for creating the Kalmiopsis Wild Area include 263 million board feet of Douglas fir, 7 million board feet of Ponderosa pine, 15 million board feet of sugar pine, 13 million board feet of various hardwoods, and lesser amounts of Port Orford white cedar, Brewer's spruce, and Shasta fir.

The economic impact of the Kalmiopsis Wild Area withdrawal upon Curry County can be gauged best when it is realized that this area amounts to $7\frac{1}{2}$ percent of the total area of the county. By comparison, the region is 50 square miles bigger than the entire City of Portland. Based on Forest Service estimates made 20 years ago of the merchantable timber, and using 1960 prices, the total value of Douglas fir, Ponderosa pine, and sugar pine growing in the area amounts to $23,000,000. This figure does not include the value of 13 million board feet of various hardwoods plus Port Orford white cedar, Brewer's spruce, and Shasta fir.

The total value of gold, silver, copper, and chromite which has been mined in the area is unknown. Existing records show that $132,000 in lode gold and about $62,000 worth of chromite have been produced. Both figures are incomplete. A conservative estimate would place the value somewhere in the neighborhood of $200,000, with a figure several times this amount possible.

It would appear that the economic potential of the Kalmiopsis Wild Area is too great to permit it to be included in the Wilderness system without some reservations. Prospecting and mining should be permitted to continue in the same manner as they have been while classified as a Wild Area. If included in the Wilderness withdrawal, mining would be effectively curtailed; for, although token provision is made for prospecting, there are also regulations which would so hamper any such activities that it would be impossible to do anything more than collect random surface samples.

Mining is a basic industry vital to our local and national economics. It has been shown that in times of emergency, the Kalmiopsis Wild Area has produced chromite urgently needed for defense. In times of peace, the same area has produced gold, the mining of which has given much needed employment.

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* * * * *

NOTICE ANYTHING DIFFERENT?

For the past few years the ORE BIN has been suffering from growing pains. With the gradual shift in emphasis from mining to geology there has been a trend toward more geologic reports and maps and the addition of photographs. So with the beginning of its 24th year, the ORE BIN discarded its old rompers and moved into a dignified suit. Instead of a bunch of $8\frac{1}{2}$- by 11-inch sheets gathered together and stapled, it became a booklet with a colored cover especially designed for it. The new seal, drawn by Hal Smith, artist for the State Game Commission, acquired an oil derrick in hopeful optimism for Oregon's future.

The new format with its smaller page, narrower column, and 10 percent reduction in type size is intended to make the ORE BIN more readable and more adaptable to the book shelf, as well as better to look at. If you have been wondering why the January number was taller than subsequent issues, the reason is that this original 9-inch height had to yield to the mechanics of the collating machine and be sheared off a half inch. Its recent tardiness is due to production problems which, we hope, will soon be overcome.

We have received a number of comments about the new look of the ORE BIN, and although some subscribers prefer the old format, most regard the change as a great improvement. What do you think? We would be glad to hear from you.

* * * * *

PETRIFIED WOOD CONSIDERED

Companion bills in the House and Senate , introduced by Interior Department request, Committee on Interior and Insular Affairs, would amend Public Law 84-167 to exclude deposits of petrified wood from appropriation under the mining laws. It would define "petrified wood" as "agatized, opalized, petrified, or silicified wood, or any material formed by the replacement of wood by silica or other matter." These bills are listed as S. 2974, Anderson (N.M.) and H.R. 10540, Edmondson (Okla.). (From American Mining Congress Bulletin Service, March 19, 1962.)

* * * * *

DEPARTMENT ISSUES NEW DRILLING PERMIT

The Department issued Permit No. 45 to the Two-State Oil & Gas Co., Inc., of Boise, Idaho, on April 17, 1962. The company plans to drill a 3,000-foot test well near Vale in eastern Oregon. The well will be named "Two-State Vale City No. 1" and will be located 3,310 feet south and 660 feet east from the northwest corner of sec. 21, T. 18 S., R. 45 E., Malheur County. Ground elevation is 2,250 feet on the Mitchell Butte topographic map. Maynard J. Davies, 6319 Randolph Drive, Boise, is president of the firm. Artesian Well & Pump Co. of Boise will do the drilling for Two-State, using a heavy cable tool rig.

* * * * *

THE DALLES TO RECEIVE ALUMINA

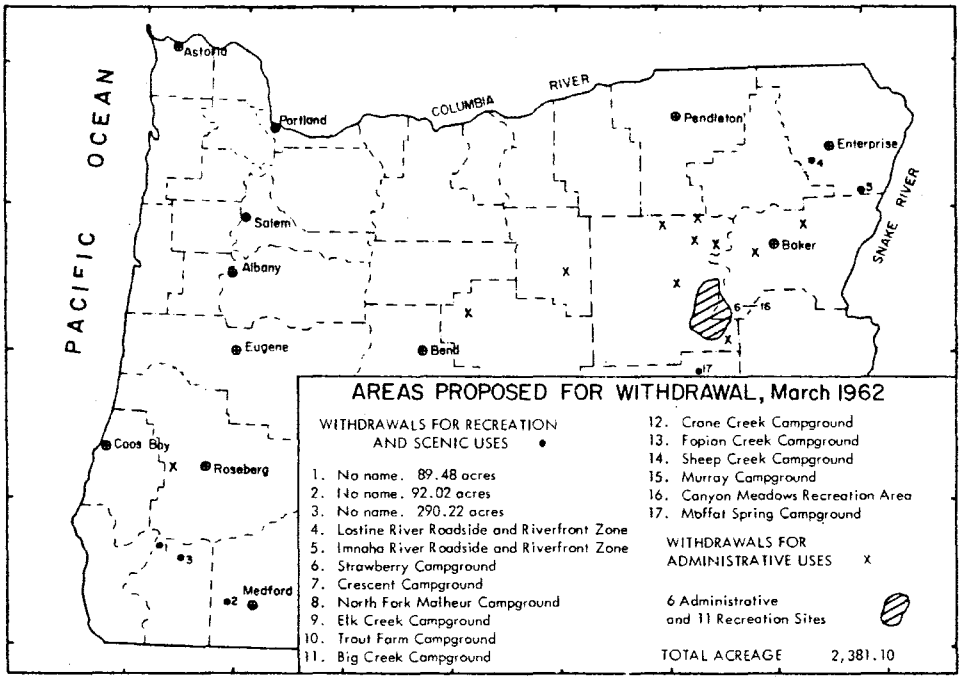
Harvey Aluminum Co. has signed a contract with the Government of the Virgin Islands to build a $25 million alumina plant, with a capacity of 100,000 tons of alumina per year, in St. Croix, Virgin Islands. The plant will be built by a Harvey subsidiary, Harvey Alumina Virgin Islands, Inc. A Harvey spokesman said his company does not, at the present time, own bauxite deposits, but is exploring for bauxite ore in Jamaica and British Guiana. The alumina to be produced at the new plant will be shipped to Harvey's aluminum plant at The Dalles, Oregon, for processing into refined aluminum. (Nevada Mining Assn. News Letter, March 15, 1962.)

* * * * * *

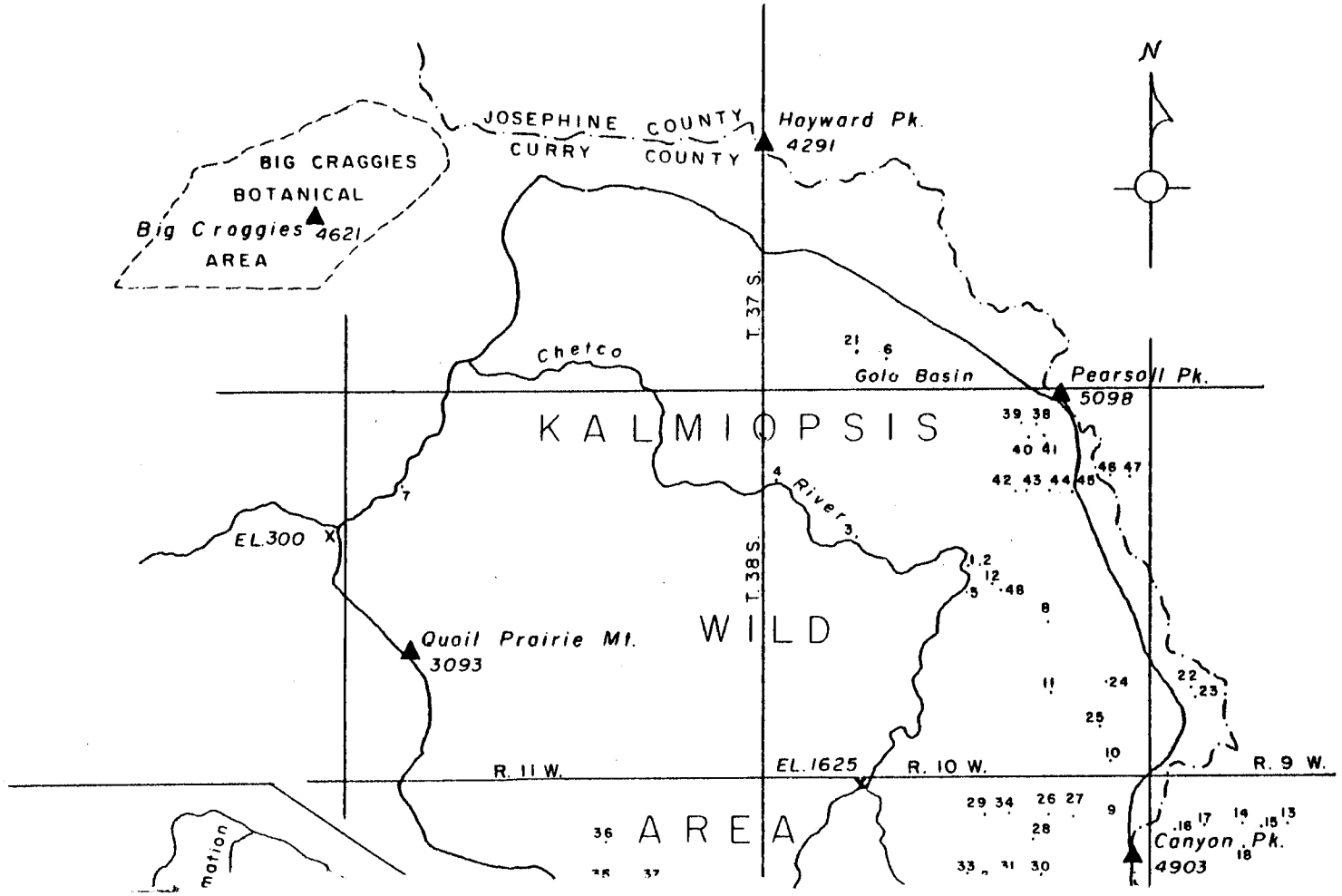
MORE WITHDRAWALS ANNOUNCED

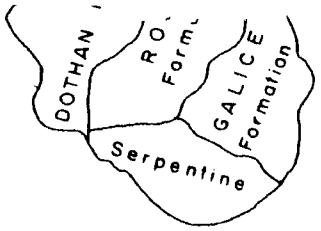
During the month of March the Department received 7 notices from the U.S. Bureau of Land Management on more land to be withdrawn from mineral entry (see map). Most of these withdrawals are for recreational purposes, but others include land needed for site of a seismological station, for reclamation purposes, and other necessary government uses. In all cases these withdrawals were small and appear to be restricted to the area required.

Although the total amount of land withdrawn, according to the March announcements, is only 2,381.10 acres, or approximately 4 square miles, it should be noted that these withdrawals are a small amount of the aggregate that continually becomes greater and greater and therefore leaves that much less land open for prospecting and mining. During the past $5\frac{1}{4}$ years since the Department has been notified of withdrawals in the State, 118,000 acres or 185 square miles have been taken from mineral location. By and large, the bulk of these withdrawals was for recreation.

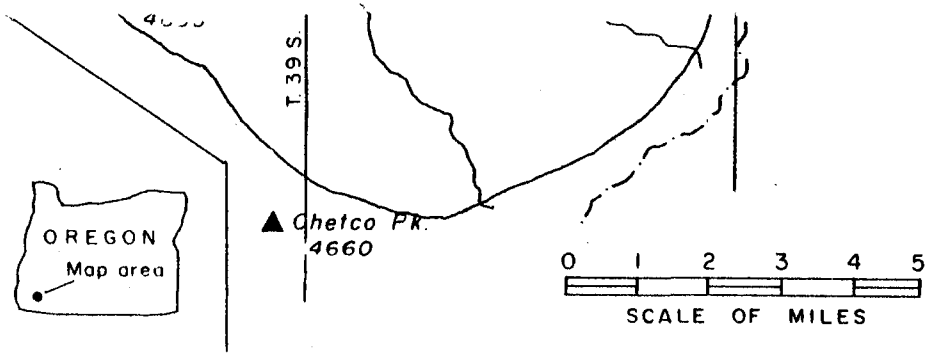


MAP OF THE KALMIOPSIS WILD AREA





INDEX MAP SHOWING
ROCK TYPES



LIST OF MINES IN KALMIOPSIS WILD AREA

Gold Placer

1. M & B Placer
2. Slide Creek
3. Granite Creek
4. Sluice Creek
5. Babyfoot Creek
6. Gold Basin
7. Boulder Creek

Gold Lode

8. Peck Mine
9. M C Claims
10. Hilltop Mine
11. Frazier Prospect
12. China Diggings
13. Canyon Creek
14. Telluride
15. Winters
16. McPherson

Copper Prospects

17. Mides
18. Bailey
19. Chetco Copper
20. Unnamed prospect

Iron Prospect

21. Tincup Iron

Chromite Prospects

22. Babyfoot
23. Lucky Day
24. Sugarloaf
25. Unnamed
26. Carter Creek
27. Burned Cabin
28. Little Boy
29. Bailey
30. Buck
31. Emily Cabin
32. Morning Sun
33. Hawks Rest View
34. Unnamed
35. Nancy Hank

Chromite, cont.

36. Gardner
37. Rosie
38. Pearsoll
39. Pearsoll Group
40. Eagle's Nest
41. Little Siberia
42. Prospector's Dream
43. Wonder Group
44. Lost If Found
45. Uncle Sam
46. McCaleb No. 1
47. McCaleb No. 2
48. Bowser

HOUSE COMMITTEE TO ACT ON WILDERNESS BILL

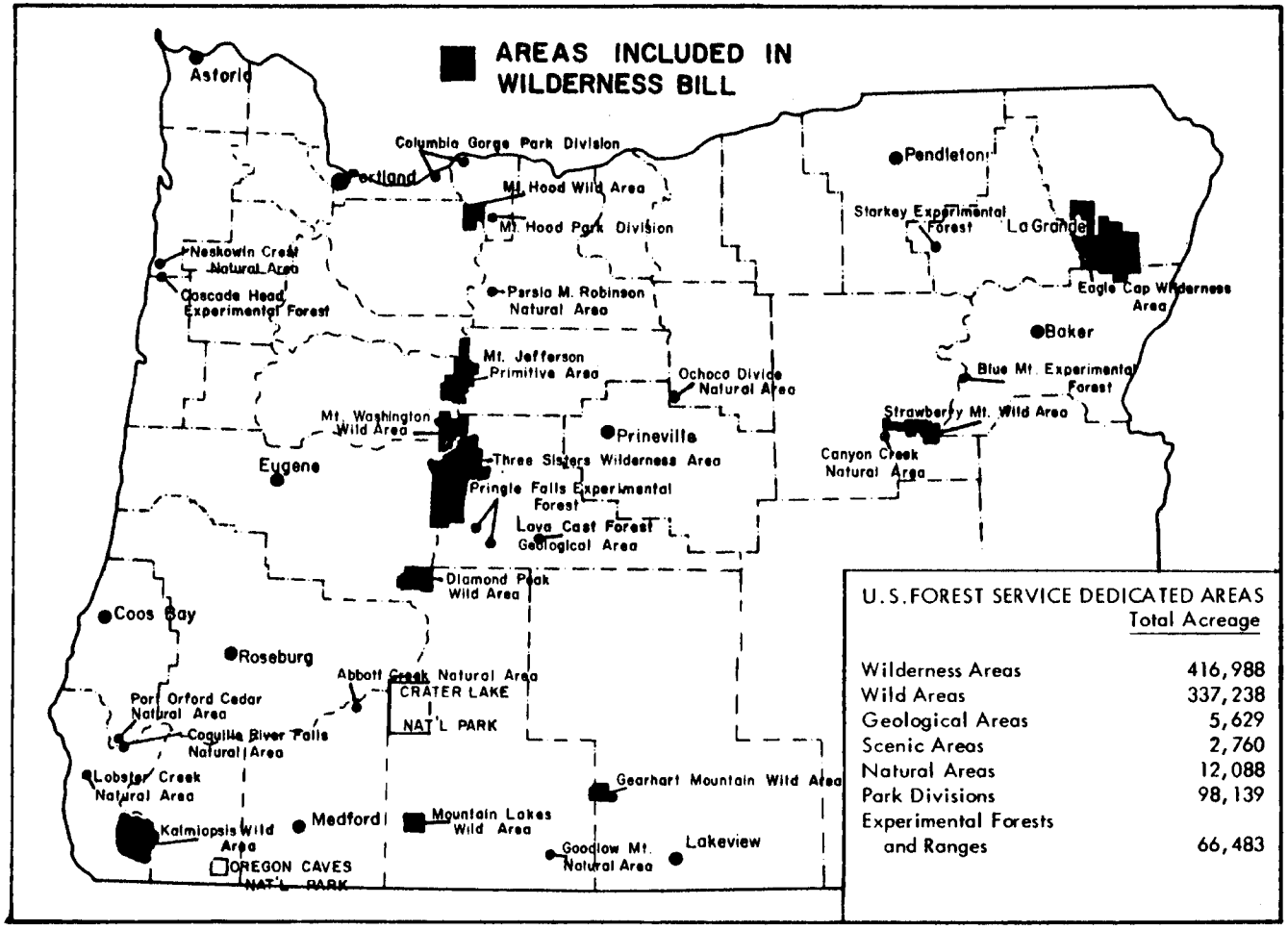
Congressman Wayne N. Aspinall of Colorado, chairman of the Committee on Interior and Insular Affairs, House of Representatives, has announced that the Public Land Subcommittee, Representative Gracie Pfost of Idaho, chairman, will consider legislation designed to establish a Wilderness Preservation System during the entire week of May 7, 1962. Proposals for the establishment of a Wilderness Preservation System are contained in S. 174, commonly referred to as the Wilderness Act, which was passed by the United States Senate on September 6, 1961.

Chairman Pfost said that officials of the Executive Departments will be the first witnesses at the beginning of the hearings, to be followed by public witnesses. Because time for consideration of this legislation and the time available to the subcommittee is limited, the time allotted to witnesses appearing before the subcommittee will be restricted. Individuals and groups that appeared or were represented at meetings held by the subcommittee in the fall of 1961 will not be heard again. However, if such groups have new and additional information to be submitted, the committee will be glad to receive it in written form and give it consideration without hearing witnesses. All persons who desire to do so may file written statements for the consideration of the committee and for inclusion in the printed record of the committee, in lieu of presenting oral testimony in a personal appearance. Statements should be sent to the Committee on Interior and Insular Affairs, Room 1324 New House Office Building, Washington 25, D.C.

As this legislation, if passed, would have a very significant effect on large areas in the West now open to mining, the main features of S. 174 are reviewed below:

1. National Forest areas now classified as "wilderness," "wild," "canoe," and "primitive" automatically would become part of the wilderness system on the effective date of the Act, subject to possible deletion of primitive areas as a result of reviews by the Secretary of Agriculture over a 10-year period. Recommendations concerning primitive areas would be submitted by the President to Congress and could be rejected by resolution of either House of Congress.

2. National Park and National Monument areas embracing a minimum of 5,000 acres each without roads, and wildlife refuges and game ranges, would be reviewed by the Secretary of the Interior for possible inclusion in the wilderness system. Recommendations would be submitted by the President to Congress and could be rejected by resolution of either the Senate or the House.


AREAS INCLUDED IN WILDERNESS BILL
Astoria
Columbia Gorge Park Division
Portland
Mt. Hood Wild Area
Mt. Hood Park Division
Neskowin Creek Natural Area
Cascade Head Experimental Forest
Persia M. Robinson Natural Area
Mt. Jefferson Primitive Area
Ochoco Divide Natural Area
Mt. Washington Wild Area
Prineville
Eugene
Three Sisters Wilderness Area
Pringle Falls Experimental Forest
Lava Cast Forest Geological Area
Diamond Peak Wild Area
Coos Bay
Roseburg
Abbott Creek Natural Area
CRATER LAKE NAT'L PARK
Port Orford Cedar Natural Area
Coquille River Falls Natural Area
Lobster Creek Natural Area
Kalmiopsis Wild Area
Medford
Mountain Lakes Wild Area
Gearhart Mountain Wild Area
Goodlow Mt. Natural Area
Lakeview
OREGON CAVES NAT'L PARK
Pendleton
Starkey Experimental Forest
La Grande
Eagle Cap Wilderness Area
Baker
Blue Mt. Experimental Forest
Strawberry Mt. Wild Area
Canyon Creek Natural Area
U.S. FOREST SERVICE DEDICATED AREAS
Total Acreage
Wilderness Areas 416,988
Wild Areas 337,238
Geological Areas 5,629
Scenic Areas 2,760
Natural Areas 12,088
Park Divisions 98,139
Experimental Forests and Ranges 66,483

3. Subject to existing rights, there would be no commercial enterprise within the system and no roads or buildings. Motor vehicles, motor boats, and aircraft would be prohibited except where such practices have become well established, in which case they would continue subject to restrictions.

4. The grazing of livestock, where well established, would be permitted subject to restrictions deemed necessary by the Secretary involved.

5. The President may authorize prospecting, mining, and other limited use if he determines that such use or uses will better serve the interest of the United States and the people thereof than will its denial.

If any areas containing roads are incorporated into the wilderness system, the roads will have to be cut off. However, it would be possible to leave the roads outside a primitive area incorporated into the system to provide direct access to the perimeter of the area.

The Forest Service has established 83 areas totaling 14,661,416 acres of land for preservation as "wilderness," "wild," "primitive," and "canoe." Of this total, 40 are presently classified as primitive areas comprised of 7,907,416 acres subject to the review indicated above.

Derivation of these terms came about as follows. In 1929, the Secretary of Agriculture by regulation authorized the Chief of the Forest Service to establish primitive areas in National Forests. That regulation was rescinded in 1939 and superseded by new regulations authorizing the establishment of "wilderness" areas exceeding 100,000 acres and "wild" areas ranging from 5,000 to 100,000 acres each. No new primitive areas have been established since 1939 and the Department has been restudying primitive areas in an effort to reclassify them as either wilderness or wild.

"Wilderness" areas can be designated by the Secretary only but the Chief of the Forest Service may designate "wild" areas. The two types of areas are administered similarly with permanent improvements, occupancy, and road and commercial timber cutting prohibited. Grazing and the development of water storage projects not involving road construction may be permitted. All "wilderness," "wild," "primitive," and "canoe" areas are presently open under the mining laws unless there has been a specific withdrawal order for some particular purpose or reason.

There are 10 wilderness and wild areas in Oregon, embracing 754,226 acres (see map on page 59). By contrast, there are 1,082 camp and picnic grounds, wildlife management areas, and other established recreational sites embracing approximately 1 million acres (data from Recreation Survey of the Pacific Northwest Region, March 1961, prepared by the recreation subcommittee of the Columbia Basin Inter-Agency Committee). On a nation-wide basis, attendance in wilderness and wild areas in 1958,

according to the U.S. Forest Service, amounted to 8/10ths of 1 percent of the overall recreation visits.

The mining people in Oregon are urged to write their Congressmen and the Committee, expressing their views on this legislation. Remember the hearing date - May 7. Not much time remains, so do not delay.

* * * * *

STRATIGRAPHIC NOMENCLATURE CAPITALIZATION REVISED

The American Commission on Stratigraphic Nomenclature has been formed in an effort to develop uniform usage in stratigraphic classification and terminology. A Code of Stratigraphic Nomenclature prepared by the commission was published in the May, 1961, Bulletin of the American Association of Petroleum Geologists. As this department is a cooperator with the commission, the recommendations set forth in the code have been adopted. Particular attention is drawn to the change in capitalization of formal rock stratigraphic names as given in Article 10 of the report: "Capitalization of the initial letters of all words used in forming the names of formal rock-stratigraphic units is recommended." Examples of Oregon units are: Columbia River Basalt, Clarno Formation, and Siletz River Volcanic Series.

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IS YOUR ADDRESS CORRECT?

Lack of prompt notification of changes of address has resulted in late delivery of many copies of the ORE BIN to subscribers, because the Post Office returns the copies to our office, the addresses must be verified, possibly by letter, and we then re-mail them at a total cost to us of 17 cents in charges, a formidable sum on a 50-cent subscription. Incomplete addresses, such as lack of box numbers on rural routes, and even changes in box numbers within the same post office, can cause the same treatment. May we ask that you please check your address as shown on this issue and notify us of any errors?

CHANGES IN MINING LAWS?

In a speech to the Colorado Mining Assn. on March 17 in Denver, Karl S. Landstrom, Director of the Bureau of Land Management, U.S. Department of the Interior, advocated changes in the present Federal Mining Laws. Among such recommended changes were:

1. Mining locations would be recorded in the land office of the BLM.
2. Increase present requirement of $100 of annual assessment work per claim to $10 per acre.
3. The price of land for patent would be $5 per acre for the mineral rights, plus the value of the surface over $25 per acre.
4. Exploration claims of 160 acres could be held for 5 years, during which time the holder could prospect for locatable minerals. Any person could hold exploration claims of up to 5,120 acres.

The U. S. Department of the Interior favors the following changes:

1. No claim shall exceed 40 acres, and each 10-acre tract shall be mineral in character.
2. Each claim shall be tied in with any existing surveys.
3. Each claim shall be recorded in the district land office, within 90 days.
4. There shall be no distinction between "lode" and "placer" claims.
5. There shall be no extralateral rights.
6. When not patented, prior to termination of a claim, the surface of the claim shall be restored as nearly as possible to its original condition.
7. Within 2 years of the effective date of this "Act" the holder of an unpatented mining claim located prior to the effective date of this "Act" shall file in the U.S. District Land Office certain information relative to his claim.
8. Assessment work may include geological, geochemical, or geophysical surveys.
9. Assessment work on exploration claims shall be not less than $10 per acre for the first, second, and third years; and not less than $20 for the fourth and fifth years.
10. The Secretary of the Interior would be authorized to issue such rules and regulations necessary to effectuate the purposes of the "Act." (Nevada Mining Assn. News Letter, April 15, 1962)

* * * * *

STIMULATION OF GOLD AND SILVER PRODUCTION EXPLORED

"To explore and consider ways and means of stimulating domestic production of gold and silver" and to consider S.J.Res. 44 regarding incentive payments to domestic gold producers - Engle (Calif.) and four others - were the purposes of a hearing March 15 by the Senate Interior Subcommittee on Minerals, Materials, and Fuels. The Resolution would provide subsidy payments of as much as $35 an ounce for newly mined domestic gold.

Senator Engle told the subcommittee that while our Nation's outflow of gold seems to have been halted, "we still have to get at the other end of the problem -- our decline in the production of gold. The supply of gold which our country needs for its reserves -- a supply being steadily drained away by unfavorable trade balances -- certainly is not going to increase significantly until something is done to make it economically feasible for our gold mining industry to stay in business." His measure, he continued, provides that incentive payments would vary in accordance with the amount necessary to enable each mine to get back into production, and would cease during the five-year period authorized by the bill when gold reserves reach the $23 billion level.

Merrill E.Shoup, president, Golden Cycle Corp., Colorado Springs, Colo., appeared on behalf of the American Mining Congress, the Colorado Mining Association, and his company, and called the subcommittee's attention to the American Mining Congress' 1961 "Declaration of Policy" on gold, recommending the following essential steps toward reestablishment of a workable gold standard: (1) Removal of restrictions on ownership, purchase, or sale of gold by American citizens; (2) cessation of Treasury sales of gold for industrial purposes, requirements to be met by the market at freely negotiated prices; and (3) redefinition of the depreciated dollar in terms of gold, and convertibility to and from that metal.

In describing the dire plight of the industry, Shoup detailed the principal contributing factors which led to the closing of Golden Cycle's operations at Cripple Creek, Colo. He said that during the last 25 years labor costs have increased 157 percent while mill supply costs have increased 205 percent. During this same period, he stated, the population of the district has decreased 80 percent and mine and mill employment 85 percent. In 1935, he said, his operations included 40 operating mines, but by 1961 that number had dwindled to 4.

Focusing attention on the domestic silver situation, Robert M. Hardy, Jr., president of Sunshine Mining Co., testifying on behalf of the American Mining Congress and the Idaho Mining Association, told the

subcommittee that the current policy of replacing silver certificates with Federal Reserve notes so that more silver may become available for coinage would have a three-fold adverse effect. "First of all," he said, "the burden upon the gold monetary reserve is increased when it is already in peril. Secondly, the silver thus minted is costing $1.29 per ounce when it could be obtained in the open market for around $1.02 an ounce. And lastly, production of silver is discouraged at a time when not only are domestic miners in dire economic trouble, but the country also needs the production of new wealth."

Subcommittee Chairman Carroll (Colo.) pointed out that S.J.Res.44 has received adverse reports from the Treasury, State, and Interior Departments and from the Bureau of the Budget. (American Mining Congress Bulletin Service, March 19, 1962)

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BILL WOULD CREATE PUBLIC LANDS APPEALS BOARD

Sen. Ernest Gruening of Alaska and 11 other Senators have introduced a bill (S.3107) which would establish in the Office of the Secretary of the Interior a three-member Board of Public Lands Appeals. The bill would provide that any final decision of the Bureau of Land Management or the Geological Survey concerning the uses of or claims to public lands under the jurisdiction of the Interior Department may be appealed to the Secretary, with the Board hearing and determining such appeals on behalf of the Secretary, and would also provide that decisions of the Board may be appealed to the U.S. Court of Appeals for the circuit in which the land involved is situated.

Speaking on the floor of the Senate, Gruening said that over the years he had received many letters of complaint concerning arbitrary and capricious decisions on the part of the Bureau of Land Management and the Geological Survey. Laws and regulations governing the use and disposition of the public lands should be interpreted and applied uniformly and equitably, he said.

"Those who seek, under applicable provisions of the law, to use or obtain public lands should not be treated as though they were trying to deprive the Federal Government of something," Gruening declared.

S. 3107, cosponsored by Senators Chavez, N.M., Morse and Neuberger, Ore., and others was referred to the Committee on Interior and Insular Affairs. (A.M.C. Bulletin Service, April 13, 1962).

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The ORE BIN
Vol. 24, No. 5
May, 1962

GEOMORPHOLOGY OF THE CONTINENTAL TERRACE OFF THE CENTRAL COAST OF OREGON

by
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Introduction

The major submarine geomorphic features off the Oregon coast are the continental shelf, extending from low water to the first pronounced increase of slope to deeper water, and the continental slope, from the outer edge of the shelf to the decrease of slope at the edge of the abyssal plain (Figure 1). Together, these constitute the continental terrace. The terrace varies in width from more than 70 miles off Astoria to less than 40 miles [1] off Cape Blanco, and extends to the 1,500- to 1,700-fathom[2] depths of the southward-deepening abyssal plain. Off the Columbia River, Astoria Canyon and Astoria Cone alter the shape of the continental terrace.

Astoria Canyon, the only major submarine canyon off the Oregon coast, heads 10 miles west of the mouth of the Columbia at a depth of 70 fathoms, and extends some 60 miles to a depth of 1000 fathoms, where its identity as a canyon is lost on Astoria Cone. It is somewhat serpentine in shape, is 4 miles wide where it crosses the edge of the continental shelf, and has an axial slope of about 2° near its head and 1° beyond the edge of the shelf.

Astoria Cone is a fan-shaped feature extending from 1000 fathoms along the continental slope to the abyssal plain at 1,500 fathoms, and covering an area of more than 3,500 square miles. It slopes about 0.5°, and is undoubtedly the result of deposition from turbidity currents which discharge from Astoria Canyon.

The continental shelf along the Oregon coast differs notably from the

1/ Statute miles will be used throughout this report.
2/ One fathom is a measure of depth equal to 6 feet.

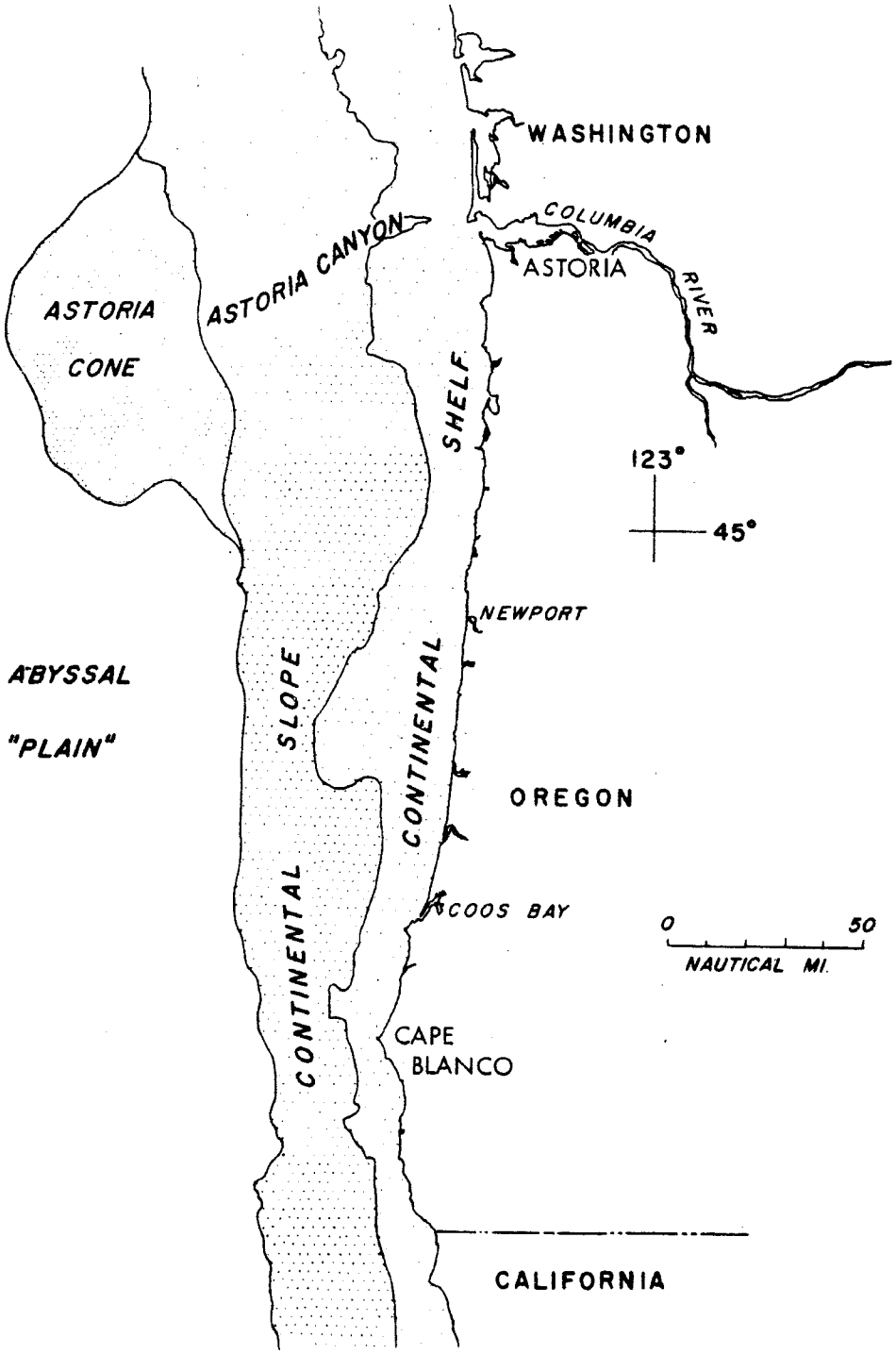


Figure 1. Index map of the submarine geomorphic features off Oregon.

average continental shelf. According to Shepard (1948, p. 143), shelves around the world have an average width of 42 miles, an average slope of 0°07', and an average depth at the outer edge of 72 fathoms. The shelf along Oregon is 9 to 40 miles wide, slopes 0°08' to 0°43', and has a depth at its outer edge of 80 to 100 fathoms. Thus, the Oregon continental shelf is characteristically narrower, steeper, and deeper than the average continental shelf.

The Oregon continental slope, from the edge of the shelf to the abyssal plain, is 13 to 60 miles wide and, eliminating irregularities, has an inclination of from 1°24' to 7°18', with 2° to 3° the most common. In general, the slope is narrowest and steepest where the shelf is widest. Shepard (1948, p. 187) states that the typical continental slope averages 4°17' for the first 1000 fathoms.

A bathymetric chart of the continental shelf and upper two-thirds of the continental slope (to a depth of 1000 fathoms) for the area between 43°30'N. and 45°00'N. has been prepared from unpublished soundings of the United States Coast and Geodetic Survey and Precision Depth Records obtained by the Oregon State University Research Vessel ACONA (see chart, Plate I, p. 72 - 73). The bathymetric detail represented on the chart is a function of sounding density and contour interval. On the shelf the sounding density varies from 15 to 20 soundings per square mile except in selected areas, such as Stonewall and Heceta Banks, where there are as many as 60 per square mile; the density is much less on the continental slope, 2 to 5 soundings per square mile. In order to show geomorphic detail of the continental shelf, a 10-fathom contour interval has been used to a depth of 100 fathoms; the interval is 50 fathoms for depths greater than 100 fathoms.

Continental Shelf

In the chart area the continental shelf widens from 16 miles at 45°00' N. to a maximum of 40 miles at 44°12.7'N. At approximately 43°55'N. the shelf narrows abruptly to about 20 miles, and then narrows gradually to 15 miles at 43°30'N. The depth of water at the edge of the shelf varies locally from 80 to 95 fathoms. The slope of the shelf averages 0°09' to 0°22', and is steepest where the shelf is narrow. The slope is generally greatest close to shore. The break in slope at the edge of the shelf is most pronounced in the central part of the area, particularly in the vicinity of Heceta Bank, and is least evident to the north and south (Figure 2).

Numerous shoals, which may be geologically related to the exceptional width of the shelf, characterize the Central Shelf Extension between

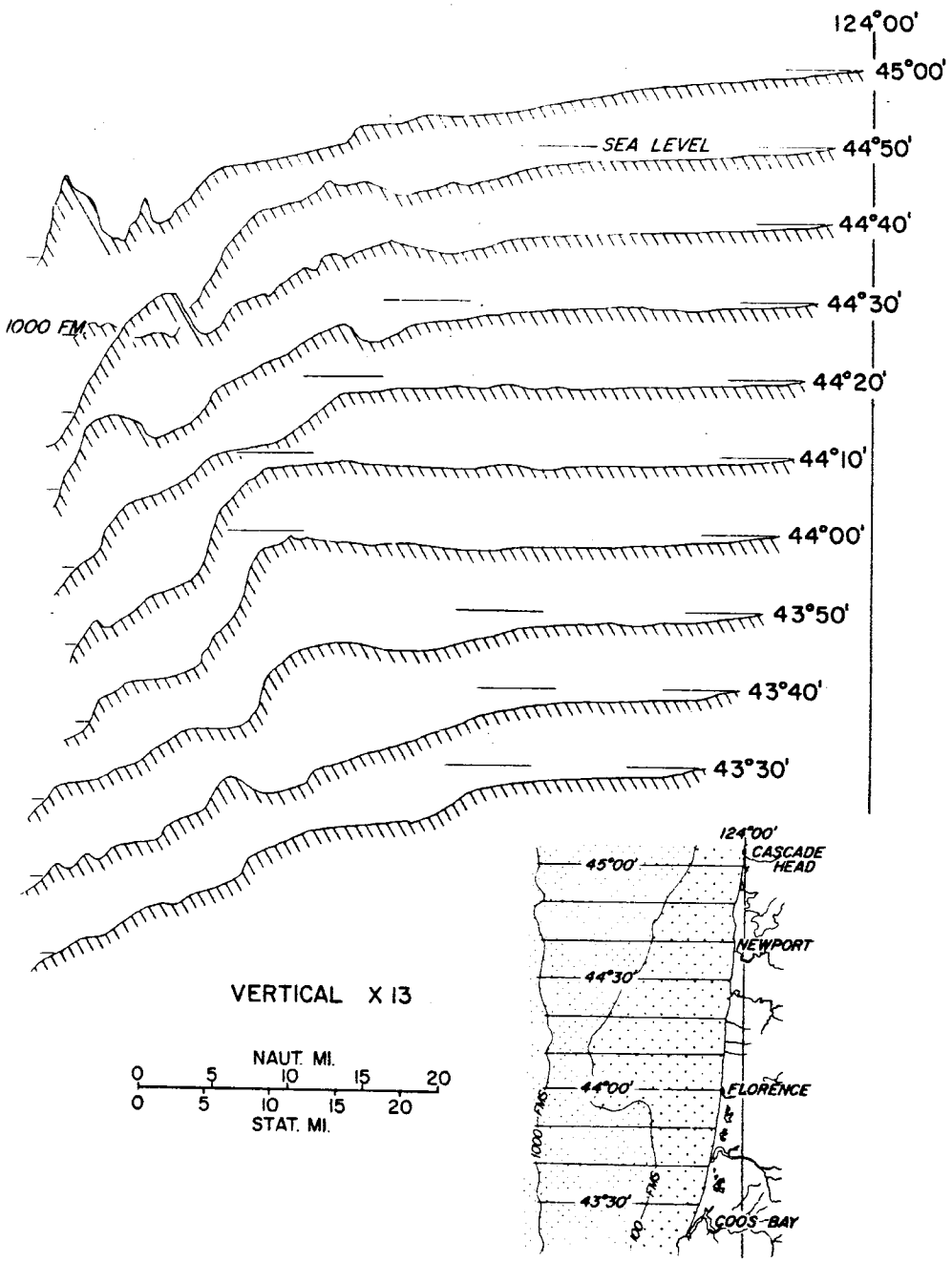


Figure 2. Profiles of the continental terrace from 43°30'N. to 45°00'N.

43°55'N. and 45°00'N. Of possible economic interest are the topographic highs Stonewall Bank, Heceta Bank, and the unnamed shoals lying between them.

Stonewall Bank

Stonewall Bank, located 17 miles southwest of Yaquina Bay, is a rise approximately 14 miles long and 9 miles wide, with 210 feet of relief, and with a crest in less than 20 fathoms of water. It consists of two high areas (delineated by the 30-fathom contour) separated by a shallow east-trending submarine valley. The bank, as outlined by the 40-fathom contour, trends N.18°W.

Rocks have been collected from two places on the bank. At the northern end of the shoal (44°37.2'N., 124°26.4'W.) dense light-gray fossiliferous mudstone was dredged from about 46 fathoms of water. Dense gray siltstone or fine sandstone was taken from the southern part of the bank at 44°30.2'N., 124°22.6'W. The faunal content of the siltstone from the southern part of the bank was determined independently by the geologic research section of the Humble Oil & Refining Co. and by the western operating division of the Standard Oil Co. of California to be of Pliocene to Recent age. On the basis of these faunal analyses and the extreme induration of the rock, it is considered to be of Pliocene age.

Precision depth records which traverse the bank reveal an exceptional topographic symmetry. The presence of several ridges remarkably alike in shape and size on both sides of the shoal suggest that Stonewall Bank is the surface expression of a symmetrical fold, more likely an anticline than a syncline.

Heceta Bank

Heceta Bank, lying approximately 35 miles west of the mouth of the Siuslaw River, is a shoal area 25 miles long, 6 to 8 miles wide, and less than 60 fathoms deep. It has a total relief of 240 feet, and consists of two individual highs outlined by the 50-fathom curve. The southern part of the bank, which is 8.5 miles long and 3 miles wide, is assymetrical (30 to 60 fathoms) with 2° to 3° slopes on the east side and slopes less than 1° on the west. The southern part of the bank, which appears to be offset from the northern part, is aligned with an escarpment to the southwest which trends N. 32° E. The alignment of the southern part of the bank with the escarpment and the lack of symmetry suggest the possible existence of a northeast-trending fault between the northern and southern

portions of the bank.

The northern part of Heceta Bank is more or less equidimensional and may be structurally related to the unnamed shoal to the northeast.

Although no rocks have been dredged by the ACONA from Heceta Bank itself, the published notations "hard brown clay" (U.S.C.& G.S. Chart 5802) at two positions on the southern part of the bank (44°01.5'N., 124°52.3'W.; 44°03.0'N., 124°51.3'W.) are more than likely based on the collection of water-soaked shale or mudstone.

Other high areas

Other high areas on the shelf of possible geologic interest are the ridge southeast of Heceta Bank (43°57.5'N., 124°40'W.) and the unnamed shoal, outlined by the 60-fathom contour, 15 miles northwest of the mouth of the Umpqua River. The ridge southeast of Heceta Bank is 8 miles long, has 120 feet of relief on the northeast side, and is oriented N.35°W. The unnamed shoal is 4 miles long, exhibits 90 feet of relief, and is oriented N. 18°W., the same orientation as Stonewall Bank.

. No rocks have been dredged from the ridge or the unnamed shoal by the ACONA. However, grayish-brown mudstone was collected from the northwestern flank of the shoal lying between Heceta and Stonewall Banks (44°21.5'N., 124°43.6'W.). Other rocks collected from the shelf by the United States Bureau of Commercial Fisheries vessel JOHN N. COBB are described as "phosphatized siltstone or sandstone," from the low area east of the north end of Heceta Bank (about 44°11.0'N., 124°39.4'W.); "light olive-gray siltstone," from water 75 to 100 fathoms deep west of the north end of Stonewall Bank (approximately 44°34.5'N., 124°32.5'W.); and "olive-gray fine to medium sandstone," from the same area (approximately 44°36.6'N., 124°33.7'W.) (Gerald A. Fowler, oral communication, 1961).

Continental Slope

The continental slope to a depth of 1000 fathoms has an average inclination of 1°12' to 4°18' in the chart area, and is generally steepest where the shelf is widest. Locally, a maximum slope of 40° is attained along a 600-foot high escarpment south of Heceta Bank (43°56.6'N., 124°56.0'W.). The escarpment west of Heceta Bank averages 16° for 1,500 feet, but slopes as much as 30° for vertical distances of 300 feet. With the exception of the previously mentioned "fault scarp" southwest of

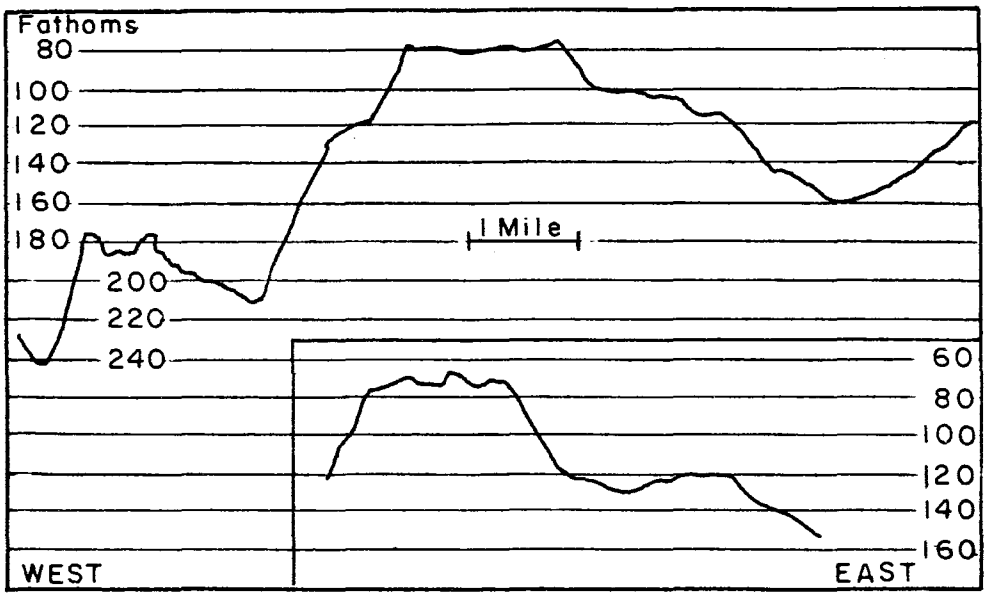


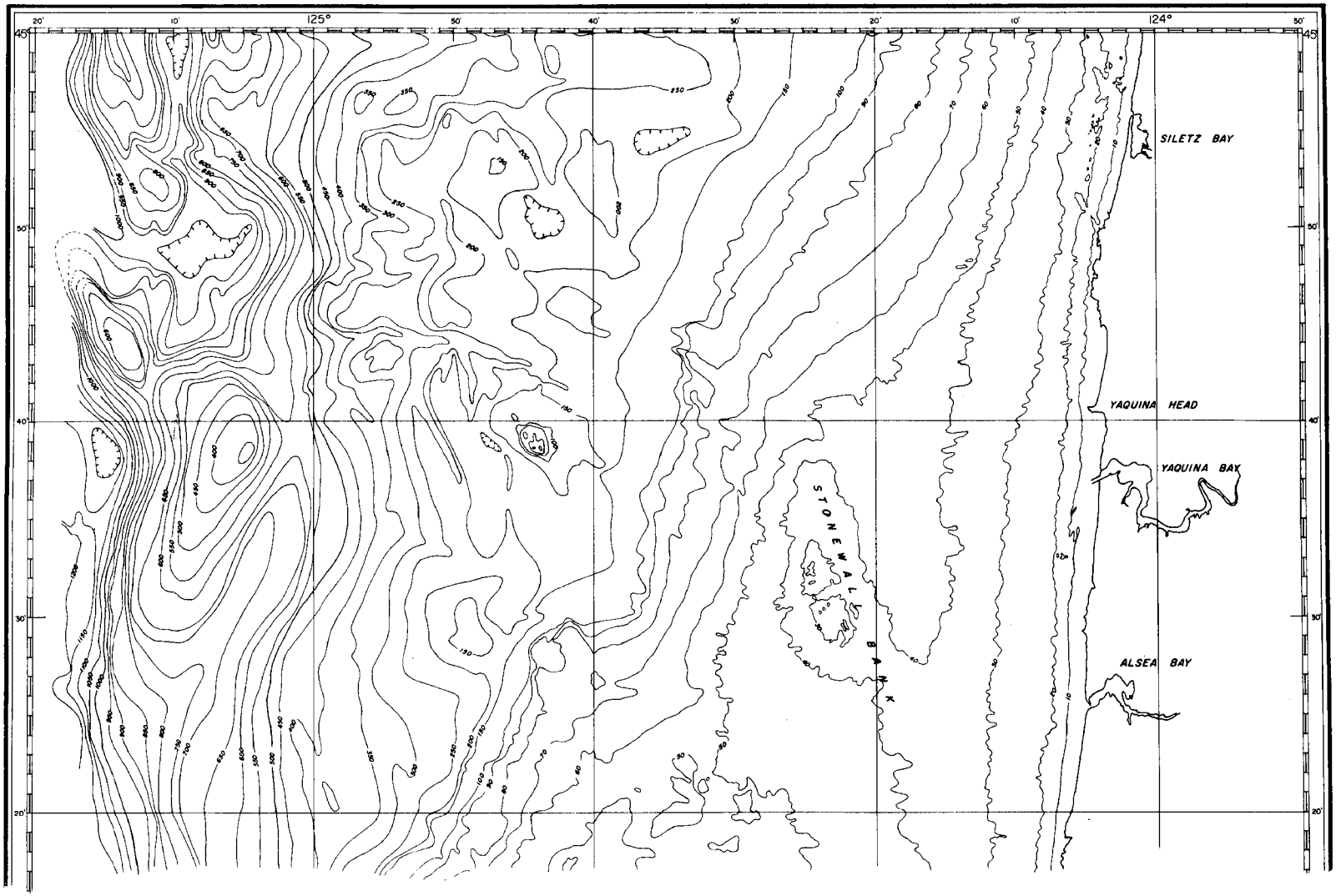
Figure 3. Precision Depth Records across the truncated seamount near the edge of the continental shelf west of Yaquina Head (44°39'N., 124°44'W.)

Heceta Bank, the Heceta Bank escarpment strikes north and is undoubtedly a structural feature.

South of Heceta Bank the continental slope is fairly gradual, and in the vicinity of 43°40'N. is characterized by a series of isolated hills. A broad trough evident below 450 fathoms opposite the Umpqua River is aligned N. 30°W. with a hill having 600 feet of relief (43°35'N., 124° 48'W.) and with a submarine canyon northeast of the hill. This alignment may also be structurally controlled.

North of Heceta Bank the continental slope is dominated by numerous hills and small seamounts, one-half to 6 miles wide, up to 1,800 feet high on the landward side, and with side slopes as high as 10°. The maximum relief of any of the hills shown on the chart occurs on the seaward side of the seamount at 44°38'N., 125°05'W. This hill drops a total of 5,352 feet, from 322 fathoms to 1,214 fathoms, in a distance of 8 miles. (See section 44°40'N. on Figure 2.)

The small seamount near the edge of the shelf opposite Yaquina Head is of some interest, since it is the only one which extends into water less than 100 fathoms deep (Figure 3). The flat top of this hill is clearly the result of truncation by wave action in shallow water. Such erosion most


125°
124°
45°
50'
40'
30'
20'
SILETZ BAY
YAQUINA HEAD
YAQUINA BAY
ALSEA BAY
STONEWALL BANK

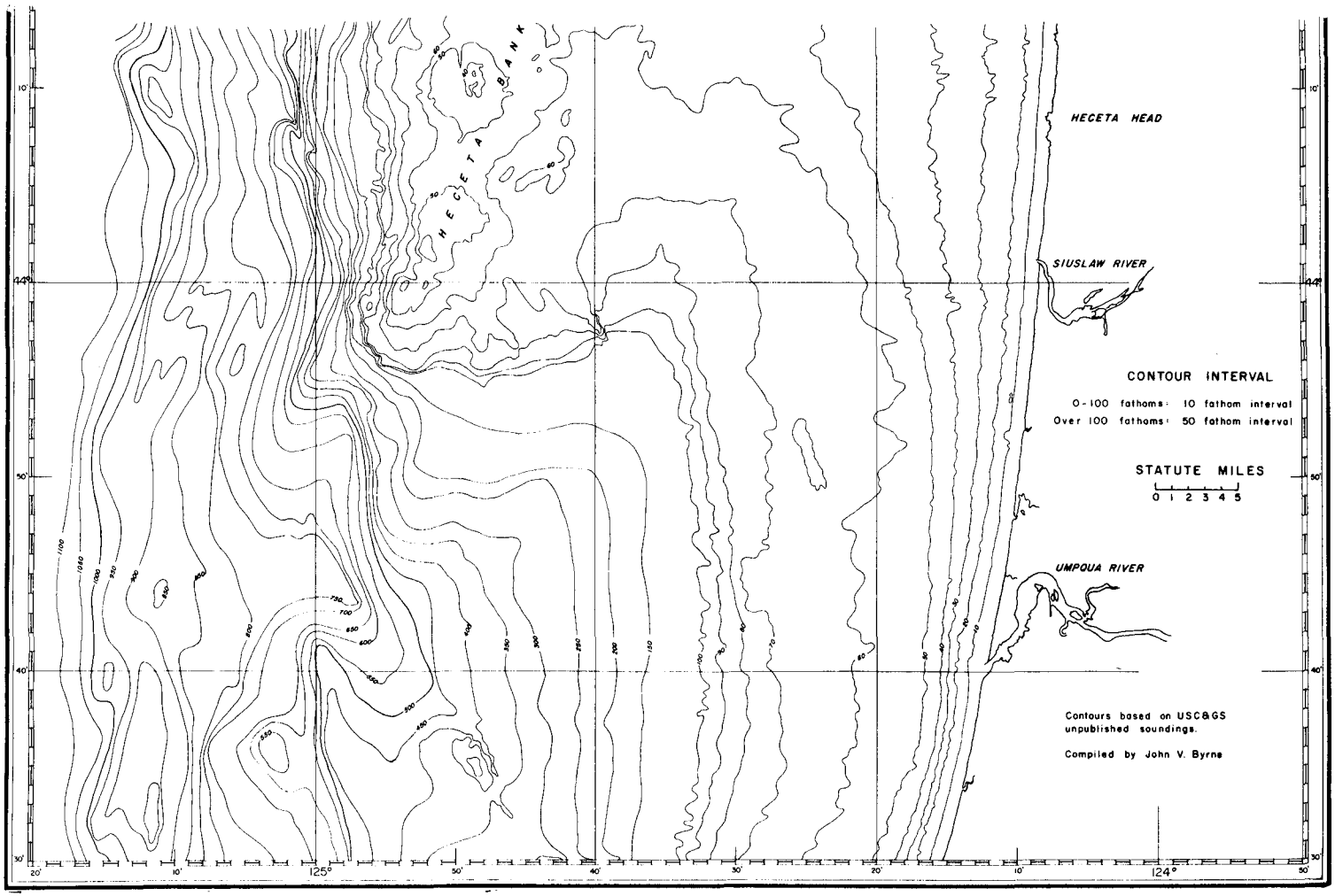


Plate 1. Bathymetric chart of the continental terrace off central Oregon, 43°30'N. to 45°00'N. and offshore to 1000 fathoms.

likely took place during the most recent Pleistocene lowering of sea level. The sides of this seamount are fairly symmetrical and slope about 5°. Phosphorite-coated limestone was dredged from the flat top, indicating that the seamount is nonvolcanic in origin. The symmetry of the sides and the rim along the top suggest that it is the surface expression of an anticlinal fold.

As erosion is relatively insignificant in deep water, most of the topographic features on the continental slope are primary and have been modified only by deposition. Thus, the hills on the continental slope must be of either volcanic or structural origin. To date, only sedimentary rocks have been collected from this small seamount province, indicating that the hills are structural features. Rocks taken from deep water in this area are: dense silty limestone, dredged from 235 fathoms of water at 44°39.6'N., 124°52.6W.); small fragments of shale, taken in 850 fathoms at 44° 27.6'N., 125°14.2'W.; and phosphorite-covered dense limestone, collected from approximately 1000 fathoms at 44°21.0'N., 125°14.3'W.

Conclusions

On the basis of the general geomorphology of the continental shelf and slope, on the detailed character of the bottom determined from precision depth records, and on the distribution of sedimentary rocks it is concluded that in the area of the Central Shelf Extension (1) volcanic rocks are scarce if not absent in the vicinity of the submarine banks, hills, and seamounts, (2) a reasonably thick sedimentary section is present with rocks as young as Pliocene, and (3) fault and fold structures exist on both the continental shelf and continental slope.

Acknowledgement: This study was carried out under Office of Naval Research contract NONR 1926(02).

Reference

Shepard, F. P., 1948, Submarine Geology. Harper & Bros., New York, 348 p.

* * * * *

A REPORT ON THE WILDERNESS BILL HEARINGS

The House Interior Subcommittee on Public Lands concluded public hearings May 7-11 on S. 174 and similar House bills to establish a "National Wilderness Preservation System" comprising some 14.6 million acres of national forest lands. Subcommittee Chairman Gracie Pfost, Idaho, has not announced when the Subcommittee will begin executive consideration of the measure.

As passed by the Senate, the bill would for all practical purposes exclude mineral exploration and development of lands now or hereafter included in the Wilderness System. American Mining Congress witnesses and others familiar with the mining industry made a strong case for continuation of the right to search for and mine any mineral deposits in these lands.

Interior Secretary Stewart L. Udall, in reiterating President Kennedy's support of the bill, deprecated the need to provide for mineral development. "Although the physical potential for future discoveries is reported by mineral resource experts to be fairly high in certain of these areas," the Secretary said, "there were few producing mines in national forest wilderness areas in 1960. The vigorous application of new discovery and processing techniques is a more promising approach to meeting future mineral requirements than is reliance on wilderness areas." Udall's views were seconded by Agriculture Secretary Orville L. Freeman. The subcommittee also heard many conservation and wildlife spokesmen endorse S. 174.

Alan M. Bateman, Silliman professor emeritus of geology, Yale University, testified as an independent geologist concerned for many years with strategic mineral supplies and with the problems of exploration and development of mineral resources. He pointed out the lessons learned from domestic mineral shortages in World War II and Korea, the necessity for replacement of exhaustible minerals, the steps taken by government and nonprofit foundations to bolster and accelerate mineral development, and the fact that the wilderness areas are geologically the most favorable for discovery and development of new mines to maintain the Nation's mineral reserves. "I strongly urge that mineral prospecting and development be not excluded from the areas of S. 174," Bateman said, adding that "scattered pinpoints of any mining operations would in no way mitigate against wilderness areas."

Rep. Wayne N. Aspinall, Colo., chairman of the full Interior Committee, asked Bateman whether the prospecting and mining provisions of S. 174 would be of any use in the event of a war. Bateman replied that

it would "just be too late" -- the war would be over before the minerals could be developed. He emphasized the need for an incentive to prospecting and exploration through assurance that any mineral deposits found could be mined as a matter of right and without undue restrictions.

The next witness, Charles H. Behre, Jr., professor of geology, Columbia University, said he was opposed to the present form of S. 174 because "it does not take account of the fact that changes in technology may make hitherto unimportant minerals critically valuable." He described the various newer prospecting methods which make it possible to find ore bodies not detectable by older methods, and emphasized the extremely limited effect such prospecting has on the wilderness nature of the land. He noted that geophysical methods for prospecting -- using instruments that can be carried on foot or horseback or flown by helicopter or airplane -- are not destructive of the wilderness nature of the landscape.

Behre also pointed out that "there is a very appreciable time lag, usually two to 10 years, between finding an important deposit and working it. We cannot, therefore, defer the search until the moment we need the minerals, for instance, in time of war."

Dr. James Boyd, president, Copper Range Co., and a former director of the U.S. Bureau of Mines, testified as president of the Mining and Metallurgical Society of America. He used a map of the United States in showing that (1) mineral occurrences are confined to distinctive areas coextensive with present mountain ranges or those that have existed in the remote geological past, and (2) wilderness areas in the western States are coextensive with lands having a high potential for minerals. He urged that the mining laws continue to be operable in lands subject to S. 174, subject to reasonable regulations. "Responsible miners have no objection to having their activities regulated so long as the restrictions are reasonable, not prohibitive, and are promptly promulgated," he said.

W. Howard Gray, Reno, Nev., attorney and chairman of the AMC Public Lands Committee, and Roger H. McConnel, chief geologist, Bunker Hill Co., testified on behalf of the American Mining Congress. Gray referred to the Declaration of Policy adopted by the AMC at its Seattle Convention last fall, which states that "We believe that the public interest is best served by keeping the public domain open for the discovery and mining of minerals." He proposed that the Wilderness bill be amended to extend the mining laws to all of the areas embraced within S. 174 or any extension thereof, subject to "reasonable but not prohibitive" regulations relating to right of ingress and egress, rights-of-way for transmission lines, water lines, telephone lines, or rights-of-way for facilities necessary in mining and processing operations, and restoration as near as

practicable of the surface of the land disturbed in performing prospecting, location and discovery work as soon as these have served their purpose. He made it clear that the mining industry desires only to use the lands lying within the boundaries of the wilderness system for mining or processing operations and for uses reasonably incident thereto.

Gray suggested that consideration should be given to the fact that our increasing population will make greater demands on mineral resources which are, by their inherent nature, exhaustible. "As the present mineral and nonmineral mining properties continue to meet the enlarged demands of our increasing population," Gray declared, "the need must necessarily arise for the search and discovery, development, and mining of new resources to take the place of the old and exhausted mines; the fact of survival may well depend upon our metal and nonmetallic resources." He reemphasized the importance of the proposed wilderness areas as the most likely locations for finding and development of mineral resources.

McConnel told the subcommittee that S. 174 "is a spectacularly large land grant for the exclusive enjoyment of an extremely small minority of the recreation-seeking public. In total, this bill would set aside at least 45,000 square miles -- an area larger than Indiana, or Kentucky, or Ohio, or Virginia -- as the privileged playground of the very few."

McConnel referred to the recently published report of the Outdoor Recreation Resources Review Commission which, he said, "strongly suggests that wilderness users, though they appear to think of themselves as conservationists, are dedicated only to conservation of wilderness and clearly are not dedicated to the conservation of natural resources in general, or even to recreation in general."

As did other mining witnesses, he emphasized that the total new area that would conceivably be physically involved in significant mining activity is small -- especially small in comparison with the tens of thousands of square miles which, under S. 174, would be permanently set aside as wilderness. "The old mineral districts will not always continue producing," McConnel said. "They must be replaced by yet undiscovered districts, some of which must certainly exist in areas now either formally designated as primitive, wilderness, or just actually wilderness."

All five mining witnesses were extensively questioned by the subcommittee members, who evidenced real interest in the question of whether -- if the proposed legislation becomes law -- the land included in the wilderness system should remain open to mineral exploration and development.

A score of other spokesmen for natural-resource industries testified in opposition to the bill or in favor of amendments which would make these lands available for proper development of their resources. (American

Mining Congress Bulletin Service, May 17, 1962.)

Editor's note: All are again urged to convey their thoughts on this very important bill to their Congressman.

* * * * *

CHROMITE BULLETIN AVAILABLE

The long awaited Bulletin 52, "Chromite Deposits of Southwestern Oregon," is now available. This publication is for sale at the Department offices for $3.50, postpaid. The bulletin is the result of an intensive study on chromite in the southwestern part of the state by Department field geologist, Len Ramp, of Grants Pass.

The bulletin contains 176 pages, 30 figures, 22 plates (3 in pocket), 16 tables, and 73 references. Its three parts cover nature and origin of the deposits, descriptions of the main chromite producing areas, and geologic descriptions of the other occurrences. More than 250 separate chromite occurrences are described.

Deposits of chromite in southwestern Oregon occur as magmatic segregations along definite zones or horizons in sill-like ultramafic intrusions. Original chromite layers have been folded, distorted, and stretched out in large part during intrusion of partly consolidated magma. Further deformation has taken place during alteration of the rock to serpentine, resulting in a seemingly haphazard, scattered distribution of lens-shaped orebodies. Mapping of a complex folded pattern of peridotite and serpentine in the central Illinois River area helps interpret the distribution of the numerous chromite occurrences which lie in the upper portion of the intrusive.

Bodies of massive chromite as much as 20 feet thick and containing 5,000 tons have been mined at the Oregon Chrome Mine in Josephine County. Zones of banded disseminated ore as much as 14 feet thick occur in the area. The majority of other occurrences described are small. The ore bodies are discontinuous, but appear to extend to great depth.

Ores analyzed have a wide range of chemical composition from metallurgical grade to refractory grade but average about 45 percent Cr_2O_3 with a 2.6 Cr-Fe ratio. In 18 years of production from 1917 to 1948 a total of about 117,500 long tons of metallurgical grade chromite valued at about 5½ million dollars has been produced in the area studied.

The best guide to prospecting and development is knowledge of the position and trend of chromite ore zones in an area. A summary of geophysical and geochemical prospecting methods shows some promise in their application to chromite in southwestern Oregon.

* * * * *

COMING EVENTS CAST THEIR SHADOWS...

> "Bureau of Land Management field employes from Oregon and Washington are in attendance this week at a school on trespass prevention at the BLM office at 710 NE Holladay St.
>
> "The school is conducted by the regional office of BLM and is designed to bring BLM men up to date on the latest investigative techniques and methods of collecting and presenting evidence in cases of unlawful use of public lands, according to a BLM spokesman.
>
> "The BLM investigated and closed 308 cases of trespass on public lands in 1961, noted the spokesman. Damages from these cases amounted to more than $97,000 he said." (Press release appearing in THE OREGONIAN, Thursday, May 17, 1962.)

Based on announced policies appearing in official Bureau of Land Management publications, miners can view the above meeting as boding them no good.

The BLM publication, "Our Public Lands," tor January 1962 states "All should avoid trespassing on public lands. Going onto public lands and using them for hunting, fishing, and camping isn't trespassing. But going onto public lands without permission and building a house on the land - that is trespassing." (Emphasis not supplied.) Also in "The BLM at Work in Oregon and Washington - 1961," the Bureau states "The mining laws allow a miner to live on his claim when this is necessary for the prudent development of the claim. The wild character of the Pacific Northwest fifty years ago required a miner to live near his work for efficient operation and for the protection of his equipment. 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 unnecessary and seldom desirable since a residence could conflict with the uses of surface resources."

Contrast these statements with the following excerpts from the mining law: "All valuable mineral deposits in lands belonging to the United States shall be free and open to exploration and purchase and the lands in which they are found to occupation and purchase by citizens of the United States." (Emphasis supplied.) And "The locators of all locations on any vein shall have the exclusive right of possession and enjoyment of the surface included within the lines of their locations." (Emphasis supplied.)

The recently passed Forest Service Multiple Use Act gave official sanction by Congress to the use of lands for "hunting, fishing, and camping."

There is no law, however, giving official sanction to these land uses on federal lands other than U.S. Forest Service lands. The right to "hunt, fish, and camp" is merely an implied right.

The Bureau of Land Management and their officers must recognize that the law giving mineral claim locators "exclusive right of possession and enjoyment of all the surface included within the lines of their locations" is a law of the land and should not be open to administrative frustration. There is nothing in this law regarding necessity or desirability of residence on the claim. It is hoped that the outcome of the recent meeting by the BLM field employes was made to stress this point and not to contrive some administrative procedure to obviate the law.

Hollis M. Dole, Director

* * * * *

GROUND WATER IN COLUMBIA RIVER BASALT

A recent publication of the U.S. Geological Survey is Professional Paper 383-A, "Storage of ground water behind subsurface dams in the Columbia River Basalt, Washington, Oregon, and Idaho," by R.C. Newcomb. The 15-page report, which includes several geologic and structure maps, may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., for 20 cents.

* * * * *

OIL TEST PERMIT GRANTED

Reserve Oil & Gas Co. of San Francisco was issued drilling permit no.46 by the Department on May 21, 1962. The company plans to drill at a site 2 miles east of Lebanon. This is about 3 miles southwest of the Barr property, where Linn County Oil Development Co. drilled in 1958 and reported shows of gas and oil.

The new well will be Reserve's second try in Oregon. The first hole drilled by the California organization, in northeastern Polk County, failed to find commercial amounts of oil or gas after reaching a depth of 5,549 feet. The official name for the present drilling will be Reserve Oil & Gas Co. "Esmond No. 1." Location is given as 1,194 feet north and 575 feet west of the south quarter corner of section 7, T. 12 S., R. 1 W., Linn County. Elevation according to the U.S. Geological Survey topographic map of the Lebanon quadrangle is 450 feet above sea level.

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The ORE BIN
Vol. 24, No. 6
June, 1962

THE DISCOVERIES OF NEW MINERALS IN OREGON

by

Lloyd W. Staples*

In October 1948 there appeared in The Mineralogist a paper titled "Oregon's New Minerals and Discredited Species", in which this writer discussed those minerals first found in Oregon. Thirteen years have elapsed since the publication of that paper and because of new discoveries, it seems worth while to bring the material up to date.

The term "new mineral" is used here only for those minerals which were first discovered in Oregon and were adequately described so that they became acceptable as new mineral species. Not included are those minerals which have been given local names by collectors, usually without any effort to describe thoroughly the material or to determine if it is a new species or merely a variety of a well described mineral. The impropriety and disadvantages of coining local names for such varieties, or mixtures, was pointed out in the 1948 paper mentioned above. Fortunately, this practice seems to have decreased and fewer of these local names are being used. Great care must be exercised in listing discoveries as new minerals, as is indicated by the fact that in the last 10 years trained mineralogists using the latest scientific equipment have been successful in only 56 percent of the cases where they have described minerals as new; in the other 44 percent the new descriptions have been invalidated and the minerals discredited, as indicated by Fleischer (1961). During this period an average of only 23 new minerals per year have been accepted as valid for the entire world.

In chronological order of discovery, 8 new minerals first described from Oregon are given below (see index map). In three instances (johannsenite, heinrichite, and metaheinrichite) the first descriptions were based on specimens from more than one locality and in these cases the honor of "type locality" must be shared with another region.

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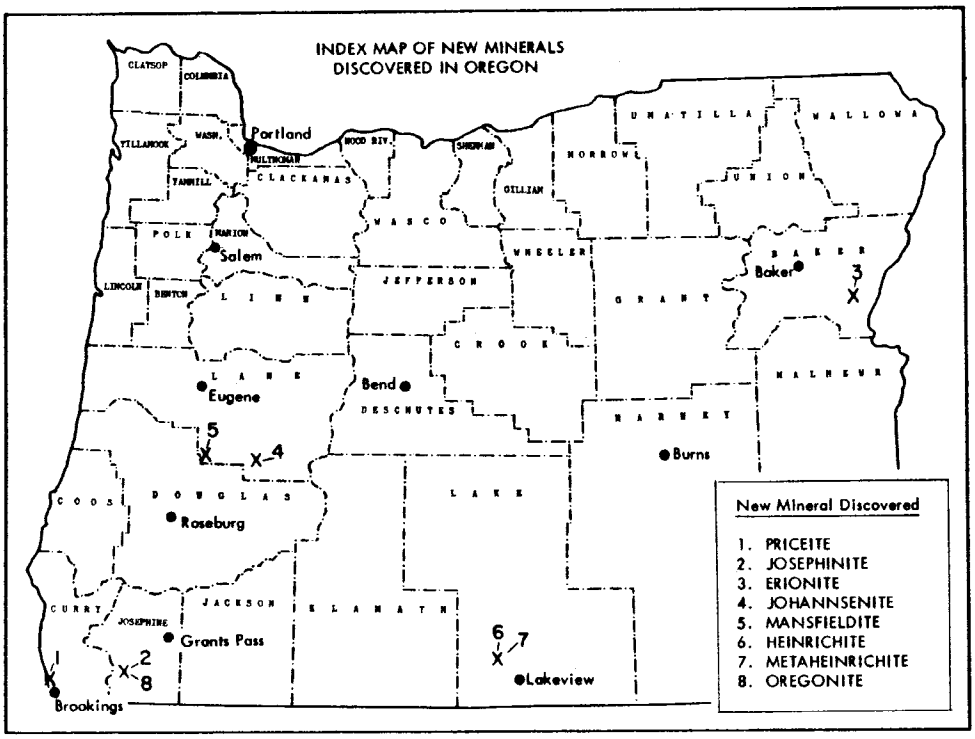
*Professor and Head, Department of Geology, University of Oregon.



Priceite

Priceite is the first new mineral to be described from Oregon. The honor of doing this went to Benjamin Silliman (1873), professor of chemistry at Yale, after whom the mineral sillimanite was named. He was also founder of the American Journal of Science, and one of the country's most famous early mineralogists. At first it was thought that priceite might be a variety of cryptomorphite, but this was proved not to be the case when Thomas Price of San Francisco showed that, unlike cryptomorphite, there was no soda present in the new mineral. This work led to naming the mineral after Price.

Priceite is a calcium borate ($Ca_4B_{10}O_{19}.7H_2O$), which was discovered near the mouth of Lone Ranch Creek, south of Cape Ferrelo, and about 4 miles north of Brookings. The mineral occurs as a soft chalky variety so fine that it is almost powdery. The occurrence at Lone Ranch, the paragenesis of the mineral, and the history of the deposit has been discussed by the writer (Staples, 1948-b). Formerly, it was difficult to drive to the deposit, but the relocation of the coast highway (U. S. 101) has made access very easy. The new highway and a state park (Lone Ranch

Area of Samuel H. Boardman State Park) are located directly on the mined area. The mine tunnels are now caved and specimens of priceite are no longer easily obtained.

Josephinite

W. H. Melville (1892) found some brown metallic pebbles in the placer gravels of a stream, which probably was Josephine Creek. The material had been collected by a Mr. Hampton and the exact locality is not known, but Melville named it "josephinite" in honor of Josephine County. For many years there was a question of whether josephinite was terrestrial or meteoric in origin. As a result of later work (Morley, 1949) it is now considered to be of terrestrial origin.

Josephinite occurs as a detrital mineral in Josephine Creek, in pebbles and ellipsoidal masses which are grayish white but usually have a dark brownish-gray coating. It is a highly magnetic nickel iron alloy, often with as much as 75 percent nickel.

Erionite

Erionite, meaning "wooly", was first described by A. S. Eakle (1898) from near Durkee, Baker County, Oregon. This mineral is a zeolite with a wool-like texture that was unknown from other localities until recently. It is now reported in acicular hexagonal prisms from Rock Island Dam, Washington, (Kamb and Oke, 1960) and also in fine grained material from many other localities where it has formed from the alteration of tuffaceous beds.

The location of the original discovery was not clear from the description by Eakle, and the writer spent considerable time in the field before finding the quarry on Swayze Creek, at a distance of 1.6 miles east from U. S. Highway 30. A complete description of the structure and unit cell of erionite was published recently (Staples and Gard, 1959).

Erionite, according to Staples and Gard, has the composition $(Ca,Mg,Na_2,K_2)_{4.5}Al_9Si_{27}O_{72}.27\,H_2O$. Indices of refraction given in textbooks are incorrect and should be O=1.468, E=1.473 with a birefringence of 0.005.

Johannsenite

It is interesting that no new minerals were described from Oregon for the 40 years from 1898 until 1938, when W. T. Schaller described

johannsenite. The mineral was named in honor of Albert Johannsen, the famous petrographer, from the University of Chicago. Johannsenite was first reported at a meeting of the Mineralogical Society of America at Harvard in December 1932 and in his abstract Schaller (1933) stated "Johannsenite occurs as a hydrothermal vein-forming pyroxene in the Bohemia District, Western Oregon, and as a product of contact metamorphism at Schio-Vincenten in Northern Italy." From this it is not clear which locality was discovered first, but the first study of the mineral was on material from both localities.

Johannsenite is a silicate with the formula $MnO.CaO.2SiO_2$ and is found in the Bohemia District of Lane County. It is in quartz veins in rhyolite country rock and occurs as brown spherulites or radiating prisms, seldom greater than a quarter of an inch in diameter. It alters to rhodonite, and the excess calcium silicate is deposited as white xonotlite.

Mansfieldite

At Hobart Butte, Lane County, well known because of its kaolinite, realgar, and scorodite, the new mineral, mansfieldite, was discovered. This was first described by Allen and Fahey (1948).

Mansfieldite was named in honor of G. R. Mansfield of the U. S. Geological Survey. It has the composition $Al_2O_3.As_2O_5.4\ H_2O$ and is the aluminum analogue of scorodite. It occurs as white to gray, porous cellular masses with spherulitic structure, some as much as 20 cm in size. It is believed that it was formed by the action of hydrothermal arsenate solutions assimilating aluminum from the Hobart Butte clays, and it is often found in intimate intermixture with kaolinite.

Heinrichite and Metaheinrichite

These are two hydrated arsenates of uranium and barium found at the White King uranium mine near Lakeview. Heinrichite contains 10-12 H_2O and is unstable, dehydrating rapidly to metaheinrichite which contains 8 H_2O. These radioactive minerals occur as yellow to green tetragonal tabular crystals which fluoresce bright green to greenish yellow.

The two new minerals were described by Gross, Corey, Mitchell, and Walenta (1958). Minerals, which later proved to be identical with the heinrichite and metaheinrichite of Lakeview, were found earlier in the central Black Forest of Germany, but the names applied to the White King material have been generally accepted.

As mentioned above, heinrichite rapidly dehydrates, and metahein-

richite is the stable mineral found at the White King. With depth, metaheinrichite gives way to coffinite which is associated with realgar and orpiment.

The new minerals were named after E. W. Heinrich of the Mineralogy Department of the University of Michigan. They were found in a rhyolite tuff where they line vugs and coat fractures.

Oregonite

Only with time can it be certain that a new mineral name will withstand attempts to discredit it. It appears that a bona-fide new mineral has been named after the State of Oregon, through the work of Ramdohr and Schmitt (1959). It is interesting that the name of this mineral, honoring Oregon, should have been given by two Germans from Heidelberg. The article describing the mineral is written in German, in a periodical of limited distribution in this country, but one which is received regularly at the library of the University of Oregon.

The new mineral, oregonite, was discovered by Paul Ramdohr when he was studying josephinite, awaruite, and souesite from various localities. Mr. R. E. Morley of Salem, Oregon, had contributed considerable material from Josephine Creek for this study, and in this material was a pebble of about the size of a plum which closely resembled josephinite. The pebble had a thin, smooth brown crust through which a brilliant metal glistened. It was sectioned, studied with the ore microscope and by X-ray methods, proving to be a new mineral to which the name "oregonite" was given. Mixed with the oregonite was another similar mineral which the authors have designated as mineral "X", rather than name, because they were unable to describe it well enough to set it up as a new species.

Oregonite has a hardness of about 5, S.G. calculated as 6.92, and is hexagonal. The formula assigned is $Ni_{10}Fe_6As_9$ or possibly Ni_2FeAs_2. It is weakly anisotropic, as can be seen along grain boundaries. The authors give X-ray data for it.

A very short review of the paper, in English, is given by Rooseboom (1960). The use of the name "oregonite" for a probably valid mineral reemphasizes the danger of confusion caused by the arbitrary use of mineral names for invalid species. The misuse of "oregonite" was pointed out earlier (Staples, 1948-a), but the practice continues (Ramp, 1962). The writer regrets that Oregon, a state with many beautiful crystals, does not have named after it a mineral which is more readily identifiable. However, it can take pride in the fact that very few of the 50 states have minerals named after them. A study of the literature shows that although 15

states have previously been so honored, in the cases of only four (Alaska, Colorado, Minnesota, and Montana) are the minerals well-recognized species rather than varietal names or synonyms.

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CHECK LIST OF MINERALS FIRST DISCOVERED IN OREGON

Mineral	Date Described	Authors	Locality	Chemical Formula
1. Priceite	1873	Silliman	Lone Ranch Curry County	$Ca_4B_{10}O_{19}.7H_2O$
2. Josephinite	1892	Melville	Josephine Creek Josephine County	Ni, Fe
3. Erionite	1898	Eakle	Swayze Creek Baker County	$(Ca,Mg,Na_2K_2)_{4.5}$ $Al_9Si_{27}O_{72}.27H_2O$
4. Johannsenite	1938	Schaller	Bohemia District Lane County	$CaMnSi_2O_6$
5. Mansfieldite	1948	Allen & Fahey	Hobart Butte Lane County	$Al_2O_3.As_2O_5.4H_2O$
6. Heinrichite	1958	Gross, Corey, Mitchell amd Walenta	Lakeview Lake County	$Ba(UO_2)_2(AsO_4)_210-12H_2O$
7. Metaheinrichite				$Ba(UO_2)_2(AsO_4)_2\ 8H_2O$
8. Oregonite	1959	Ramdohr and Schmitt	Josephine Creek Josephine County	$Ni_{10}Fe_6As_9$

GEOLOGY OF COLLIER STATE PARK AREA, KLAMATH COUNTY, OREGON

By Norman V. Peterson*

As a visitor to central Oregon approaches Collier State Park and Logging Museum along U.S. Highway 97, its natural beauty is at once apparent. The combination of clear, cold rushing streams, rustling pines, and green lawns make the park one of the most pleasant, restful, and delightful recreation areas in Oregon. When he looks around, he sees no immediately visible points of unusual geologic interest. However, the rocks that are exposed within and around the park have a story to tell, and this report has been written to give the visitor a better understanding and appreciation of that story and to show him where to see it.

Collier State Park is an area of about 400 acres situated on both sides of Spring Creek and along the Williamson River within the recently dissolved Klamath Indian Reservation in the western central part of Klamath County. The park is crossed by U.S. Highway 97 about 35 miles north of Klamath Falls, Oregon. There are excellent picnic facilities, including electric stoves, shelters, fireplaces, and tables. More than a mile of trails follow along Spring Creek and the Williamson River. Both streams are stocked with trout and are favorites of fly fishermen. Limited overnight camping facilities have been added.

Logging Museum

An added attraction that is perhaps as famous as the park is "Cap Collier's Camp," an outstanding outdoor logging museum. The museum, the largest of its kind in the nation, displays the tools of logging from its beginning in the Pacific Northwest. The unique collection contains items as varied as old boots to McGiffert stiff-boom log loaders. Single pieces of equipment weight as much as 25 tons and some date as far back as 100 years. Alfred D. "Cap" Collier, Klamath Falls lumberman, is the museum curator and has donated much of the equipment.

History of The Park

The natural beauty of the area now included in Collier State Park was recognized long before Alfred and Andrew Collier envisioned its present use. The first owner was Carlos Blair, who selected the land at the confluence of Spring Creek and the Williamson River as his allotment

*Geologist, State of Oregon Dept. Geology & Mineral Industries.

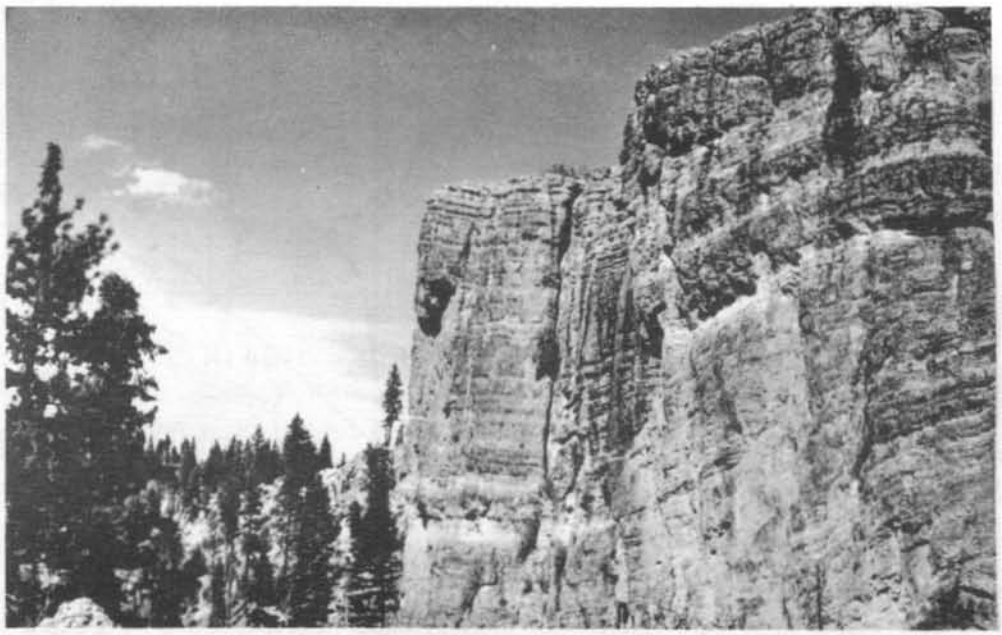


Figure 1. Explosion tuffs about 3 miles northeast of the park where the Williamson River emerges from its canyon.

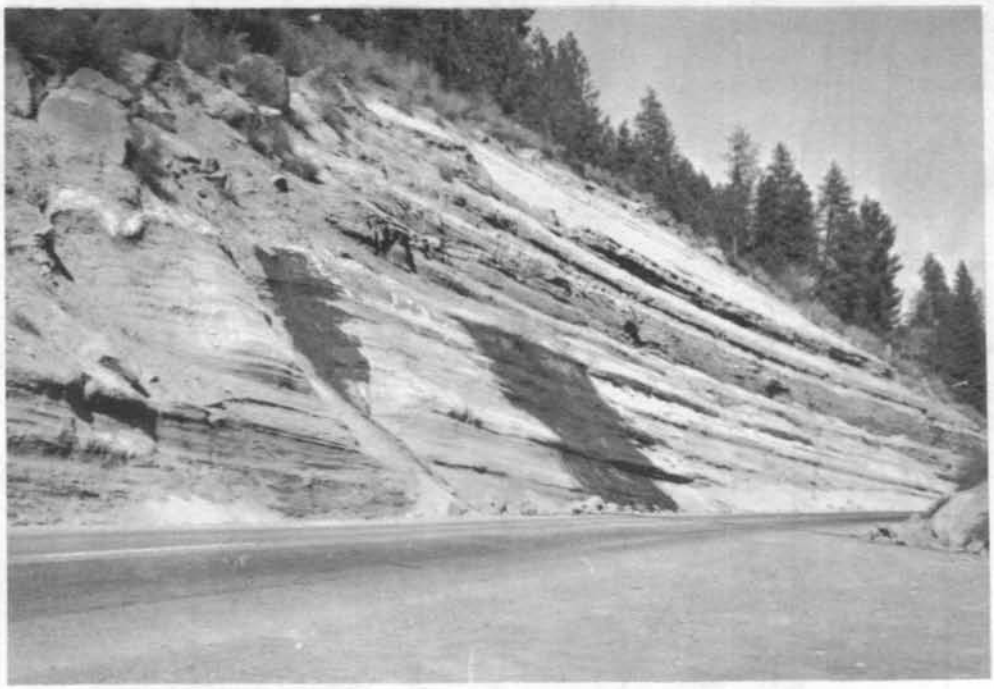
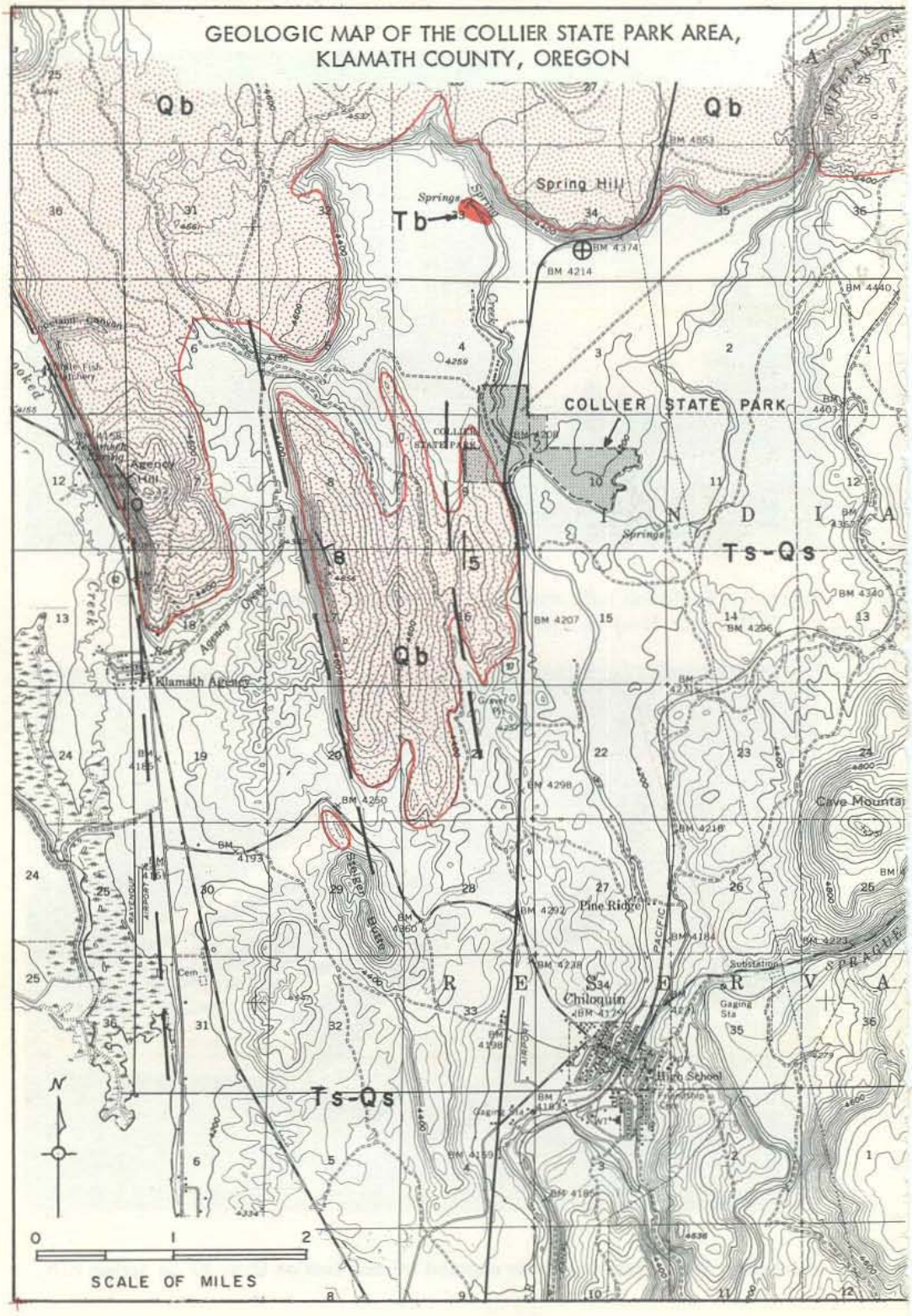


Figure 2. Horizontal lake beds exposed in road cuts on U.S. 97 on Spring Hill.


GEOLOGIC MAP OF THE COLLIER STATE PARK AREA,
KLAMATH COUNTY, OREGON
Qb
Qb
Tb
Ts-Qs
Ts-Qs
Qb
Spring Hill
COLLIER STATE PARK
Springs
Agency Hill
Klamath Agency
Pine Ridge
Chiloquin
Cave Mountai
BM 4374
BM 4214
BM 4440
BM 4207
BM 4250
BM 4193
BM 4298
BM 4218
BM 4292
BM 4238
BM 4159
BM 4185
N
0
1
2
SCALE OF MILES

Explanation

Pleistocene?

Qb — Light gray to black vesicular basalt flows.

Plio-Pleistocene

Ts-Qs — Layered tuffaceous sedimentary rocks, mainly waterlain but in part airborne. Thin to thick lacustrine beds of silt, sand, and gravel with occasional layers of peat and impure diatomite. Tan to dark brown explosion tuffs locally.

Pliocene

Tb — Dark gray fractured porous flow basalt.

/5 — Strike and dip of flows

⊕ — Horizontal beds

— — — Fault approximately located

① ② — Points of interest described in text

Maps adapted from U.S. Geol. Surv. Chiloquin quad. and Army Map Service Sheet NK 10-6, Klamath Falls.

INDEX MAP OF POINTS OF INTEREST, COLLIER STATE PARK AREA

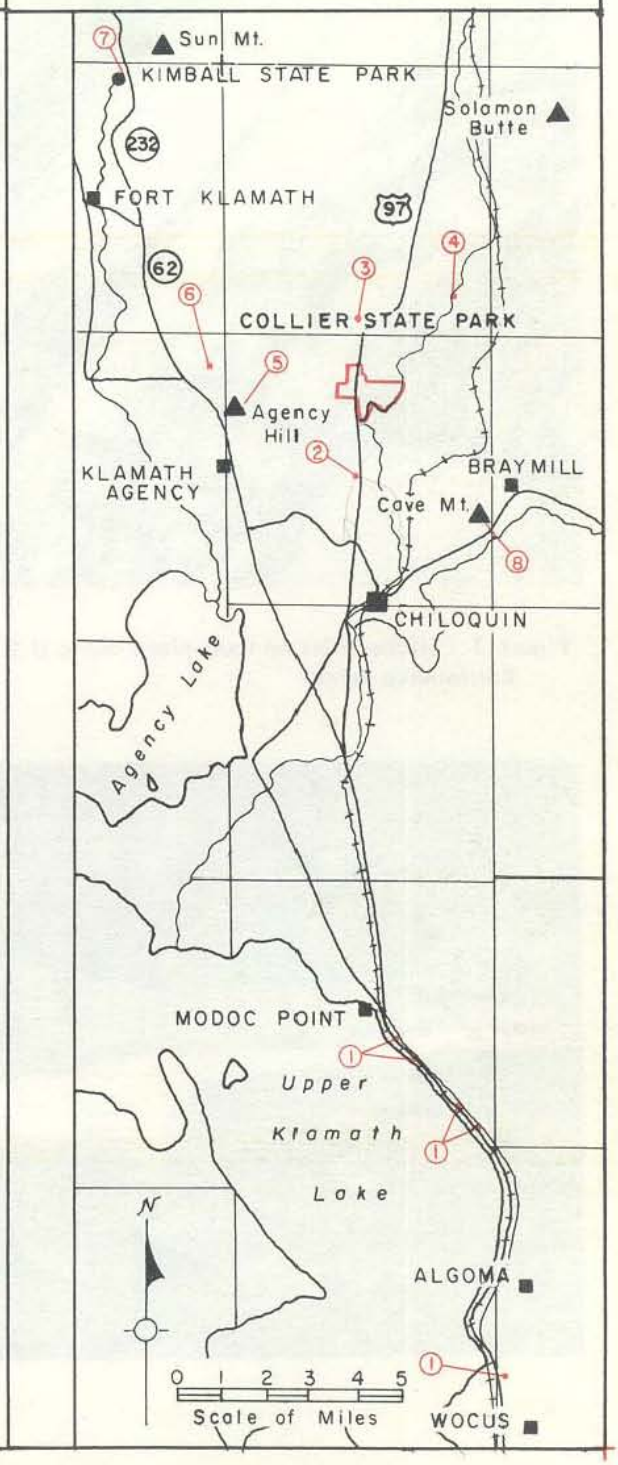


Figure 3. Slickensides on fault plane along U.S. Highway 97 a mile south of Rattlesnake Point.

Figure 4. Erosion of horizontal beds of tuffaceous rock forms step-like riffles and small rapids in Spring Creek about 200 yards east of highway bridge in Collier State Park.

under the Treaty of 1866 between the United States Government and the Klamath and Modoc Indians. When asked why he chose this piece of land he replied, "Because it is such a nice place." Blair was noted as a hunter and fisherman and trapped otter, beaver, and martin in Spring Creek and along the Williamson River.

He sold the land to R. C. Spink for a Model "T" Ford and $800.00. William and Claudia Spink Lorenz of Chiloquin inherited the property and it was from them that Alfred D. Collier and Andrew Collier of Klamath Falls purchased it in 1944 and gave it to the State of Oregon as a park site in honor of their parents, Charles Morse Collier and Janet M. Collier.

Geologic Setting

The geologic history that can be interpreted from the rocks exposed in the cuts of Highway 97 and in the channels of Spring Creek and the Williamson River is relatively short and recent in geologic time. It dates back about 11 million years to the Pliocene epoch when the region was a broad basin, which was occupied at times by large, shallow lakes.

The oldest rocks (see geologic map, page 90) are dark gray basalt flows with only the top of one flow exposed. We can but guess its origin, but the fluid lava is probably a part of a thin sheet that poured out from the east flanks of the Cascade Range into the basin. This basalt can be seen north of the park at the springs which are the source of Spring Creek. The fractured scoriaceous structure of this basalt layer makes it an excellent aquifer, and the abundant snowmelt and groundwater originating to the northwest and northeast can percolate through it freely.

These basalt flows had barely cooled when volcanoes began to puff out ash and cinders that dropped into the lakes or were carried into them by streams. The first explosions were immense, and thick layers of punky pumiceous tuffs were laid down. These are present as horizontal beds exposed in the channels of Spring Creek and the Williamson River.

Short-lived violent explosions formed maars or tuff rings to the east and south. The eroded edges of thin layers of broken rock fragments and ash that formed rims around an explosion crater can be seen also about 3 miles northeast of the park where the Williamson River emerges from its steep canyon (see figure 1). These explosion tuffs are also present in Steiger Butte, about 3 miles south of the park.

A thick series of lake beds, composed mainly of light-colored silt, sandstone, gravel, and clay, accumulated in the regional basin. This series of horizontal, layered rocks can be seen in the road cuts of Spring Hill (figure 2) north of the park. Here a thin capping of resistant basalt protects them from erosion. In the park area, however, several hundred

feet of these lake-bed deposits have been removed by erosion.

At times the lakes provided suitable environment for the rapid growth of minute plants called diatoms. Their siliceous skeletons settled to the bottom and became mixed with volcanic ash and sand, forming layers of impure diatomite. These are exposed as almost white layers in the Spring Hill highway cuts.

There were periods when the volcanoes were quiet and vegetation abundant. This is shown by a black layer of peat about one foot thick, which is sandwiched between silt and sand beds. It may be seen in the cuts half way up Spring Hill.

The deposition of the silt, sand, and gravel layers probably continued into the Pleistocene epoch (Ice Age) until finally the lakes were either filled or drained. Then erosion began to form an irregular surface of moderate relief.

Volcanism resumed, probably in Pleistocene time. Light gray olivine basalts from nearby vents spread out to fill the slight depressions and form a gently undulating plateau, which can be seen to the north along U. S. Highway 97. A single flow of this basalt caps the sedimentary rocks at the top of Spring Hill and forms rimrock to the east and west. The contact between the underlying lake beds and the basalt can be seen in the highway cuts; here the molten lava has baked the soil a reddish brown.

Northwest-trending high-angle normal faults (shown on geologic map) are present west of the park. These faults are parallel to the major Basin and Range faults that form the steep escarpments along the east side of the Klamath graben or valley. The relative displacement and tilting of the capping basalt layers by these smaller faults has been slight. The high angle and normal movement on the faults is shown by slickensides on fault planes at several places along the escarpment, such as near Rattlesnake Point (figure 3), Modoc Point, and at a locality a mile north of Klamath Agency.

Uplift, either regional or that associated with Basin and Range faulting, has resulted in rapid erosion in the park area. At least 350 feet of silt, sand, and gravel has been removed to expose the basalt flow at the source of Spring Creek. The rate of erosion has probably gradually slowed, but the youthful streams are still busily cutting down the land surface. Some of the horizontal tuff layers are harder than others, and where the streams undercut the softer underlying material, small falls and rapids form (see figure 4). Deeper pools below the riffles make excellent fishing spots.

The climactic volcanic explosion only 7,500 years ago that led to the collapse of Mount Mazama and the formation of Crater Lake is indirectly

visible in the park area. Pumice thrown high in the air drifted eastward on the prevailing winds to shower a vast region. In the park area, the pumice is present just beneath the grass roots. The layer is rather thin (a few inches to a few feet), but it thickens rapidly to the north and has been measured as much as 45 feet thick at Kirk, about 7 miles away. Variation in thickness of the pumice over short distances is caused by the irregular surface on which it fell and also by subsequent wind erosion and drifting.

Points of Interest Near Park

Many of the places that reveal the geologic story are not within Collier State Park but can be reached on a short side trip or on the way to or from the park. The following are some of the points that should be interesting to most visitors (see index map, page 91, for location).

1. Fault escarpments along east side of Klamath Lake: Traveling north from Klamath Falls on U.S. Highway 97, the predominant topography is the result of fairly recent faulting. The steep northwest-trending ridges are practically uneroded fault scarps. The recency of the faulting can be seen at several places where the slickensided surfaces of the fault plane are exposed. One mile south of Rattlesnake Point and at several places between Barkley Spring and Modoc Point the shiny slickensided surfaces can be seen. They are usually exposed where the talus has been removed for use as road material.

Continuing northward toward Modoc Point, the highway cuts through the complex breccias, cinders, lava flows, and dikes that are found near and in vents of volcanoes.

2. Cinder Pit: The center of a small eroded cinder cone has been exposed in a Highway Department quarry about $1\frac{1}{2}$ miles south of Collier State Park just west of U.S. Highway 97. Layered ashes and cinders of this small explosive volcanic feature are easily seen. The cinders of one layer have iron oxide coatings that give bright iridescent colors.

3. Spring Creek Springs: The springs are about $1\frac{1}{2}$ miles north of the park. They can be reached by turning left from U.S. Highway 97 just before it starts to climb over Spring Hill. A large flow of clear cold artesian water bubbles to the surface to form Spring Creek. The pool at the springs and the creek below constitute one of the two places in central Oregon where mares egg algae is found. This rare Nostoc algae grows as colonies of rounded, wrinkled, brown leathery masses from the size of a pinhead to 6 inches in diameter. The other place where mares egg algae is found is at Mares Egg Spring located at the base of the east flank of the Cascades about 7 miles southwest of the town of Fort Klamath.

4. Williamson River canyon: The Williamson River is confined in a steep-walled canyon for several miles before it flows out onto the flat surface eroded in the softer sedimentary rocks about $2\frac{1}{2}$ miles northeast of the park. The canyon has been cut in thick layers of basalt that probably flowed out from the flanks of Solomon Butte, a steep-sided shield volcano to the northeast made up mainly of basaltic lava. There are springs within the canyon that contribute large quantities of water to the Williamson River. For the adventurous angler there is excellent fishing in the deep holes worn in the basalt bedrock.

5. Klamath Agency, Agency Spring, and Agency Hill: These features are 3 miles due west of Collier State Park and can be reached by driving south on U.S. 97 to the junction north of Chiloquin, west to Oregon Highway 62, and then north to the Klamath Agency. This was the administration center for the Klamath Indian Reservation. It is now owned and used by a private corporation and it also serves as the temporary headquarters of the new Winema National Forest.

Agency Spring, just across the highway, is the southernmost in a row of springs at the base of the Agency fault escarpment. This spring flows out from large blocks of rubble at the base of the escarpment, and it is believed to result from the uplift of a basalt aquifer along the north-trending fault scarp. Agency Hill is the highest point along the Agency fault escarpment. A steep road to the summit gives a spectacular view of the Klamath Plain and High Cascades to the west.

6. State Fish Hatchery Springs and Copeland Canyon: Two miles north of Klamath Agency another group of spring orifices at the base of the Agency fault escarpment have been developed for use at the fish hatchery where rainbow trout are raised. These springs, as well as Tecumseh Spring a half mile to the south, are the sources of Crooked Creek. Visitors are welcome at the hatchery and can see large trout where the hatchery outlet empties into Crooked Creek. Copeland Canyon is a hanging or perched valley just to the north of the hatchery. It has been uplifted to its present position by recent movement along the fault. It can be seen by looking east toward the scarp from Oregon Highway 62 about 1 mile north of the road to the hatchery.

7. Jackson F. Kimball State Park: Three miles north of Fort Klamath junction on Oregon Highway 232, turn left just before starting up over Sun Mountain. Here another large spring begins amid boulders of basalt that have broken off the rim and rolled down the steep slope. This spring is the main source of upper Wood River and is noted for its clear, deep blue water. Like the other spring-fed streams, it furnishes excellent trout fishing.

8. Cave Mountain: Cave Mountain is a large mass of bedded tuffs, explosion breccias, occasional basalt flows, and dikes. It is situated about 2 miles northeast of Chiloquin and can be reached by way of Sprague River road. A cave situated on the south side of the mountain was occupied by Indians in ancient times. Artifacts disclose that a favorite camping ground for them was along the Sprague River upstream from Braymill.

* * * * *

REACTIVE METAL CASTINGS ON DISPLAY

A group of reactive metal castings manufactured by Oregon Metallurgical Corp. of Albany, Oregon, is on display in the Department museum in Portland. The castings are made from vanadium, tungsten, and beryllium, usually in a high vacuum under very exacting controls. These metals are resistant to heat and corrosion and are used for nuclear, aircraft, and chemical applications.

* * * * *

DRILLING PERMIT NO. 47

The Department issued permit No. 47 to Humble Oil & Refining Co. on June 6, 1962 for a test well in Marion County, 1,633' south and 1,681' east from the NE. corner sec. 11, T. 7 S., R. 1 E. Drilling will be done on the Francis Wicks property 6 miles east of Silverton.

* * * * *

WELL RECORDS RELEASED IN OPEN FILE

Company & Well	County	Depth	Records
John T. Miller Sullenger No. 1 Sec. 18, T. 8 S., R. 5 W.	Polk	710' T.D.	Driller's log History Cuttings*
Oregon Oil & Gas Co. Roberts No. 1 Sec. 25, T. 10 S., R. 8 W.	Lincoln	2,630' T.D.	Driller's log History Gas analysis Cuttings*
Reserve Oil & Gas Co. Roy - L& G - Bruer No. 1 Sec. 31, T. 6 S., R. 4 W.	Polk	5,549' T.D.	Induction log Sonic log Mud log History Dipmeter Cuttings & cores*

*Available for study at the Portland office.

* * * * *

WHAT IT TAKES TO DRILL FOR OIL*

"This location was drilled on the southeast edge of McComb Field. The McComb Field pay sand was shaled out. No shows were present in the well; plugged and abandoned."

So reads the epitaph for a drilling venture--McComb Field Unit 26-1 in Pike County, Mississippi--in a neatly typed report resting in Sun's Production files. All that remains now of the $60,000 project is a long, slim hole extending two miles down into the South Mississippi earth, and a brief drilling report. Factual and to the point, the report tells the oil man all that he really needs to know about MFU 26-1. It was a dry hole.

But behind that cryptic report lies an interesting story. Back in June, 1961, brisk activity marked the site of MFU 26-1. Eighty-eight men and close to $1.5 million worth of equipment were assembled on the rolling Pike County countryside to buck the odds once more in an effort to bring in a producing oil well. They gambled and, as it turned out, they lost.

The well itself wasn't unusual. It was just one of some 47,000 wells drilled in the U. S. last year, and it wasn't particularly difficult to drill. The fact that it turned out to be a duster wasn't unusual either. After all, 36 per cent of all the wells drilled in 1961 were dry, more than 17,000 wells altogether (in exploratory drilling in untested areas, some 90 per cent of all wells are dry).

To bring MFU 26-1 into perspective, let's back up a bit. The McComb Field is veritably a baby as oil fields go; it was discovered in August, 1959, when Sun and an independent operator brought in a wildcat producing 240 barrels daily. This discovery well, producing from a thin Lower Tuscaloosa sand about two miles down, set off a small boom in drilling and leasing. By the end of the year, 15 producers had been completed.

However, in early 1960 the outlook darkened considerably. Engineering studies showed that the oil sand contained more salt water than oil and that McComb would be a marginal field financially. But the engineers also suggested that the problem could be licked by operating the field as a unit and by applying modern technology to supplement the natural pressure existing in the reservoir. This would be done by pumping additional salt water through selected wells into the producing formation to help displace oil from the sandstone and increase the oil flow from producing wells. After more than a year of intensive effort, agreement on unitization was reached with Sun as unit operator. The salt water injection program, now in operation, is expected to more than double oil recovery.

*Excerpt from article by Dean S. Chaapel in "Our Sun," Spring, 1962, reprinted by permission of Sun Oil Company.

Men, Materials, and Machines for Typical Well

At bottom center are 25 drill bits, flanked by floating tools, centralizers, scratchers and other equipment used in setting casing. Behind are drums of lubricants, with Christmas tree assembly at left. Personnel in foreground are district superintendent in front, two toolpushers behind him at left, and three drilling crews and one roustabout crew in hard hats at left and center. Six men in line at right front are two petroleum engineers, landowner, landman, lawyer and civil engineer. Directly behind are two geologists, left, and two foremen. (Other men in photo work with equipment indicated.)

First row of trucks, from left, includes four pickups used by pumpers; gravel and lumber trucks used in site preparation; and two trucks loaded with mud materials. In second row are butane fuel truck, personnel carrier, two bulldozers, welding truck, swabbing truck, logging truck, perforating truck, electrical logging truck and logging laboratory unit. Large flat-bed truck facing left, first truck in third line, and pickup in rear are utility units. Others in angled line are four special-purpose units used in fracturing producing formations and in cementing operations, a pickup, and two cement trucks (large boxes). Trailer provides field office space. Two rows of trucks at right are loaded with drill pipe, tubing and casing. Drilling rig with mast down is at rear, with toolhouse at front left. At far left are kerosine fuel tank, core-house, mud-house and butane fuel tank for rig. (Sun Oil Co. photo.)

In the late spring of 1961, Sun, as operator, was pushing a drilling program to define all prospective producing acreage. As a part of this program, MFU 26-1 was planned as a unit definition well (a well to help outline the limits of the oil pool) on the southeast edge of the field. According to geological reports, the Lower Tuscaloosa oil sand should be found about 11,000 feet down.

With the decision to go ahead, the stage was set for getting ready to drill, a mammoth job in itself. First, a four-man civil engineering crew moved in to locate and stake the exact site. Since the site was located in the middle of a pasture, the next step was building a quarter-mile stretch of board road in from the highway to enable heavy trucks to bring in equipment and supplies without damage to the land. With the road in, bulldozers were moved in to level the ground, scoop out pits for the drilling mud and prepare the well-site for the drilling rig.

Then came the rig. MFU 26-1 was drilled by a rotary rig owned by Reading & Bates, drilling contractors of Tulsa, Okla. Valued at $568,000, the big rig could drill a hole more than four miles into the earth. After it was positioned, the 142-foot, tapering steel mast was erected and auxiliary equipment tied in.

Although this powerful rig was the prime mover in drilling MFU 26-1, a vast array of other equipment and supplies had to be assembled at the well-site before drilling could begin. (See photo.) . . . When all equipment had been moved in and set up and all personnel were on hand, the stage was set for starting to drill. For MFU 26-1, this moment arrived on the morning of July 4, 1961. A sharp steel bit was screwed onto a section of drill pipe, the pipe was lowered through the rotary table, the big rig came smoothly to life and the bit began biting into the Mississippi soil.

Drilling continued around-the-clock for the next three weeks, with the steady progress of the hole being interrupted only by necessary time out to pull the drill pipe to change bits, and to set surface casing. The Lower Tuscaloosa Formation was hit at 10,855 feet. Between that depth and 11,016 feet, 23 cores (earth samples) were taken from the hole and carefully examined. None showed any signs of oil. MFU 26-1 was a bust. On July 25, after being drilled to a total depth of 11,050 feet, the well was plugged and abandoned.

This story of MFU 26-1 doesn't paint the oil-finding business as a particularly easy one. But to the oil man, disappointing as a dry hole is, the picture is somewhat different. After all, that next well might be a producer and he'll never know unless he drills. And if it is a producer, maybe he can get back some of the money he dropped on dry holes.

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The ORE BIN
Vol. 24, No. 7
July, 1962

THE OREGON KING MINE, JEFFERSON COUNTY, OREGON

by F. W. Libbey* and R. E. Corcoran**

The Oregon King mine, although inactive at the present time, is of particular interest, not only because its ores contained sizeable amounts of silver along with gold, copper, lead, and zinc, but the age and type of mineralization resemble the "bonanza" deposits in Nevada.

A compilation of all data available on this mine, together with a summary on the history of its development, has been published by the Department as Short Paper 23. Copies of this report may be obtained from the Department's offices in Portland, Baker, or Grants Pass for $1.00.

Introduction

The great majority of metallic ore deposits in Oregon are found in the northeastern and southwestern parts of the state, where they occur in pre-Tertiary rocks and associated granitic intrusives or as placers in adjacent stream valleys. An important exception is the silver-gold lode in central Oregon known as the Oregon King mine (see Figure 1). There the oldest rocks are early Tertiary volcanics locally intruded by rhyolitic to andesitic masses. The geology and mineralogy of this mine have some similarities to the silver deposits of the Tonopah, Nevada, district, which has produced more than 150 million dollars in silver and gold since 1900.

Until mining was halted by a shaft fire in 1950, records of the U. S. Bureau of Mines show that, during the period from 1935 to and including 1950, the Oregon King had a total production of 232,402 ounces of silver, 2,419 ounces of gold, 59,076 pounds of copper, and 110,071 pounds of lead, with 37,351 pounds of zinc reported but not recovered. In addition there was a small production from smelter shipments from 1899

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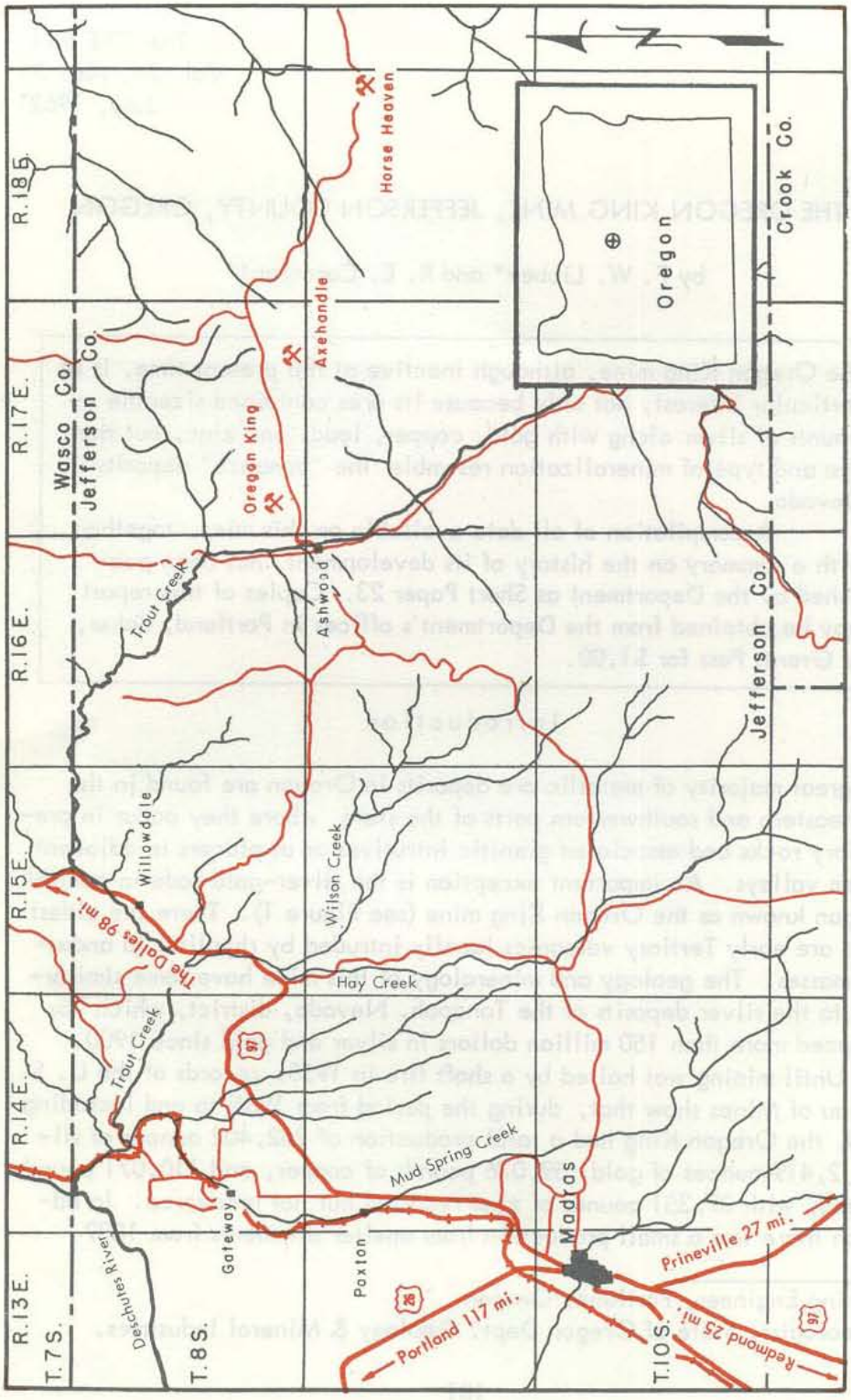

Figure 1. Map of Ashwood area, Jefferson County, Oregon, showing location of the Oregon King mine.

t'nrough 1904.

The mine is now flooded up to the second or adit level, which is about 150 feet vertically and 173 feet on the incline below the collar of the shaft. Levels below the adit therefore cannot now be examined. Old assay reports of samples taken when the exploration work was done in the 1899-1904 period indicate the presence of ore of good quality at these lower depths. However, some conflicts and omissions in the available records are evident and, until these are clarified, definite statements regarding assay values in the early records are open to question; but because of the history of operations, especially the smelter shipments, a geologic and economic study of the property both on the surface and underground seems warranted.

Smelter returns provide the only authentic evidence of the grade of ore that may be available, but much of this information is on ore shipped by lessees from the third level and above, representing a part of the body that is presumably mined out. Ore shipped from the dump was vein material from shaft and drifts at all levels when the mine was originally developed by W. S. Thomas, mining engineer for J. G. Edwards. Smelter figures, together with assay reports of samples taken when the shaft was sunk from the surface to the sixth level, indicate an average grade that could be economic if the quantity available is proved sufficient, and if operations are conducted by experienced mining people.

The Alaska Juneau Mining Co. did extensive sampling of the mine in 1934-1935, and, although a satisfactory comparison is difficult to make, its assay results do not check well with those from the earlier exploration work under the supervision of W. S. Thomas.

The Orie and Roy claims in the so-called Roy group which borders the Oregon King group on the south (see Plate 1) appear to have mineralization similar to the Oregon King vein, and investigation might show that these claims would be a desirable addition to the Oregon King ore supply.

The Oregon King deposit has generated some interest at this time because of the world silver market situation. For the past few years the demand has substantially exceeded supply, and the United States' stock of "free" silver, that is, the domestic stock not ear-marked for currency backing and available for purchase and commercial uses, has been largely depleted. The market price for silver has risen from $0.905 to $1.04 an ounce (July, 1962). This has caused any new potential source to assume more importance. Hence attention has been directed to the Oregon King as a possibility.

Geography

The Oregon King mining property is in sec. 25, T. 9 S., R. 16 E., and secs. 30 and 31, T. 9 S., R. 17 E.W.M., Jefferson County, Oregon, approximately 3 miles by graveled and dirt roads northeast of Ashwood, which is 28 miles east of Madras, the county seat. The mine is 26 miles by road from Gateway on the Oregon Trunk Railroad.

The mining property, as shown in Plate 1, comprises 18 patented mining claims including 11 fractions. Title is held by The First National Bank of Oregon as Trustee of the J. G. Edwards estate. Total area is 293 acres, more or less, as evidenced by patent surveys made over the period 1906-1918.

The topography is hilly with V-shaped canyons having a relief in the mine area of about 300 feet. Elevation of the shaft collar is reported in Alaska Juneau records to be 3,000 feet. Aneroid reading (July 1957) was 2,940; at Ashwood it was 2,580. Contours on Plate 1 are of sketch map quality only. Drainage is westerly into Trout Creek and the Deschutes River.

Central Oregon has a semi-arid climate with extremes of temperature during the year, hot in summer and cold, often with subzero temperatures, in winter. Precipitation is small and snowfall light, but heavy precipitation for short periods is not uncommon. The rolling hills have grassy patches and sparse junipers. Grazing and wheat raising are the principal industries of the immediate area.

Geology

The Ashwood area is underlain by a complex assemblage of Tertiary volcanics and subordinate sedimentary rocks in the western part of the Blue Mountains of central Oregon. Most of the rock in the general vicinity of the Oregon King mine ranges in age from Eocene (?) to Miocene (?), and comprises at least two formations: Clarno and John Day (see map, Figure 2). The Eocene-Oligocene Clarno Formation, in which the mine is situated, is composed of lava flows and coarse volcanic breccias of porphyritic pyroxene andesite with less abundant tuff and mudstone. The John Day Formation of Oligocene to Miocene (?) age, characterized by tuff, lapilli tuff, strongly to weakly welded ash flows, and subordinate flows of trachyandesite and rhyolite, is exposed a short distance north and west of Ashwood (D. L. Peck, written communication, 1962). Rhyolitic and andesitic domes or plugs which intrude the Clarno volcanics near the mine on the Bird claim and possibly the Ella, are thought to be possible

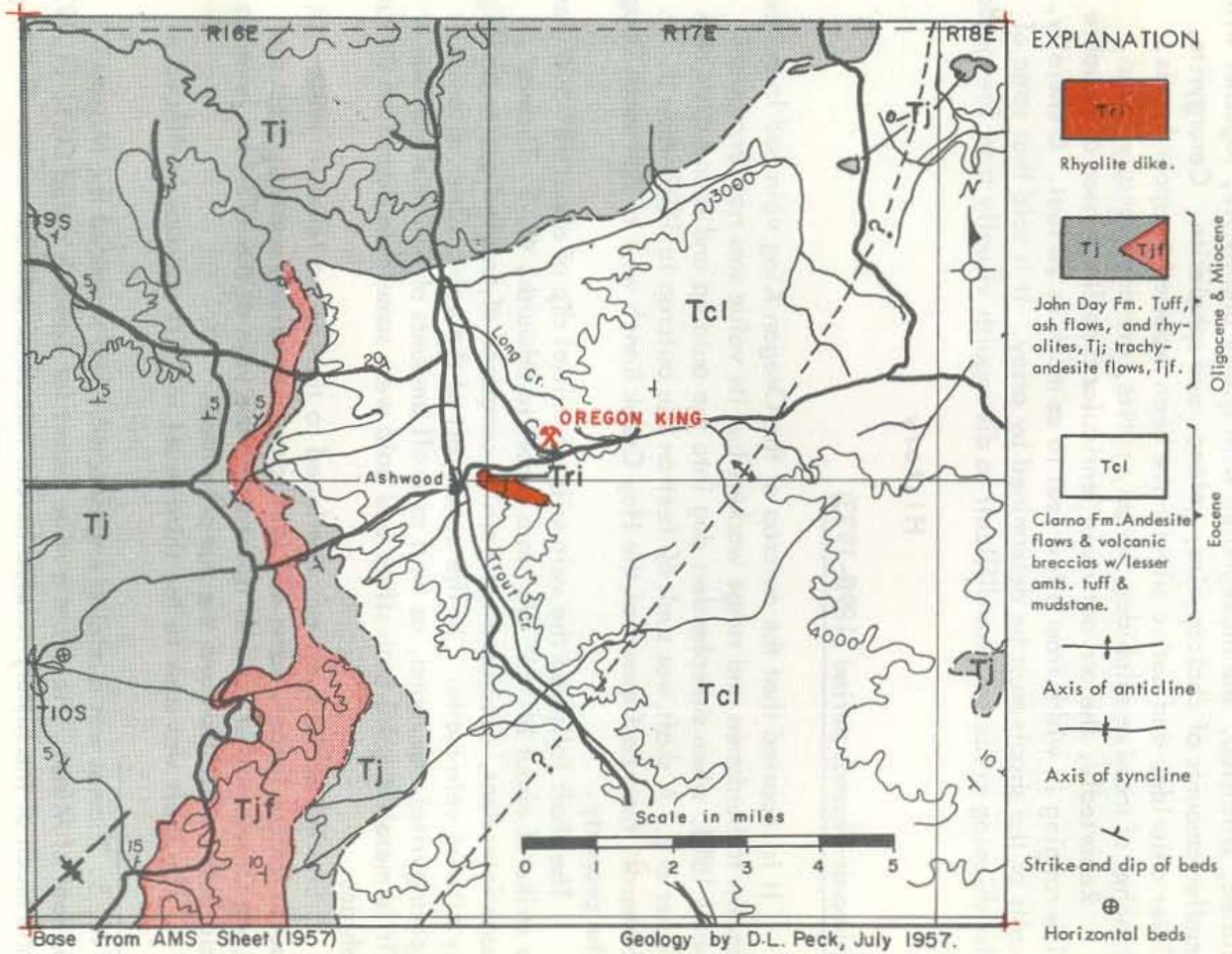

Figure 2. Reconnaissance geologic map of the Ashwood area, Jefferson County, Oregon.

correlatives of rocks of similar composition which occur in the John Day Formation.

The ore zone at the Oregon King mine is associated with a fault trending N. 75° W. The dip on the fault averages about 75° S.W., but it is steeper in the lower levels of the mine, according to mapping by the Alaska Juneau Co. The andesitic rocks along the fault have been brecciated, silicified, and impregnated with quartz and pyrite, together with smaller amounts of chalcopyrite, galena, and sphalerite. Cerargyrite, silver chloride, and native silver have been reported in upper levels. Bunches of massive sulphides, largely pyrite, are occasionally found.

Reportedly, the ore occurs in lenticular pipelike masses of variable size ranging in width from a few feet to as much as 20 feet. Generally, walls of the shoots must be determined by assay. It is said that some of the shipping grade ore was difficult to distinguish visually from low grade.

History

Edwards-Thomas period (1898-1933)

It is reported that the outcrop of the Oregon King vein had long been known to herdsmen and range workers but its value was not recognized until 1898, when sheepherders dug into the outcrop and found some rich silver ore. A shaft was sunk 60 feet on the outcrop in 1899 when J. G. Edwards, then half owner of the Hay Creek Ranch west of Ashwood, bought the property.

The shaft followed the vein with an initial dip of about 60° S.W. and a strike of about N. 75° W. In a report to Edwards, W. S. Thomas*, superintendent, described the vein as composed of crushed quartz and highly altered vein matter. In the upper part of the vein, silver chloride (cerargyrite) was found, as well as small amounts of native silver and a little metallic gold; both silver and gold were sometimes deposited on sulphides.

Sinking of the shaft was continued to the second level in 1900. An adit crosscut tunnel, some 470 feet long, was driven westerly from the Long Creek side of the hill to intersect the vein at the 173-foot level to aid both ventilation and the pumping load.

The shaft was sunk to the third level in 1901 and was continued to

*W. S. Thomas was a mining engineer who had attended the Missouri School of Mines. He wrote a mine report for Edwards dated Oct. 11, 1933, and much of the history related herein was obtained from a copy of it.

the fourth level where, according to the Thomas report, the vein flattened somewhat. Lateral work was done on both the third and fourth levels.

From 1901 to 1903, the mine was closed down because of litigation in the Federal courts over title. Judgment was in Edward's favor and mine development was resumed in October 1903. The shaft was sunk to the fifth and sixth levels in 1903 and 1904 and east and west drifts were run on these levels. Thomas reports that "the rich ore thins out as the sixth level is reached." He states that ore may be followed in the hanging wall side of the west drift on the sixth level to the face, a distance of 96 feet. In the face there is a "good showing" of ore. The east drift on this level shows no ore at its face although "some nodules of good ore were found scattered around in a soft white quartz near the shaft." His report continues "This ore body in the west drift on the sixth level has the greatest lateral extent of any yet found." Two samples taken later by Edwards and Thomas from the face of the west drift, March 10, 1930, as shown below are pertinent here.

Sample No.	Name	Gold oz.	Silver ozs.	Copper percent	Zinc percent	Lead
1	Special High grade Stringer	0.38	105.6	present	-	-
2	All of ore on hanging side of drift ("30" of this")	0.08	15.7	2.86	7.05	present

Ore shipments reported by Thomas: Shipments of ore from development work in the shaft between the fifth and sixth levels and from stopes "on the east and west side of the shaft between the fifth and fourth levels" were made in 1904.*

Thomas recorded "In September 1904 further litigation was threatened and the property was closed down and so remained." In 1929 Edwards reopened the mine and made some additions to the surface plant, among which were a 125-hp diesel engine and an electric generator, together with some other electrical equipment. Shaft sinking below the sixth level

* All shipments made during the Edwards-Thomas period of operation are tabulated in Short Paper 23.

was begun on April 9, 1930. When the shaft had reached the seventh level, Thomas reports: "Engine trouble had now come to be frequent and a source of annoyance, delay, and impossible expense." Operations ceased on June 20, 1930. He states that the shaft was making 25 g.p.m. when the mine shut down.

The only development work of record during the Edwards-Thomas period, other than that described, was the Ruby Tunnel driven at irregular time intervals during the early part of operations.*

Alaska Juneau period (1934-1935)

The mine was idle from 1930 to 1934, when the Alaska Juneau Mining Co. took possession under an option to purchase. Underground work was resumed and continued until the end of 1935, when the company gave up its option. As shown by the mine maps, Alaska Juneau explored underground on the fourth, fifth, and sixth levels. Whether or not Alaska Juneau measured the shaft is not recorded. The company's longitudinal cross section (Figure 3-a) scales in excess of 675 feet vertically. Smelter records show that during 1935 the company shipped 6 cars of ore containing 200 dry tons valued by the smelter at $15,374. The bulk of these shipments reportedly came from the small stopes above the fifth level (see Figure 3-a).

Rohlfing-Anderegg period (1940-1950)

Rohlfing lease: After Alaska Juneau stopped work, the mine was idle until 1940 when Edwards leased the property to Ernest Rohlfing, a Portland wheat broker with whom Edwards had previously had business dealings. The lease, besides setting a royalty, said to have been 15 percent, called for a percentage of the receipts from ore shipments to be set aside for the purchase of a mill. Rohlfing had Custer Young of Ashwood and Frank Dahlquist of Boise as partners.

Smelter shipments were started in October 1940, and the first shipments were 14 cars from the ore pile of the mine dump. Then, later, ore was shipped from the 25-foot, 50-foot, and 100-foot levels in addition to dump ore.

In May to July, 1941, metallurgical testing work was done on a sample of Oregon King ore (110 pounds) by the Denver Equipment Co. There is no record of source of the sample or how it was obtained. A report of

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* See Short Paper 23 for description of Ruby Tunnel.

the test results was submitted by Denver Equipment Co. under date of July 9, 1941, together with a recommended flow sheet. The test sample assayed 0.15 ounce gold, 9.45 ounces silver, trace lead, 0.88 percent copper, 0.40 percent zinc, 6.75 percent iron, 6.09 percent sulphur, no arsenic, and 0.20 percent antimony. Bulk flotation with one cleaning of concentrate by flotation was recommended, together with tabling of flotation tailings, and table concentrates added to flotation concentrates. As reported, selective flotation did not seem advisable because a pyritic tailing carried too much gold and silver to be discarded as waste.

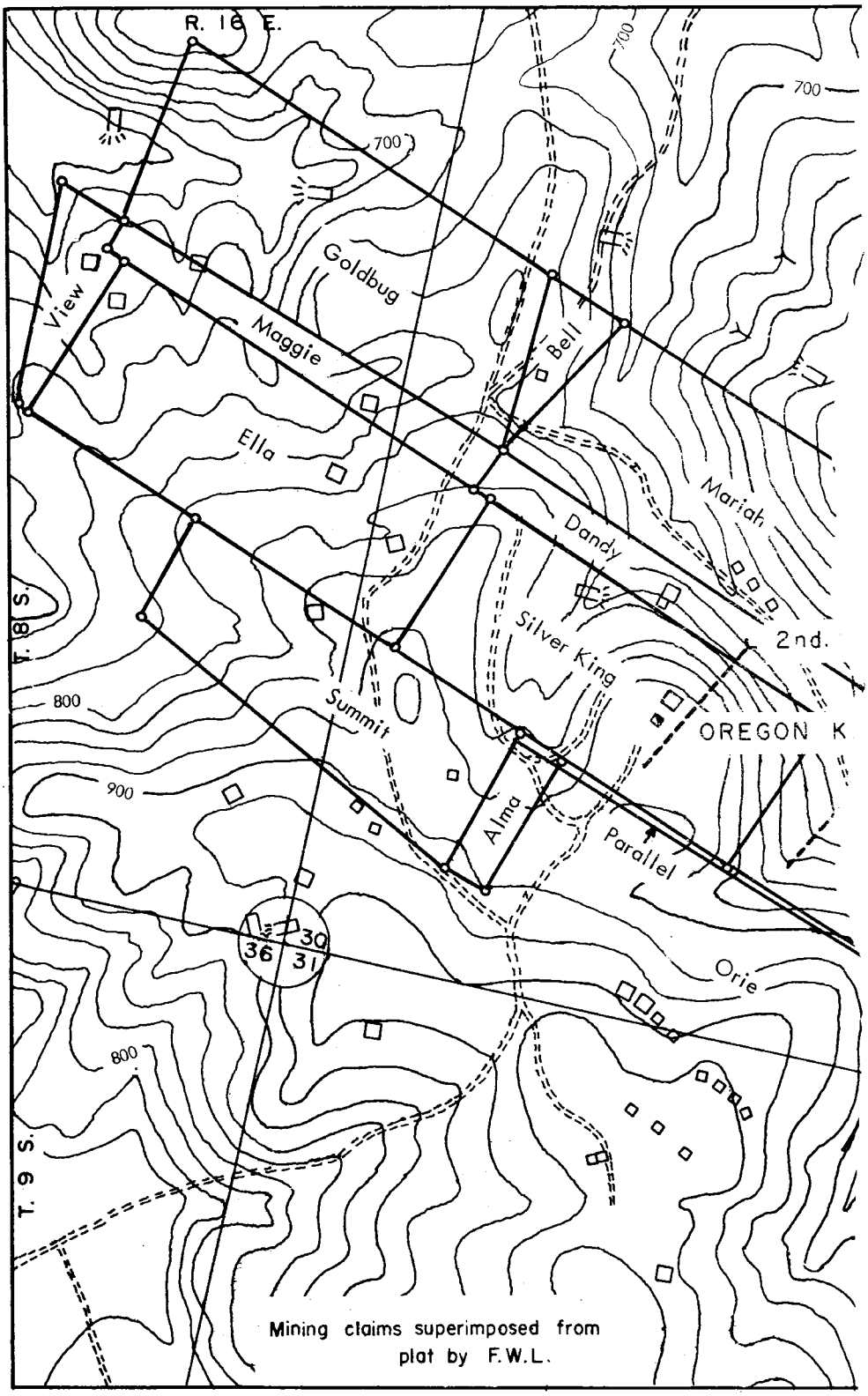
The mill was purchased and installation finished in July 1942. Custer Young reported that the first car of concentrates was shipped July 28, and that the mill feed was obtained from both the mine dump and the 200 level. According to the U. S. Bureau of Mines' records of production, 2,354 dry tons of ore and 261 dry tons of concentrates were shipped in 1942.

Anderegg lease: Rohlfing operated intermittently until 1945, when he sold his lease to Henry Anderegg. Young returned as superintendent in 1945 and stayed about one year. Work was somewhat intermittent as shown by smelter shipments, although some improvement is evident in early 1947. In the last half of 1947, however, some cars of ore were shipped which were too low grade to pay expenses. No record of where these shipments were mined is available. There is no record of production or other activity for 1948 or 1949.

In 1950 Frank A. McMenamin of Portland became associated with Anderegg in the management of the mine and there was a resumption of activity. In August 1950 a car of concentrates (39 tons) obtained from milling 200 tons of ore was shipped to Tacoma. The return was 23 ounces of gold and 1,886 ounces of silver plus 700 pounds of copper. This was the last shipment .

At about this time a power transmission line was put into the property by the Wasco County P.U.D. and the Oregon King has a transformer on a pole structure near the shaft.

In September 1950 a night fire which, as reported at the time, apparently started on the second level, traveled up the shaft timbers and burned the shaft house, containing hoist and compressor, and bunkers. Mr. McMenamin reported: "...the fire continued in the sulphide ore for some two weeks until we had to put in a large charge of dynamite and blast down below to shut off the air currents." The fire caused a stoppage of all mining activity, and seemingly soon thereafter the lease was canceled. Nothing has been done at the mine since.


R. 18 E.
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Mining claims superimposed from
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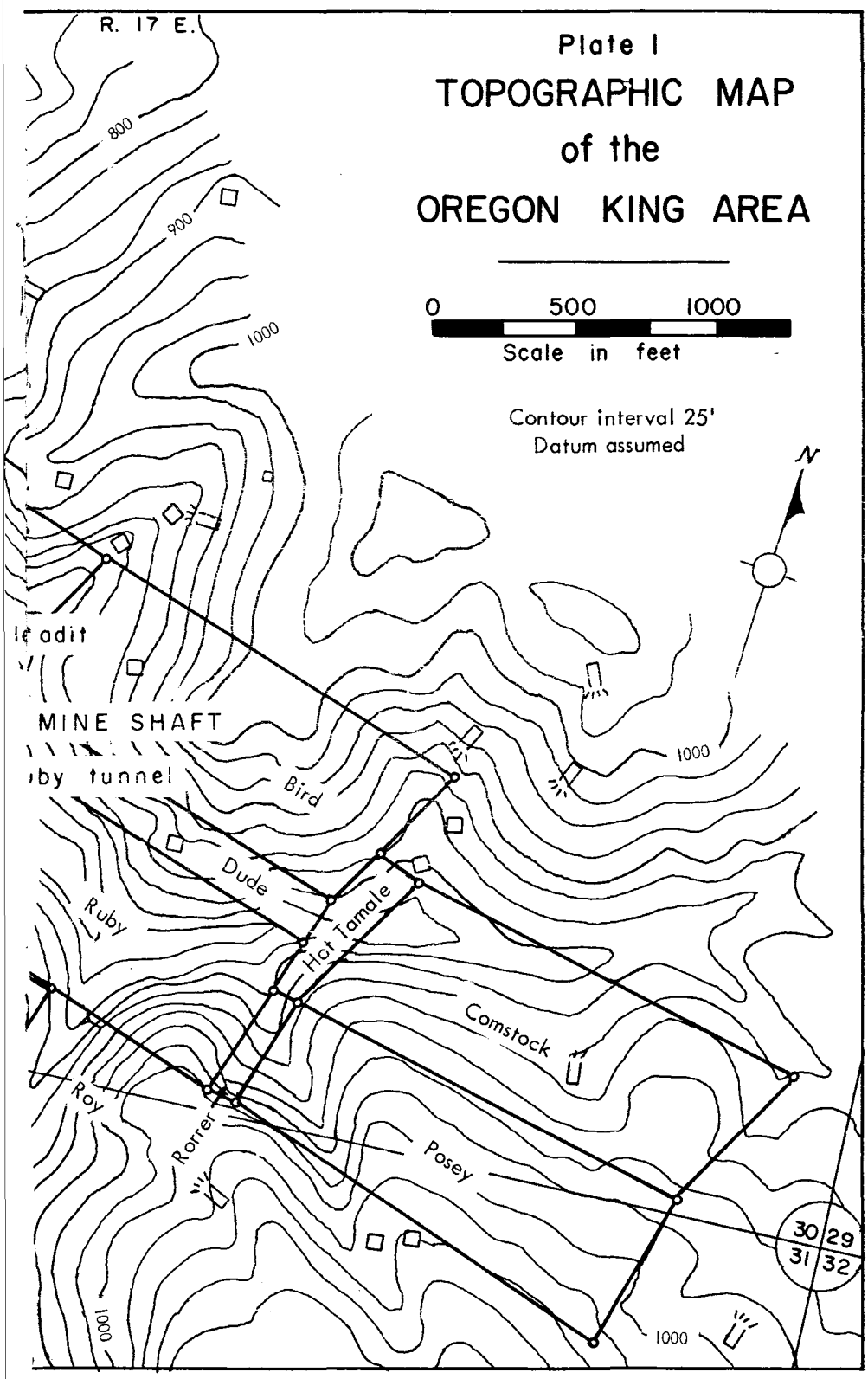
R. 17 E.
Plate I
TOPOGRAPHIC MAP
of the
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Scale in feet
Contour interval 25'
Datum assumed
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adit
MINE SHAFT
by tunnel
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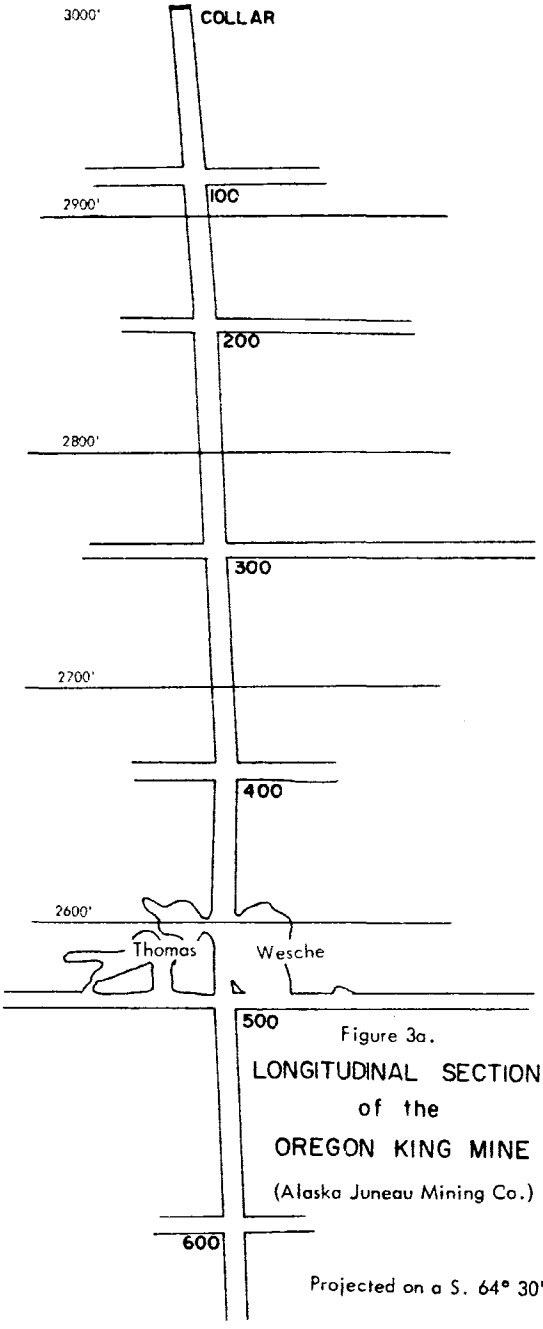

Figure 3a.

LONGITUDINAL SECTION of the OREGON KING MINE

(Alaska Juneau Mining Co.)

Projected on a S. 64° 30' E. plane

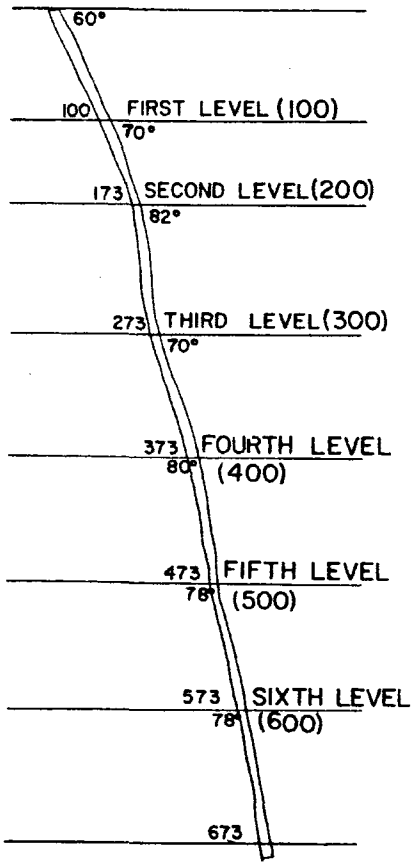

Figure 3b.

SECTION of SHAFT LOOKING EAST

(F. W. Libbey)

Mine Development and Production

From the records furnished by the late Louis Enderud, Edward's business manager at the Hay Creek Ranch, it appears that Alaska Juneau prepared a synthetic log of samples and assays obtained in development work under Thomas, utilizing daily report sheets which they found at the mine.*

In addition to a longitudinal section of the shaft (Figure 3-a), Alaska Juneau prepared plan and assay maps* down to and including the sixth level. These indicate that they did several hundred feet of development work, the exact amount of which cannot be determined because of incomplete knowledge of the early work. A section on the shaft looking east (Figure 3-b) was constructed by the authors to show the variation in dip of the ore zone as it was followed downward during the initial development. Alaska Juneau's maps show a total lineal footage of about 3,500 feet in the mine, including about 700 feet of shaft, up to and including 1935.

Known ore is reportedly stoped out completely above the second level, and, to a large extent, above the third level. There is no evidence of stoping on the fourth level. The Alaska Juneau longitudinal section (Figure 3-a) shows small stopes above the fifth level. They probably represent in part the source of ore mined by Alaska Juneau for shipment in 1935. An Alaska Juneau assay record sheet names the stope east of the shaft the "Wesche Stope" and the one west of the shaft "Thomas Stope." In both of these stopes some rather high gold values were recorded, and probably a higher than average gold-silver ratio. Average assays reported are as follows:

Stope Name	Samples		Assays		
	Description	Location	Width (feet)	Gold (ozs.)	Silver (ozs.)
Wesche (east)	Back 25' long	Hanging wall	2.75	0.74	44.6
" "	" "	Foot wall	0.9	0.10	13.8
Thomas (west)	Back 20' long	Hanging wall	3.9	3.18	24.7
" "	" "	Foot wall	2.0	0.10	3.9

An average of 23 samples from the Wesche (east) Stope taken in the back and breast gives 0.38 ounce of gold and 29.8 ounces of silver. In the Thomas (west) Stope only two samples are recorded. They average 0.34 ounce of gold and 58.43 ounces of silver. In the short sub-level off the Thomas Stope an average of 7 samples gives 0.06 ounce of gold and

* Given in Short Paper 23.

Table 1 - Oregon King Mine. Production 1935-1950*

Year	Dry Tons Shipped or Milled	Concentrates (Dry Tons)	Smelter	Gold (Ounces)	Silver (Ounces)	Copper (Pounds)	Lead (Pounds)
1935	200	0	Tacoma	315	7,471	4,026	5,794 1/
1936-39	No production	0					
1940	1,062	0	Tacoma	329	20,313	6,000	18,000 1/
1941	2,348	0	Tacoma	945	88,823	14,000	34,000 1/
1942	2,615 3/	261	Midvale, Tacoma	333	56,797	14,000	20,000 2/7/
1943	1,248 4/	178	Midvale, Tacoma	108	9,727	5,700	7,800 2/
1944	1,561 5/	90	Tacoma	150	16,754	6,000	8,000 1/
1945	120	0	Tacoma	38	8,443	350	677 1/
1946	24	0	Tacoma	6	954	300	600 1/
1947	988	0	Midvale, Tacoma	172	21,234	8,000	14,000 2/
1948-49	No production						
1950	200 6/	39	Tacoma	23	1,886	700	1,200 1/
Totals	10,366	568		2,419	232,402	59,076	110,071

*Adapted from U. S. Bureau of Mines records.

1/ No lead recovered at Tacoma smelter.

2/ Lead and copper, but not zinc, recovered and paid for at Midvale smelter.

3/ Includes 1,035 dry tons mine ore, and 400 tons dump ore from which was recovered 202 ounces of gold and 39,459 ounces of silver. Included also is total of 1,180 tons milled producing 261 tons of concentrates which returned 313 ounces of gold and 17,338 ounces of silver.

4/ Includes 98 tons of crude ore shipped from which was recovered 16 ounces of gold and 1,153 ounces of silver. Included also is a total of 1,150 tons milled which gave 178 tons of concentrates containing 92 ounces of gold and 8,574 of silver.

5/ Includes 661 tons of crude ore containing 114 ounces of gold and 12,305 ounces of silver. Included also is a total of 900 tons of ore milled producing 90 tons of concentrates containing 36 ounces of gold and 4,449 ounces of silver.

6/ 200 tons milled which gave 39 tons of concentrates containing 23 ounces of gold and 1,886 ounces of silver.

7/ Zinc in concentrates shipped to Midvale amounted to 18,103 pounds. Total zinc in crude ore shipped to smelters was 37,351 pounds.

7.5 ounces of silver.

Production records of the Oregon King mine (1935-1950), adapted from statistics supplied by the U.S. Bureau of Mines, are given in Table 1. According to smelter settlement sheets, the last car of crude ore was shipped October 21, 1947. This shipment averaged $5.20 per ton and showed a debit of $284.75.

Recent Sampling

An inspection of the mine was made by the senior author in 1957, and samples were taken as shown in Table 2. All places sampled and inspected were tested with a scintillator. A variation in background count was recorded due to mass effect underground, but no significant radioactivity was noted anywhere.

Table 2 - Recent Sampling (1957)

Location	Sample Description	Assay		
		Gold (ozs.)	Silver (ozs.)	Copper
Adit, Second Level 25' section starting at pyrite seam 240' from portal.	Bleached, siliceous rocks. Contains sparse pyrite chips from S.W. wall.	Trace	0.32	Nil
Next 25' section beginning 265' from portal.	Same.	Trace	0.24	Nil
Across 5' face of cut w. of & below mine dump in line with Oregon King vein outcrop.	Silicified, fissured iron-stained rock. No visible sulphides.	Trace	1.28	Not assayed.
Mill tailings on face of cut made by Long Creek.	Layered dump.	Trace	1.64	Not assayed.
Grab from "ore" on dump of prospect shaft on Bird claim hill E. of portal of 2nd level adit.	Shaft on well-defined fissure striking S. 80° E. steep dip, altered rhyolite. Specks galena in "ore."	Trace	1.08	Not assayed.
Top of Ruby Tunnel winze. Well-defined foot wall.	Across 9' crushed quartz, pyrite and clay gouge. Few gypsum seams.	Trace	0.36	Not assayed.

* * * * *

DUNES AREA WITHDRAWAL PROPOSED

The Department of Agriculture has filed application for the withdrawal of lands from "location and entry under the general mining laws only" in the Oregon Dunes Recreation Area in the Siuslaw National Forest. The lands involved total 21,124 acres, or about 33 square miles along the coast in Lane, Douglas, and Coos Counties. According to the notice from the Bureau of Land Management, "The applicant desires the land for the purpose of conserving, developing, and making accessible for the inspiration, enjoyment, and use of all American people of present and future generations the recreational and scenic resources of the area."

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NEW MINING SAFETY CODE

A public hearing to consider the adoption of a safety code for mining, tunneling, and quarrying is being called for 9 a.m. standard time, Thursday, August 2 by the State Industrial Accident Commission. The meeting will be held in Room 202 Labor and Industries Building, Salem. The code has been revised in accordance with recommendations received at a public hearing held May 16 and with those of a special advisory committee on quarry operations. The August 2 hearing is expected to be final, and the public is invited to be present and to offer any suggestions it feels would improve the provisions of the proposed code.

* * * * *

RECENT OPINIONS OF THE ATTORNEY GENERAL

Four opinions handed down by the Attorney General's office recently are of interest to the mineral industry.

In an opinion (No. 5431) requested by the State Marine Board, the Attorney General advised that the Board has no regulatory powers which would require skin divers to use a diver's flag when diving or to remain within a stated distance of such flag while submerged.

Areas of control of the state's ground water, requested by the State Engineer, were clarified in an opinion (No. 5435) by the Attorney General on May 11. The lengthy opinion is summarized by the Attorney General as follows:

"It is therefore our opinion that even though the Legislative Assembly has expressed the policy that the state water resources program be coor-

dinated under a single state agency, the same legislature specifically permitted the control and use of ground water to remain in the State Engineer. It is further our opinion that the classification of ground water by the State Water Resources Board in the Deschutes and Upper Willamette River Basins does not restrict the ground waters to any particular classified use."

In a third opinion (No. 5441) requested by Columbia County, the Attorney General concluded that reserved mineral interests must be separately listed and assessed for ad valorem tax purposes, even though no minerals are known to exist. The valuation should, however, be nominal unless the existence of an actual value of the reserved rights can be established. The reserved mineral interest is a tangible property interest, while right of entry retained in connection therewith is intangible.

According to a fourth opinion (No. 5452), "Oregon acquired title to the beds of all navigable waters within its borders upon admission into the Union. The state has power to sell or lease tidelands in its proprietary capacity and holds the submerged lands in its sovereign capacity in trust for the public. A riparian owner has a right incident to the land to wharf out to navigable water subject however to control and regulation by the state. Waters including wharves within port districts are subject to control and regulation by the port with the same power and authority as lies in the State of Oregon. A wharf has been defined to include a bank or earth fill."

* * * * *

WELL RECORDS RELEASED IN OPEN FILE

Company & Well	County	Depth	Records
Ross Mitchell & Assoc.'s Bliven No. 2 Sec. 10, T. 8 S., R. 5 W.	Polk	430'	Driller's Log Cuttings*
Ross Mitchell & Assoc.'s Bliven No. 3 Sec. 10, T. 8 S., R. 5 W.	Polk	580'	Driller's Log History Cuttings*
Ross Mitchell & Assoc.'s Adams-Bliven No. 4 Sec. 15, T. 8 S., R. 5 W.	Polk	340'	Driller's Log Cuttings*

*Available for study at the Portland office, State of Oregon Department of Geology and Mineral Industries.

* * * * *

HATFIELD ENDORSES MINING RESOLUTIONS

At the Western Governors' Conference in Anchorage, Alaska, May 2-5, 1962, Governor Mark O. Hatfield of Oregon joined with the other governors in adopting resolutions proposed by the Western Governors' Mining Advisory Council to aid the mineral industry. Resolutions adopted are as follows:

Discovery requirements: Changing concepts of what constitutes a "discovery" applied by government agencies in their contesting the validity of mining claims has led to an increasing insecurity of the right of a claim holder to develop a metallic mineral deposit. The "prudent man concept," established early in the life of our present mining law by numerous court decisions, has been changed by government administrative decisions. They now tend to require a "present marketability test," as in common nonmetallics, and which is not a practical or fair test for a metal discovery. It is also not consistent with the fundamental theory or intent of the mining law. In our proposed resolution on discovery requirements, we recommend your approval and action on the following three items: (1) return of government agencies to the original judicial concept of discovery requirements applicable to metallic minerals; (2) legislation requiring the federal government to act in claim contests within a time limit, thereby granting the claimant the same right enjoyed by the government under the Multiple Use Act; and (3) passage of H.R. 1960 to allow proceedings by a claimant against the government to be carried out in his own District Court, rather than in Washington, D.C.

Gold: We recommend incentive or subsidy payments to cause an increase in the production of gold. This will benefit the balance of gold in our United States Treasury as well as the gold mining industry. The outflow of gold from the Treasury threatens the value of the dollar and the safety of the Treasury against a run by foreign creditors which could completely drain it. We recommend your opposition to any further decrease of the required gold backing for paper currency as a measure inimical to the best interests of the nation.

Silver: Last fall, President Kennedy directed the Treasury to stop selling its disposable silver stocks and to retire $5 and $10 silver certificates to meet coinage requirements. At the same time he recommended legislation to accomplish the following three objectives: (1) deletion of the silver transactions tax from the Internal Revenue Code; (2) repeal of the Silver Purchase Acts; and (3) replacement of silver certificates by $1 and $2 Federal Reserve notes. In our silver resolution presented for your approval, we recommend approval of the first listed objective and opposition to the second and third. As mentioned earlier, repeal of the Silver Purchase Acts would add further confusion and uncertainty to a presently unstable market condition. The replacement of silver certificates by Federal Reserve notes creates a greater total of currency which must be backed by gold, thereby placing our gold reserves in further jeopardy.

Import controls: The WGMAC recommends your approval of import controls by means of adequate duties or quotas and under certain price conditions for the protection of the western mining industry against low-cost foreign minerals.

Resolutions for many other specific minerals were also approved and adopted. Those of greatest interest to Oregon miners are as follows:

Lead and zinc: Adequate import controls be established (either tariff or quotas or a combination of the two) to be effective only if and when unneeded imports depress the United States market prices below a reasonable legislated peril point level required for the maintenance of a healthy domestic industry.

Mercury, fluorspar and cobalt: 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.

Antimony, chrome, manganese, columbium and tantalum: 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.

In his presentation to the Western Governors, James Williams, Chairman of the WGMAC, noted that the Council was in its 10th year of service to the governors and stated that its past predictions on the probable happenings to the western strategic metal mining industry, if certain actions or precautions were not taken, had turned out to be quite accurate. He reported that the critical and strategic mining industry of the western states is declining and will continue to decline under prevailing conditions and circumstances.

"This decline," Williams said, "includes the number of operations, number of jobs, and the ability to supply the present or future mineral requirements of our country in case of emergencies." He continued, "To illustrate the decline in some of the strategics, not a mine in the West now produces, except as a minor by-product, any of the following metals: chromium, cobalt, antimony, or columbium-tantalum. A few years ago, western mines produced from 10 to 95 percent of the United States' requirements of these metals. Five out of 20 mercury mines are now operating. Tungsten is down to two mines from over 300. Lead-zinc mining is uncertain."

Members of the WGMAC for Oregon are: Fayette I. Bristol, Rogue River; Harold Banta, Baker; Hollis M. Dole, Portland; William W. Gardner, Canyon City; Clinton P. Haight, Jr., Baker; Pierre R. Hines, Portland; Bruce J. Manley, Medford; and Frank C. McColloch, Portland.

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PIEREN APPOINTED BY GOVERNOR

John W. Pieren, Grants Pass, was appointed to the Rogue River Coordination Board by Governor Hatfield on June 27, 1962, to fill the position made vacant by the death of J. E. Bartlett.

Mr. Pieren has lived in Grants Pass since 1949. He owns the Almeda, Golden Wedge, and Greenback mines, and the Columbia (in part), Cal-Ore group, Dean, Leopold group, and Sordy placer mines. His placer mining has been chiefly on the Leopold group on the North Fork of Galice Creek. He has done some exploration and development work in recent years on the Greenback lode mine, a former major producer in southwestern Oregon, and has installed a small mill on the property. He was a charter member and first president of the Josephine County Sourdoughs, a recently formed mining organization in Grants Pass, and was re-elected to a second year as president in January.

J. E. Bartlett, who died May 11, was a long-time mining member of the Rogue River Coordination Board. He was appointed to the board by Governor Snell in June 1943 and was still serving in this capacity at the time of his death. He owned and operated the Big Four Placer in the Grants Pass Mining District until government closure in 1942. He was active in chrome mining during World War II as part owner of the Doe Flat mine in northern California.

Mr. Bartlett, known to all his friends as "Slim," will be remembered for his fairness and his steadfast defense of the rights of placer miners in disputed matters involving muddying of waters of the Rogue River. He was recognized as a devoted conservationist and headed the campaign against "litter bugs." As an ardent fisherman and sportsman, he was a past president of the Isaac Walton League.

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GROUND WATER REPORTS LISTED

"List of Reports Pertaining to Ground Water in Oregon," compiled by B.L. Foxworthy, has been issued by the U.S. Geological Survey. The 13-page booklet brings up to date a similar publication prepared in 1956 by R. C. Newcomb. Recorded are all published documents, open-file reports, and reports in preparation by the U.S. Geological Survey, as well as publications by other agencies and articles in journals. Copies of the list may be obtained free of charge from U.S. Geological Survey Ground Water Branch, Oregon District Office, Room 415 Old Post Office Bldg., Portland.

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The ORE BIN
Volume 24, No. 8
August, 1962

GEOLOGY OF THE CAPE BLANCO AREA, SOUTHWEST OREGON

By R. H. Dott, Jr.*

Introduction

Cape Blanco, the most westerly headland in Oregon, encompasses some critical geological relationships important to the understanding of the western Klamath-Siskiyou region. The cape was named by 16th century Spanish sailors, as were many other Oregon headlands such as Cape Sebastian and Cape Ferrelo. Figure 1 shows the location of the Cape Blanco area, which includes also Blacklock Point, lying 3 miles to the northeast within the undeveloped Newburgh State Park.

Cape Blanco and Blacklock Point lie along the northwest landward end of a great sheared zone which is at least one mile wide. Though Cenozoic deposits mask most of the region to the east and south, the zone is considered co-extensive with the previously named Port Orford shear zone exposed 8 miles southeast of the cape (Koch and others, 1961). This is one of a series of such zones which lace the southwest Oregon coast just as they do in the northern California Coast Ranges (figure 1).

The bedrock types and ages exposed in the area are extremely varied, ranging from the Dothan? Formation of uncertain but presumably Jurassic age to extensive Cenozoic deposits. Particularly noteworthy is the recognition of Late Cretaceous strata north of Blacklock Point (Koch and others, 1961). These, together with the Dothan? Formation and rocks in Cape Blanco, were all mapped as the "Myrtle formation" by Diller (1903). Only those in Cape Blanco are here regarded as representing true equivalents of the Myrtle Group as defined by Imlay and others (1959). Of special interest in these latter strata is a spectacular unsorted pebbly mudstone zone exposed in the southwest face of Cape Blanco (plate 1). The writer discovered this curious deposit in 1955 and has since described it elsewhere (Dott, 1961; 1962). Because the Cenozoic deposits have been discussed previously (Diller, 1902; 1903; Bandy, 1944; Baldwin, 1945;

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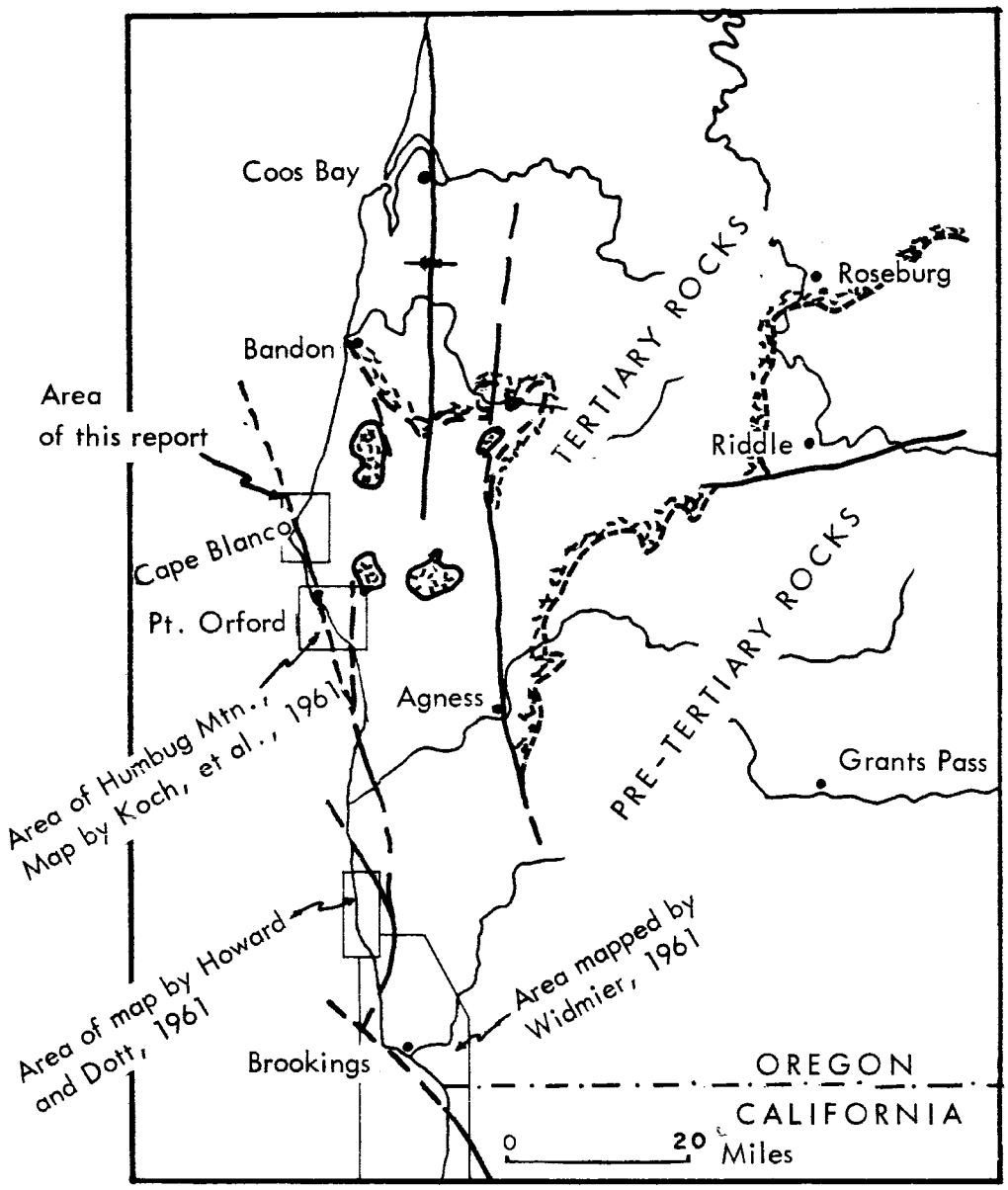


Figure 1. Index map showing major structural features and limits of Tertiary strata along the southwest Oregon coast. Areas of University of Wisconsin studies referred to in text are outlined.

Durham, 1953), only the Mesozoic rocks will be discussed in detail here.

Stratigraphy

Dothan? Formation

In 1959 the writer examined graywackes, bedded chert, greenstones, and glaucophane schist just south of Blacklock Point (plate 2), which had been mapped by Diller (1903) as the "Myrtle formation." Not until 1961, however, after further work to the south by the writer and co-workers, was it realized that this assemblage of rock types completely lacking fossils points to an older age. Nowhere do known "Myrtle rocks" (containing Buchia and other late Mesozoic fossils) include bedded chert, coarsely porphyritic, thick pillow lavas, and glaucophane schist like those at Blacklock Point. Only the Dothan Formation of the interior Siskiyou region is known to have all of these attributes. Moreover, petrology of the graywackes and associated conglomerates indicates closest affinity with lithologic equivalents of the Dothan Formation studied in detail by J.M. Widmier (1962) in the Brookings region (see figure 1). Figure 2 shows the most significant differences of sandstone composition in the chief formations of the northwest Klamath Province. Not shown here, however, are the varying percentages of potassium-bearing or K-feldspars in different formations. It has been found that Buchia-bearing ("Myrtle") strata contain a modest percentage of K-feldspar, whereas all older ones have essentially none (including the Dothan? Formation), but younger Late Cretaceous and Eocene ones contain large percentages. The graywackes south of Blacklock Point are barren of K-feldspar, thus strengthening the suggested correlation with the Dothan Formation. The nearest known similar assemblage of Dothan-like rocks is on Sixes River, approximately 15 miles east of Cape Blanco.

Of special interest is the discovery, just south of the mouth of Sixes River, of conglomerate with coarse, quartz-rich granitic cobbles essentially identical with those found in apparently equivalent conglomerates at Crescent City, California, by Widmier and Dott. Being in the Dothan? Formation, they indicate existence of important "pre-Nevadan" granitic plutons that have not hitherto been recognized in this region (Dott and others, 1962). These distinctive granites are coarser and more siliceous than the typical "Nevadan" and younger diorites. Small dioritic dikes and sills of the latter type, more or less brecciated, are also present south of Blacklock Point ($SE\frac{1}{4}$ sec. 24, T. 31 S., R. 16 W.), where they intrude graywacke, chert, and coarsely porphyritic pillow lavas. They are too

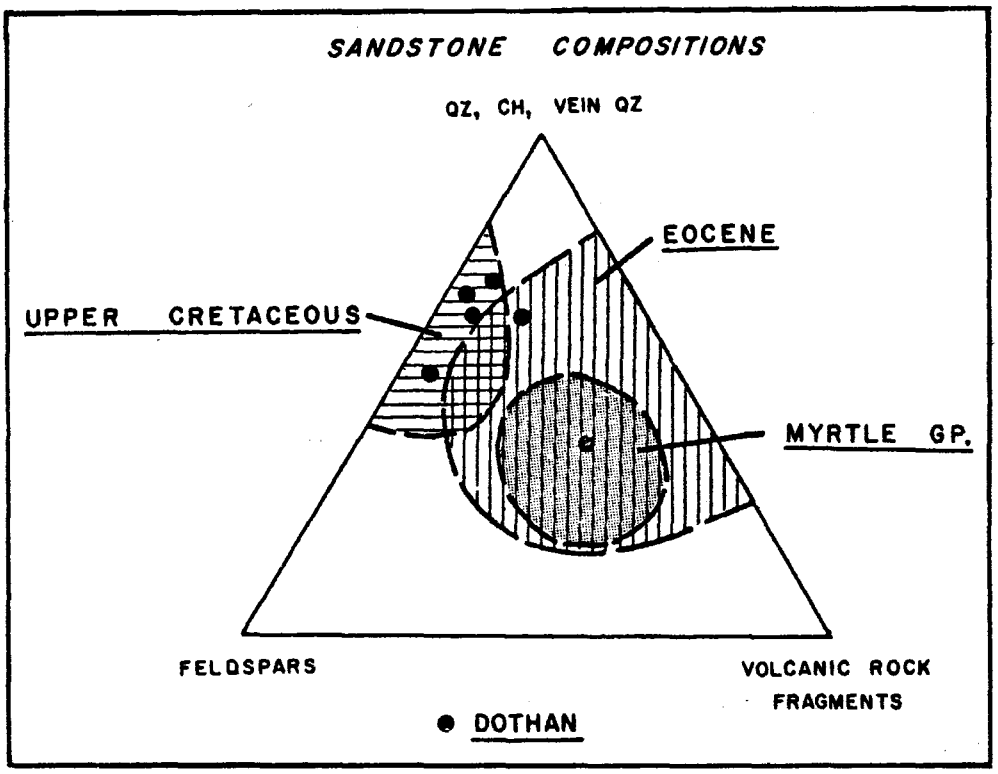


Figure 2. Comparison of modal analyses of Jurassic, Cretaceous, and Eocene sandstones of the northwest Klamath-Siskiyou Province. Relative abundance of volcanic rock fragments is the most diagnostic property shown here.

small to show on the map. The pillow lavas, which also crop out along the north bluff of Sixes River near its mouth, appear identical with distinctive ones in the Crook Point-Pistol River area farther south being studied by the writer and J. M. Widmier (figure 1).

Metamorphism has produced local schistose graywacke a short distance north of the mouth of Sixes River and bluish glaucophane schist southeast of Blacklock Point as well as just south of the mouth of Sixes River (plate 2). Similar very local glaucophane schist or amphibolite occurs in the Port Orford shear zone on the beach west of Battle Rock at Port Orford. Glaucophane schists are notably very localized and occur particularly in fractured and crushed zones (Williams and others, 1954, p. 225). In California they are known to have formed variously from diabase, basalt, sandstone, and chert. Those in the Cape Blanco area appear to have formed from either volcanic or sedimentary rocks of the Dothan? Formation.

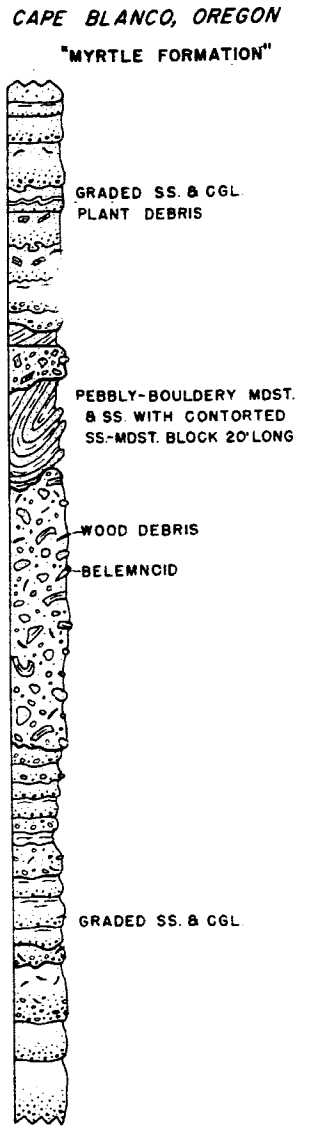
Latest Jurassic and Early Cretaceous strata

Diller (1903) applied the name "Myrtle formation" to all pre-Tertiary strata of the Cape Blanco-Port Orford region and correlated them with his original "Myrtle" of the inland Roseburg-Riddle area. Fossils similar to those of the type "Myrtle" have been found in the coastal area around Port Orford, Humbug Mountain, and Gold Beach (Imlay and others, 1959; Koch and others, 1961). However, the coastal strata are sufficiently distinctive lithologically that local formational names will probably prove preferable to "Myrtle."

At Cape Blanco the dark older rocks unconformable beneath Cenozoic deposits are considered a part of this same sequence, though no diagnostic index fossils have been found. This correlation is suggested chiefly by their petrology, lack of metamorphism (a perhaps tenuous criterion by itself), presence of belemnoids, abundant plant debris, and pebbles of diorite and porphyritic volcanic rocks like those described in the Dothan? Formation near Blacklock Point. Sandstones equivalent paleontologically to the Myrtle Group typically have more abundant volcanic rock fragments and a darker matrix than do the Dothan? or Late Cretaceous sandstones (figure 2).

The Cape Blanco strata are characterized by dark gray, clearly graded fine-granule conglomerate and sandstone interstratified with black mudstone. Graded sedimentation units range from a few inches to 7 feet in thickness with the average approximately one foot. Sole markings include load-flow, flute, and groove structures. Current stratification and convolute lamination are conspicuously rare. Reversal of sole marks and graded bedding clearly indicates that the entire sequence is overturned (plates 1 and 2).

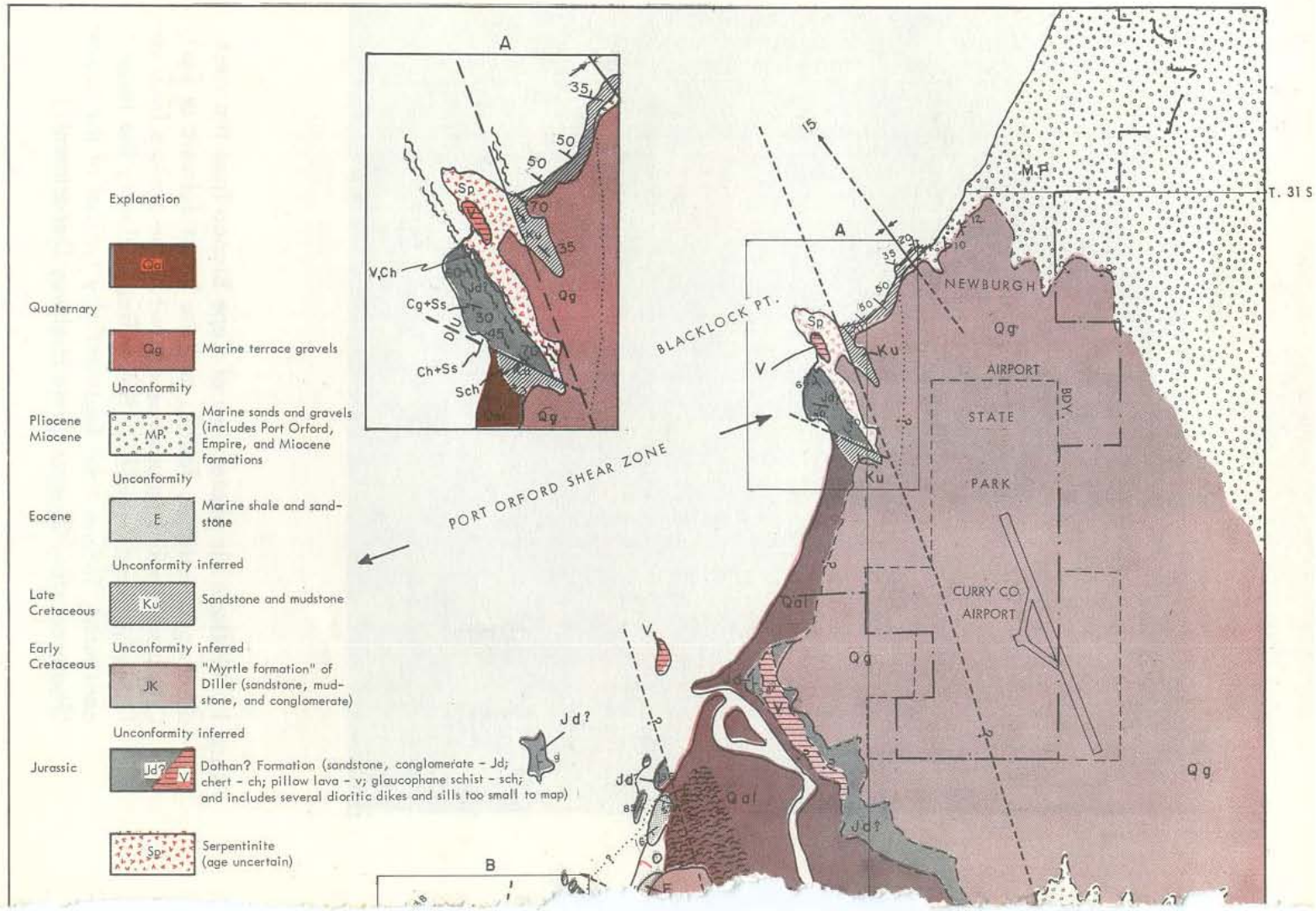
On the lower southwest face of the cape, a large, spectacular, lenticular unsorted pebbly mudstone mass is clearly exposed (plates 1 and 2). This deposit contains subrounded sandstone boulders as much as three feet in diameter, rounded pebbles and cobbles averaging one to two inches, and angular slabs and rolled masses of penecontemporaneous laminated mudstone and fine sandstone as much as 20 feet long. Angular chunks of wood (now charcoal) three feet long and several belemnoid tests also are present. Rounded cobbles include porphyritic volcanic rocks, sandstone, milky quartz, chert, and diorite. Photographs of this deposit are published elsewhere (Dott, 1961; 1962), but its general character is diagrammed in figure 3. The most impressive feature is a block of thinly stratified sandstone and mudstone about 20 feet long, which was folded upon itself plastically and now stands up-ended within the deposit.



Pebbly mudstone deposits like that at Cape Blanco were formed by subaqueous mass-gravity movements caused by failure of newly deposited sediments. The material flowed plastically, apparently just surpassing its liquid limit, to become a very viscous, churning, fluid mass -- a submarine mudflow. Then it suddenly regained cohesion, and was buried again by additional graded, stratified deposits. Occurrence of mass-gravity deposits such as this within graded sequences provides insight into one important mechanism for generation of turbidity currents. Normally, dilution and increased turbulence would convert the flowing, plastic mass to a turbulent suspension from which sediment could settle in graded fashion. Rarely, however, as at Cape Blanco, a very viscous plastic mass flow was arrested by sudden regain of cohesion, producing a heterogenous, unsorted and non-graded body. Thus these unusual subaqueous deposits were potential parents for turbidity currents; presumably many other such masses were completely converted to true turbid, fluid suspensions which ultimately deposited graded units. Typically pebbly mudstone deposits are lenticular; the Cape Blanco example is 60 feet thick at its center and thins to but a few feet in both directions along strike within a total outcrop distance of one-eighth mile (plate 1). This example is somewhat thicker than most others known to the writer. Because of its size, unusually clear exposure, and mixed marine and non-marine organisms, this deposit provides

Figure 3. Diagrammatic columnar section of the "Myrtle formation" exposed in the southwest face of Cape Blanco illustrating relationships of graded sedimentation units to the unsorted pebbly mudstone mass. Note that the entire section shown is overturned in the cape, but it has been restored to its normal situation for illustrative purposes. (Column also illustrated in Dott, 1961, fig. 4.)

Plate 1. Oblique air photo view of Cape Blanco from the west showing formations, faults, and the latest Jurassic or Early Cretaceous pebbly mudstone deposit. The various fault relationships and unconformities indicate clearly the long-continued, intermittent fault activity typical of the region. (Photo courtesy Oregon State Highway Department.)


Explanation
Qal
Quaternary
Qg
Marine terrace gravels
Unconformity
Pliocene Miocene
MP
Marine sands and gravels (includes Port Orford, Empire, and Miocene formations
Unconformity
Eocene
E
Marine shale and sandstone
Unconformity inferred
Late Cretaceous
Ku
Sandstone and mudstone
Early Cretaceous
Unconformity inferred
JK
"Myrtle formation" of Diller (sandstone, mudstone, and conglomerate)
Unconformity inferred
Jurassic
Jd? V
Dothan? Formation (sandstone, conglomerate - Jd; chert - ch; pillow lava - v; glaucophane schist - sch; and includes several dioritic dikes and sills too small to map)
Sp
Serpentinite (age uncertain)
PORT ORFORD SHEAR ZONE
BLACKLOCK PT.
NEWBURGH
AIRPORT
STATE
PARK
CURRY CO. AIRPORT
T. 31 S
A
B
V,Ch
Cg+Ss
Ch+Ss
Sch
Dlu

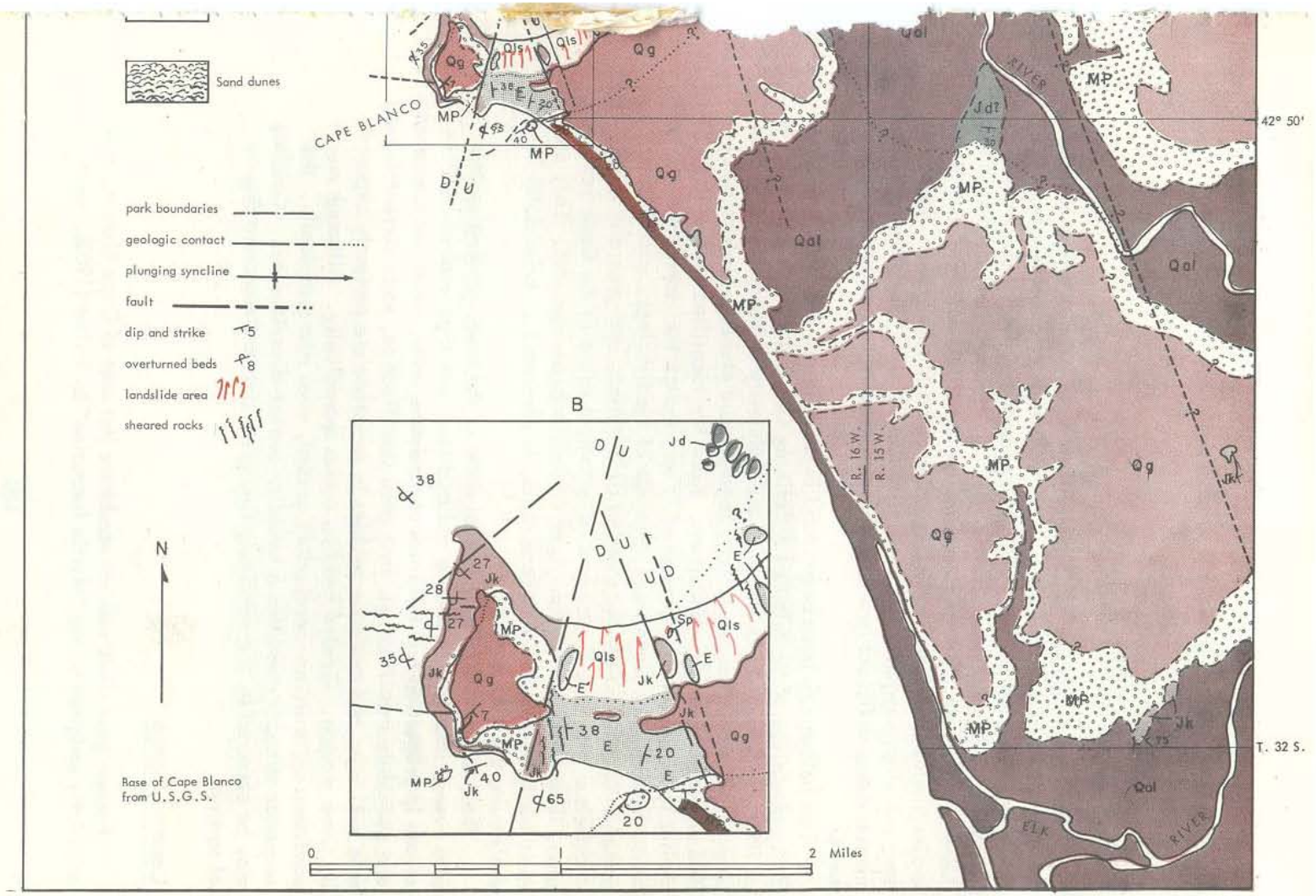


Plate 2. GEOLOGY OF THE CAPE BLANCO AREA

valuable insight into the general mechanisms of subaqueous gravity deposition.

Upper Cretaceous strata

More than 1,500 feet of interstratified light gray sandstone and dark olive-gray mudstone and shale occupy a broad, northwest-plunging syncline northeast of Blacklock Point, here named the Blacklock syncline (plate 2). These rocks were mapped as "Myrtle formation" by Diller (1903). However, they are lighter colored and are much less deformed than the known Myrtle Group equivalents and the Dothan? Formation. Moreover, their petrology suggests no affinity with the "Myrtle," for these sandstones are relatively deficient in volcanic rock fragments and possess a lighter matrix.

Two belemnoids have been found in these strata, the first in 1954 by D. L. Morgridge of Humble Oil & Refining Co. and another by the writer in 1959. In 1960, J. G. Koch of the University of Wisconsin collected several calcareous nodules which, through acid etching, yielded silicified and agglutinated Foraminifera. Koch has identified several forms similar to Upper Cretaceous ones of Texas, though the assemblage cannot be considered very diagnostic. Because of the lithology, microfauna, presence of belemnoids, only modest deformation, and generally close comparison with Late Cretaceous (Campanian) strata in the Cape Sebastian area, these rocks are considered of Late Cretaceous age also. They are most easily confused with Eocene rocks, but presence of belemnoids in shale rules out that age.

These deposits display dominant shale at the base, grading upward into evenly stratified sandstone and mudstone with a general upward increase in proportion and thickness of sandstone units. Intricate contorted and convolute stratification, fine cross stratification, some current-formed sole markings, and mudstone pebbles in sandstone are perfectly exposed by wave erosion. Graded bedding occurs sporadically. Although most sandstone units are not perceptibly graded, even microscopically, the sequence strongly resembles a turbidity current-deposited one. Grading may be obscured by the relatively fine grain size and moderate degree of sorting.

Cenozoic strata

Eocene gray shale and tan sandstone just east of Cape Blanco, also originally assigned to the "Myrtle formation" by Diller (1903), were

dated as Eocene by Bandy (1944). These and older rocks are unconformably overlain by the Empire Formation of Diller (1903), presumably Pliocene (plates 1 and 2). Recently, however, Durham (1953) reported Miocene mollusks from the lower "Empire" southeast of Cape Blanco, and Warren Addicott of the U.S. Geological Survey (written communication, 1962) tentatively identified probable Miocene Securella cf. S. ensifera (Dall), Securella sp., and Calyptraea sp. collected by Koch from similar, poorly consolidated sandstones along the coast 1½ miles southeast of Port Orford. Pliocene deposits are also present in the Cape Blanco area and they unconformably underlie the high marine terrace deposits (plate 2). Excellent exposures of Miocene and/or Pliocene cross-stratified sandstone and conglomerate lenses occur in a long sea cliff extending from half a mile north of Blacklock Point northward to Floras Lake (plate 2).

Pleistocene marine terrace sands and gravels as much as 150 feet thick mantle much of the region, which constitutes a broad, nearly flat surface (plates 1 and 2). The terrace has a general elevation of 200 feet above sea level, but it is somewhat warped (Baldwin, 1945; Dicken, 1961). Problems of the stratigraphy, dating, and correlation of these deposits and terrace surfaces are discussed by Baldwin (1945) and Addicott (in preparation).

Serpentinite

Serpentinite is present at Blacklock Point, where it has been intensely brecciated and sheared. A small mass of poorly exposed, sheared serpentinite also occurs half a mile northeast of Cape Blanco. At Blacklock Point, the ultramafic rock appears to have intruded the Dothan? sedimentary and volcanic rocks. Subsequently it was intensely brecciated along the northeast boundary of the Port Orford shear zone where it was faulted against Upper Cretaceous strata. Thus the age of its initial emplacement is quite dubious. It is probable that it was emplaced along the shear zone by profound faulting that penetrated deep into the earth's crust and that it has been remobilized, perhaps several times, by subsequent faulting. Similar sheared serpentinite has penetrated Lower Cretaceous sedimentary rocks in the same shear zone at Port Orford (Koch and others, 1961). Very probably the initial emplacement of such rocks occurred at different times in different sheared areas.

Structural Summary

The Port Orford shear zone appears to be one of the greatest structural features in southwest Oregon. It is believed to extend from Blacklock

Point southward through Port Orford, past the Humbug Mountain area and, according to the work of J. G. Koch, probably connects inland near Nesika Beach with a shear zone that extends at least to Rogue River a few miles above Gold Beach. It very likely continues still farther south (fig. 1).

In the Cape Blanco area, the Port Orford shear displays admirably all of the chief characteristics of these zones. Intense shearing, brecciation, overturning of strata, and great heterogeneity of contiguous rock types and ages are very typical. Presence of old rocks in a region of generally younger ones is common. Thus Dothan? rocks with local dioritic intrusives, volcanic rocks and chert, local glaucophane schist, and serpentinite are outstanding trademarks of this zone. Metamorphism as is displayed in foliated graywackes and glaucophane schist may be due to dynamic effects of the faulting. Extensive brecciation of the serpentinite and faulting of it against Upper Cretaceous shale is noteworthy as well. Less common, but of special interest, are the moderately large, gentle folds that are subparallel to the fault zones in young strata. Sub-parallel folds like that northeast of Blacklock Point and east of Cape Blanco are also prominent in the Upper Cretaceous of the Cape Sebastian region (Howard, 1961; Howard and Dott, 1961) and in California, particularly at Moss Beach in Tertiary rocks next to one of the major zones of the San Francisco Peninsula fault complex a few miles southwest of San Francisco. These folds were all produced as by-products of movement along slightly curving faults that presumably had important components of lateral movement (Howard and Dott, 1961). Around Cape Blanco, the great breadth, intensity of fracturing, steepness of dip of the major faults, and their apparent great depth constitute the only evidence for lateral displacement.

The coastal shear zones have had long histories of activity. The Port Orford shear cuts Dothan? rocks, and movement along it apparently caused overturning of the "Myrtle" graywackes on Cape Blanco. Movement related to the Port Orford zone clearly began before Early Cretaceous time near Humbug Mountain (Kaiser, 1962) and it probably dates from pre-latest Jurassic (Portlandian) time. Late Cretaceous marine deposits overlapped the shear zone as did Eocene ones. Both of these were subsequently caught up in intense faulting and final emplacement of serpentinites. Latest movements are recorded by subsidiary faulting in Cape Blanco that dropped the "Empire Formation" against Eocene and latest Jurassic or Early Cretaceous ("Myrtle") graywackes (plate 1). This and other faults were in turn overlapped by Pleistocene marine terrace deposits. Lastly, the whole region has been raised and warped gently. However, there is no reason to suppose that the Port Orford shear zone will not again become restless.

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NEW MINE SAFETY CODE ADOPTED

The State Industrial Accident Commission has adopted a new safety code covering mining, tunneling, and quarrying, following public hearings held May 16 and August 2. The effective date of the new code will depend upon the date it becomes available in printed form. This will probably not be before mid-December.

Safety regulations included in the code cover inspections, communications, fire protection and mine rescue, mapping of underground workings, hoisting equipment, access and egress, timbering, ventilation, operations underground, and pits and quarries.

Those who would like to receive a copy of the code should send their requests to the Accident Prevention Division, State Industrial Accident Commission, Salem, Oregon. Codes will be mailed as soon as they become available.

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WITHDRAWAL NOTICES AFFECT PUBLIC LAND STATUS

Notice has been received from the Bureau of Land Management that some of the proposed withdrawals in Malheur County (see The ORE BIN for October, 1961) have been terminated. Lands in Malheur County still subject to the original withdrawal application are the Nigger Rock area in Ts. 21 and 22 S., R. 43 E., and the Disaster Peak area in T. 40 S., R. 40 E.

Recent withdrawal applications involve two areas in national forests. They are 65 acres for campground in T. 32 S., R. 11 W., in the Siskiyou National Forest; and 279.96 acres for development of the Bull Prairie Recreation area in T. 7 S., R. 26 E. in the Umatilla National Forest.

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WILDERNESS BILL AMENDED BY HOUSE SUBCOMMITTEE

The House Interior Subcommittee on Public Lands reported to the full committee August 9 a substantially amended version of the Wilderness Bill (S. 174). The Subcommittee bill was reported as H.R. 776. The full Interior Committee has set August 28 as the date to consider the new version. Areas in Oregon affected by the amended bill total 662,847 acres and include the wilderness and wild regions in the national forests.

Although the mining industry considers H.R. 776 a great improvement over S. 174, it believes the provision limiting location of new mining

claims until January 1, 1973 not in the national interest. Such a limitation, it was brought out in the hearings, would stop exploration in the wilderness areas, which coincide to a major extent with the areas in which geologic conditions are inherently favorable for the discovery of important new ore bodies. This would mean that a development of future supplies of minerals needed to replace those that will be exhausted 25 to 50 or more years from now would be drastically hampered. Miners are again urged to convey their feelings immediately to their Congressmen on this important piece of legislation.

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NEW DRILLING PERMIT ISSUED

The third permit of the year (Permit No. 48) was issued by the department to the Humble Oil & Refining Co. for a test hole to be drilled 6 miles north of Albany in the central Willamette Valley. Humble abandoned "Francis Wicks No. 1" in the Silverton hills area on August 1, 1962, and moved the Natl. 130 Montgomery Drilling Co. rig to the Howard Miller farm north of Albany. Drilling began on August 5, 1962. Location of the new well was given as 1,862 feet north and 4,156 feet east of the J. L. Miller donation land claim No. 61 in the $SE\frac{1}{4}SE\frac{1}{4}$ sec. 10, T. 10 S., R. 3 W., Linn County. Elevation of ground above sea level is 215 feet.

* * * * *

WELL RECORDS RELEASED IN OPEN FILE

Records on the Linn County Oil Development Co. "Barr No. 1" drilled in sec. 32, T. 11 S., R. 1 W. were released by the Department in August. Information available includes history, cutting descriptions, electric log, gamma ray-neutron, gas analysis, and cuttings samples.

Although drilling on this hole was suspended in January 1959, abandonment plugging was not accomplished until August 1960. The Governing Board of the Department of Geology and Mineral Industries granted several extensions on the permit upon proof that arrangements were being made to continue drilling. The board refused further extension of the permit in August 1960 and ordered the hole to be plugged.

* * * * *

AMERICAN MINING CONGRESS RELEASES PROGRAM

The 1962 American Mining Congress mining show will be held in the San Francisco Civic Auditorium and Brooks Hall September 24-27. The convention program includes discussions on national policies that affect the mining industry; technological advances in underground and open-pit mining, minerals beneficiation, exploration, health and safety; and management tools and techniques. At the Exposition, some 215 manufacturers of mining equipment will use five acres to exhibit all types of modern mining machinery.

Some of the scheduled events listed on the AMC advance program are as follows:

Monday morning, Sept. 24. Trade Expansion Act of 1962 and the European Common Market - their Impact on the Mining Industry. A panel discussion with Dr. James Boyd, Pres., Copper Range Co., as moderator. Panel members will include the Hon. Stewart L. Udall, Secretary of the Interior.

Tuesday afternoon, Sept. 25. Exploration and Geology Session, with Francis Cameron, Pres., St. Joseph Lead Co., as chairman. The session will include a paper on "Major new mineral discoveries in the past 10 years," by Charles F. Park, Jr., Stanford University.

Wednesday afternoon, Sept. 26. Taxation Panel, with Herbert C. Jackson, Exec. Vice Pres., Picklands Mather & Co., Cleveland, as chairman. Stockpiling discussion, with C. Jay Parkinson, Exec. Vice Pres., Anaconda Co., as chairman.

Thursday morning and afternoon, Sept. 27. State of the Mining Industries. Chairman of the session will be the Hon. Alan Bible, U.S. Senator from Nevada. On the same day there will be a Tax Forum with Lincoln Arnold, Attorney, Alvord & Alvord, Washington, D.C., presiding.

Friday, Sept. 28. Field trips to see: U.S. Army Engineers' hydraulic model of San Francisco Bay; IBM plant at San Jose and the Ideal Cement Co. and Leslie Salt Co. plants at Redwood City; and the Lawrence Radiation Laboratory at Berkeley.

On Sunday, Sept. 23, the California Division of Mines and Geology will hold open house at its new and enlarged quarters in the Ferry Building.

Members of the Western Governors of the AMC for Oregon 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.

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The ORE BIN
Volume 24, No. 9
September, 1962

OREGON MINERAL PRODUCTION RESISTS DOWNWARD TREND

By Ralph S. Mason*

The total value of minerals produced in Oregon in 1961 was only slightly less than that reported for 1960, which broke all previous records. The U.S. Bureau of Mines reports that Oregon minerals last year were valued at $51,467,000. This figure is exclusive of recycled lime used in pulp and paper plants valued at $3,455,000, which was included in the Bureau's canvass for the first time this year, bringing the total to $54,922,000 as shown in Figure 1. Although the mineral industry supplies vitally needed materials to all basic industries and construction activities and is in turn affected by their trends, it was able to resist the downward curve better than the heavy industries commonly used as business indices. Building permits declined 6 percent, highway contracts were off 14 percent, and heavy engineering awards dropped 51 percent. The mineral industry decreased only slightly over 5 percent by comparison.

Newest development in Oregon's mineral industry during the year was the commencement of off-shore oil exploration by four major petroleum companies. This is a long-range program which employs highly specialized equipment similar to that which has been successful in locating oil off the California and Gulf States coasts. Thirteen major oil companies and one independent operator made geophysical and geological surveys in the state during the year. One well southeast of Lakeview was abandoned early in the year at a depth of 9,759 feet. By year's end over 100,000 acres of land were under lease for oil exploration in the Willamette Valley and surrounding areas.

The production of sand and gravel and crushed stone, long the two top-value mineral commodities, amounted to nearly $35,000,000 in 1961. This figure is down slightly from 1960, owing to reduced demand for sand and gravel but partly offset by a small increase in the quarrying of stone. Smelting of ferronickel at the Riddle plant operated by Hanna continued on a round-the-clock basis, with production approximately equal to the previous year.

*Mining Engineer, Oregon State Dept. of Geology & Mineral Industries

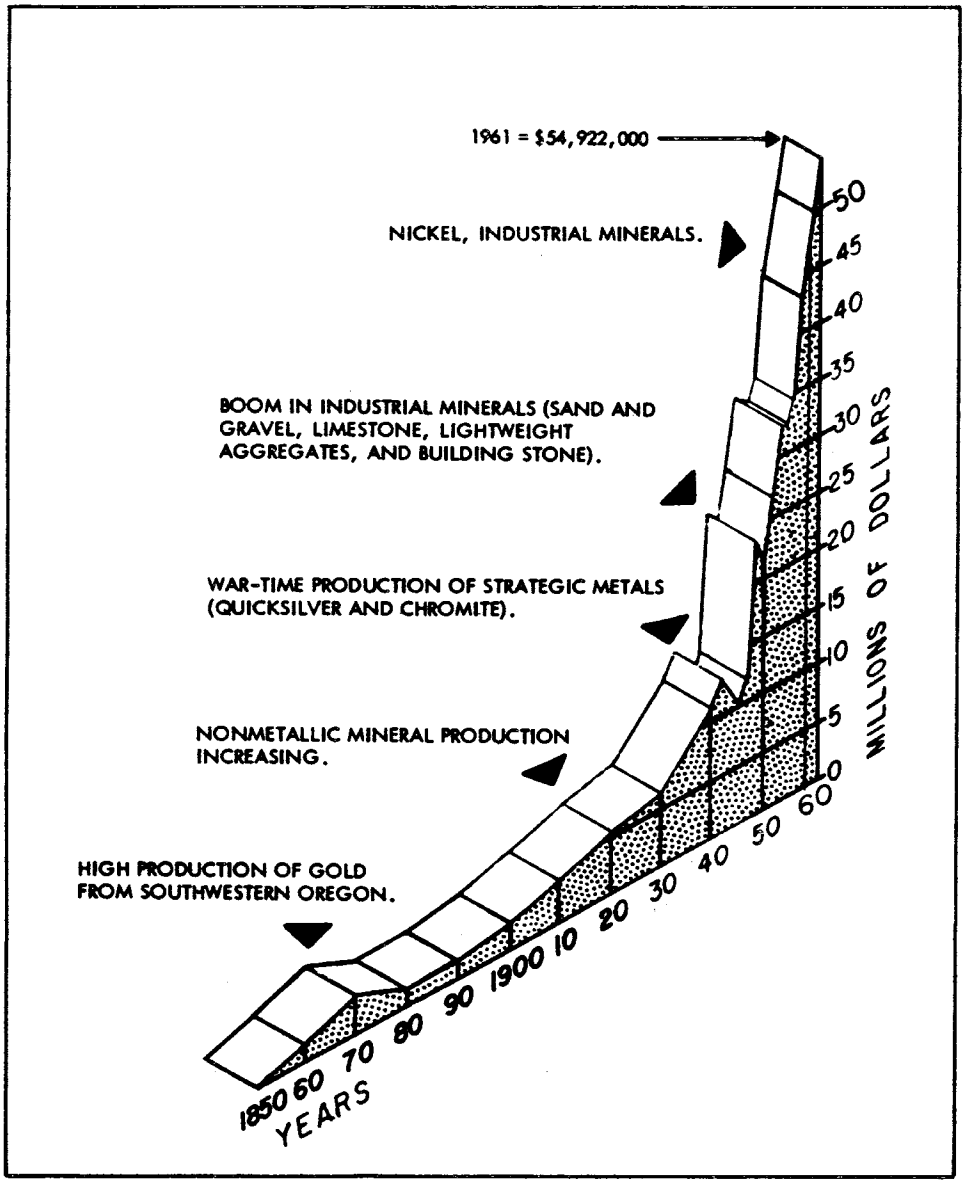


Figure 1. Oregon mineral production, 1850-1961. Values shown are from the U.S. Bureau of Mines Minerals Yearbooks. Periods when important factors influenced the rapidly expanding mineral economy are indicated by arrows. Note steep rise in the production of industrial minerals following World War II in response to demand for construction raw materials.

Sharp increases in the use of volcanic cinders and scoria for highway construction were reported. The attractive "red roads" of central Oregon are constructed of this material, which has excellent frost resistance and greater volume per ton than standard crushed stone or sand and gravel. Although still at a very low level, the production of gold managed to increase 37 percent over 1960, with a total of $37,000 reported. Mercury mining practically came to a standstill with only 138 flasks retorted. Quarrying of limestone decreased 19 percent, due chiefly to lessened demand for cement in large dams. Limestone was also used in the manufacture of burnt lime and calcium carbide, in agriculture, and in the sugar, paper, and metallurgical industries.

Table 1 summarizes the state's mineral production for 1961 together with a comparison for the preceding year. Mineral industry employment and payrolls for the past two years are tabulated in Table 2. Oregon's mineral industry is active in every county in the state, and extends directly or indirectly into every community as well. In sharp contrast to many of the state's income-producing activities, which are highly seasonal and characterized by severe though temporary labor shortages followed by periods of wide-scale unemployment, the mining industry tends to maintain a more measured and even course throughout the year. Mineral production by counties is shown in Figure 2. Principal mineral commodities contributing to each county total are shown in the order of their value. Exactly half of the counties show increases in the value of minerals produced over the previous year.

Mineral production casualties in the state during the year included the shutting down, after 40 years of production under various ownerships, of the Lower Bridge diatomite deposit in northern Deschutes County. The Gas-Ice Corp. plant near Ashland also ceased production, after having recovered approximately 50 million pounds of dry ice from a series of drilled wells which yielded carbon dioxide. The plant was established in 1945. On the positive side, the production of uranium increased to 15,162 pounds of contained uranium oxide. Two mines, both in Lake County, contributed all of the ore; the Lucky Lass produced 2,000 pounds and the White King approximately 13,000. The open pit at the White King was unwatered by the Thornburg Mining Co. and ore recovered from the pit walls. All of the uranium ore from the two mines was shipped to Vitro Corp. at Salt Lake City, Utah, for treatment. The old Lakeview Mining Co. mill was purchased by Kermac Nuclear Fuels Corp. in March, but was not placed in operation during the year.

Zinc production in Oregon reached a 10-year high with the shipment of 38 tons of ore containing 3 tons of recoverable zinc from the Musick

TABLE 1. Mineral Production in Oregon, 1960 - 1961 1/

Mineral	1960 Short tons (unless otherwise stated)	1960 Value (thousands)	1961 Short tons (unless otherwise stated)	1961 Value (thousands)
Clays . . . . . thousand short tons	318	$ 370	294	$ 357
Copper (recoverable content of ores, etc.) . . . short tons	6	4	2/	2/
Gold (recoverable content of ores, etc.) . . . .troy ounces	835	29	1,054	37
Iron ore (pigment material) . . . . . long tons	- -	- -	829	2/
Lime . . . . . thousand short tons	2/	2/	82	1,702
Lime (recycled) . . . . . thousand short tons	- -	- -	139	3,455
Mercury . . . . . 76-pound flasks	513	108	138	27
Nickel (content of Ore and concentrate) . . . . short tons	13,115	5,246	12,860	2/
Pumice . . . . . thousand short tons	2/	2/	203	461
Sand and gravel . . . . . thousand short tons	17,673	16,170	12,299	13,680
Silver (recoverable content of ores, etc.). . . troy ounces	284	3/	2,022	2
Stone . . . . . thousand short tons	4/16,913	4/19,721	17,272	20,939
Uranium ore . . . . . short tons	2/	2/	2,160	66
Zinc (recoverable content of ores, etc.) . . . . short tons	- -	- -	3	1
Value of items that cannot be disclosed: Asbestos, carbon dioxide (1960), cement, diatomite, gem stones, lead (1961), and values indicated by footnote 2/		14,124		15,557
Total 5/		4/54,520		54,922

Note

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.

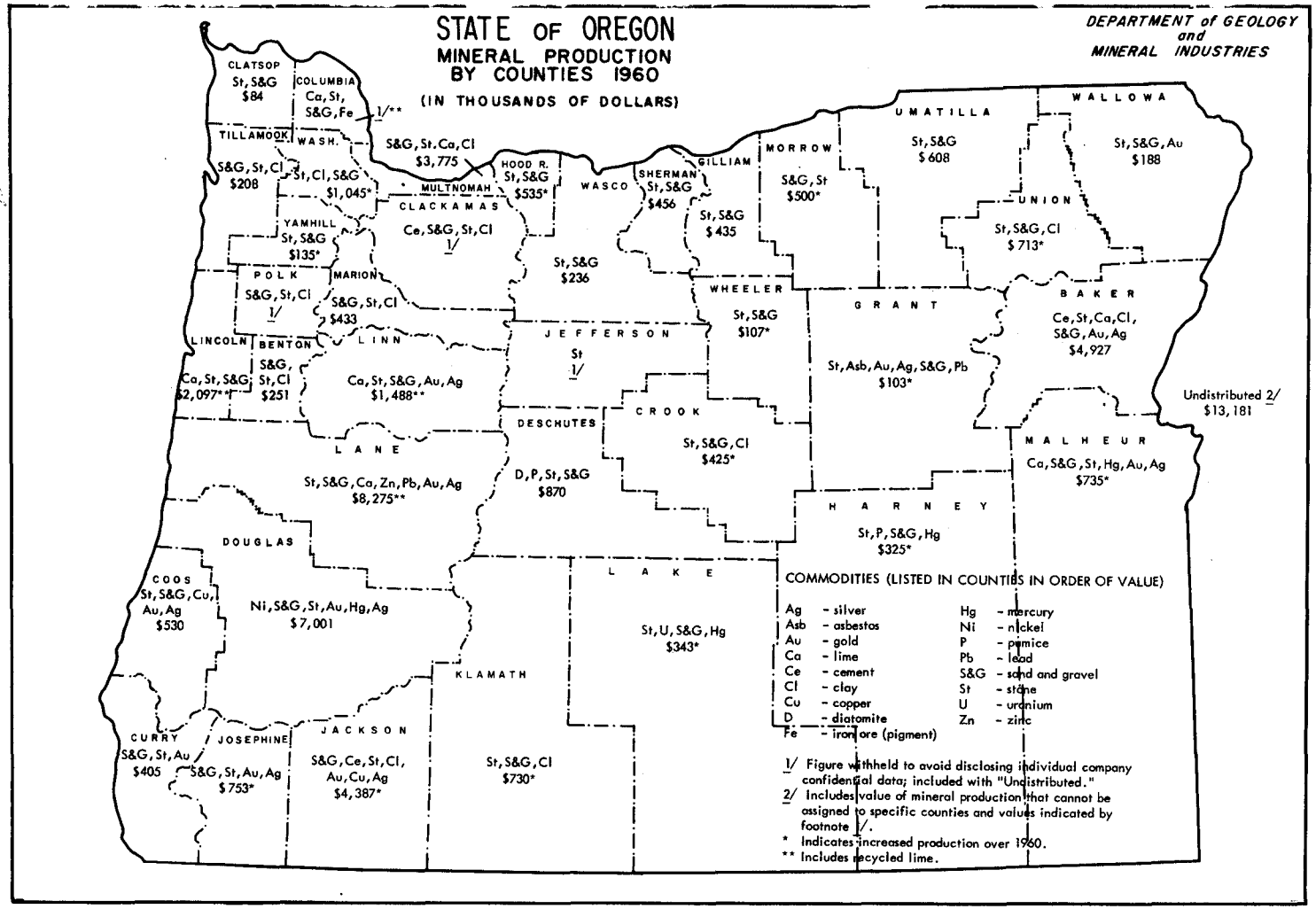
4/ Revised figure.

5/ Total adjusted to eliminate duplicating value of raw materials used in manufacturing cement and lime.

TABLE 2. Oregon Mineral Industry Employment and Payrolls*

	1960 Employment	1960 Payrolls	1961 Employment	1961 Payrolls
1. Mining	1,181	$ 6,662,000	1,112	$ 6,558,000
2. Mineral manufacturing	2,860	16,740,000	2,674	16,216,000
3. Primary metals	5,751	37,128,000	5,532	36,662,000
4. Miscellaneous	796	4,786,000	821	5,274,000
Totals	10,588	65,316,000	10,139	64,710,000

*Oregon State Employment Department figures.


STATE OF OREGON
MINERAL PRODUCTION
BY COUNTIES 1960
(IN THOUSANDS OF DOLLARS)
DEPARTMENT of GEOLOGY and MINERAL INDUSTRIES
CLATSOP
St, S&G
$84
COLUMBIA
Ca, St, S&G, Fe 1/**
TILLAMOOK
WASH.
S&G, St, Cl
$208
St, Cl, S&G
$1,045*
S&G, St. Ca, Cl
$3,775
HOOD R.
St, S&G
$535*
MULTNOMAH
CLACKAMAS
Ce, S&G, St, Cl 1/
YAMHILL
St, S&G
$135*
POLK
S&G, St, Cl 1/
MARION
S&G, St, Cl
$433
LINCOLN
BENTON
S&G, St, Cl
$251
Ca, St, S&G
$2,097**
LINN
Ca, St, S&G, Au, Ag
$1,488**
WASCO
St, S&G
$236
SHERMAN
St, S&G
$456
GILLIAM
St, S&G
$435
MORROW
S&G, St
$500*
UMATILLA
St, S&G
$608
WALLOWA
St, S&G, Au
$188
UNION
St, S&G, Cl
$713*
WHEELER
St, S&G
$107*
GRANT
St, Asb, Au, Ag, S&G, Pb
$103*
BAKER
Ce, St, Ca, Cl, S&G, Au, Ag
$4,927
JEFFERSON
St 1/
DESCHUTES
CROOK
St, S&G, Cl
$425*
Undistributed 2/
$13,181
LANE
St, S&G, Ca, Zn, Pb, Au, Ag
$8,275**
D, P, St, S&G
$870
MALHEUR
Ca, S&G, St, Hg, Au, Ag
$735*
HARNEY
St, P, S&G, Hg
$325*
DOUGLAS
COOS
St, S&G, Cu, Au, Ag
$530
Ni, S&G, St, Au, Hg, Ag
$7,001
LAKE
St, U, S&G, Hg
$343*
KLAMATH
CURRY
S&G, St, Au
$405
JOSEPHINE
S&G, St, Au, Ag
$753*
JACKSON
S&G, Ce, St, Cl, Au, Cu, Ag
$4,387*
St, S&G, Cl
$730*
COMMODITIES (LISTED IN COUNTIES IN ORDER OF VALUE)
Ag - silver
Asb - asbestos
Au - gold
Ca - lime
Ce - cement
Cl - clay
Cu - copper
D - diatomite
Fe - iron ore (pigment)
Hg - mercury
Ni - nickel
P - pumice
Pb - lead
S&G - sand and gravel
St - stone
U - uranium
Zn - zinc
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 1960.
** Includes recycled lime.

Mine in the Bohemia District of Lane County. Also showing a steady growth, despite notoriously inefficient mining methods, lack of coordinated effort, a complete decentralization of management, and with small operations scattered over most of the state, the semi-precious gem "industry" continues to grow. Outstanding among the communities in the state which are attempting to encourage the rockhounds is the City of Prineville. The Crook County Chamber of Commerce distributes maps and information about local diggings and has even located its own claims which are open to the public. At year's end other communities in the state were laying plans to provide the public engaged in this fast-growing activity with help and information.

Metallurgical plant activity during 1961 saw continued development in the processing and fabricating of reactive and other space-age metals. Oregon Metallurgical Corp., Wah Chang Corp., and Oregon Precision Industries, plus the U.S. Bureau of Mines Metallurgy Research Center, all located at Albany, were engaged in research, beneficiation, reduction, smelting, casting, forging, or fabricating a long list of once-rare metals. In the Portland area Sierra Metals Corp. began construction of research facilities to develop high-temperature materials and processes for space craft.

Interest in fossil fuels as a source of energy for the generation of base-load electrical power continued as Pacific Power & Light Co. turned its attention to the coal seams in Squaw Basin in southern Coos County. Pacific has also investigated the reserves on Eden Ridge adjacent to the basin. The Coos Bay coal field, which has a long record of production dating back to the 1850's, was inactive during the year although several investigations were conducted by private firms. The Coos County coals are high-volatile, sub-bituminous with a high ash and moisture content.

* * * * *

AEROMAGNETIC MAP OF THE LEBANON QUADRANGLE

The U. S. Geological Survey recently issued Map GP-212, "Geologic interpretation of the aeromagnetic map of the Lebanon Quadrangle, Linn and Marion Counties, Oregon," by R. W. Bromery. The map with text included may be purchased from the U. S. Geological Survey, Federal Center, Denver, Colorado, for 50 cents.

* * * * *

OREGON EARTHQUAKES, 1841 THROUGH 1958

by

Joseph W. Berg, Jr., and Charles D. Baker
Department of Oceanography, Oregon State University

That the State of Oregon is tectonically active is evident from the records of earthquakes (Townley and Allen, 1939, etc.). As it was so ably put by Dr. Perry Byerly (1952) in his Condon Lecture, "Oregon is not free of earthquakes -- it has no immunity (as all fervently wish it had). It lies between two states which have violent shocks. Moreover, Oregon's history is very short. It will not be safe to ignore the possibility (even the probability) that Oregon may have violent shocks in the future."

It is difficult to do more than augment the excellent work done by previous investigators interested in earthquakes in this area. This research presents the earthquakes previously compiled for the state (see figure 1) and, in addition, augments the list* by literature search and revises statistics of earthquakes when evidences support such changes. However, only those shocks whose epicenters are in Oregon (or off the Oregon coast) are presented here; therefore, those shocks in previous lists that were felt in Oregon but originated elsewhere have been deleted.

During the period of time to which this report is applicable, only 14 of the earthquakes occurring in the state had an intensity greater than V. The average intensity of the shocks was about IV. Of the 240 events, 73 occurred at sea and 167 occurred in the state. For the majority of those occurring on land, the epicentral locations were approximated from felt reports.

Figure 1 shows the approximate locations of earthquakes occurring in Oregon and at sea off the Oregon coast. Epicenters are encircled. The heavier circles indicate earthquakes having intensities greater than V. No attempt has been made to correlate in detail the on-shore epicenters with tectonic features of the area. The accuracy of epicenter location by "felt reports" is considered to be limited, and associating an epicenter with a given fault would be misleading. However, general

*Because of its length, the list of earthquakes could not be published in The ORE BIN. The list, together with this report, will appear in a future issue of the Bulletin of the Seismological Society of America.

EARTHQUAKES IN OREGO

(56) LOCATION OF SHOCK ON LAND. (NUMBER IS CROSS REFERENCE TO THE TABLE OF SHOCKS TO BE PUBLISHED IN THE BULLETIN OF THE SEISMOLOGICAL SOCIETY OF AMERICA)

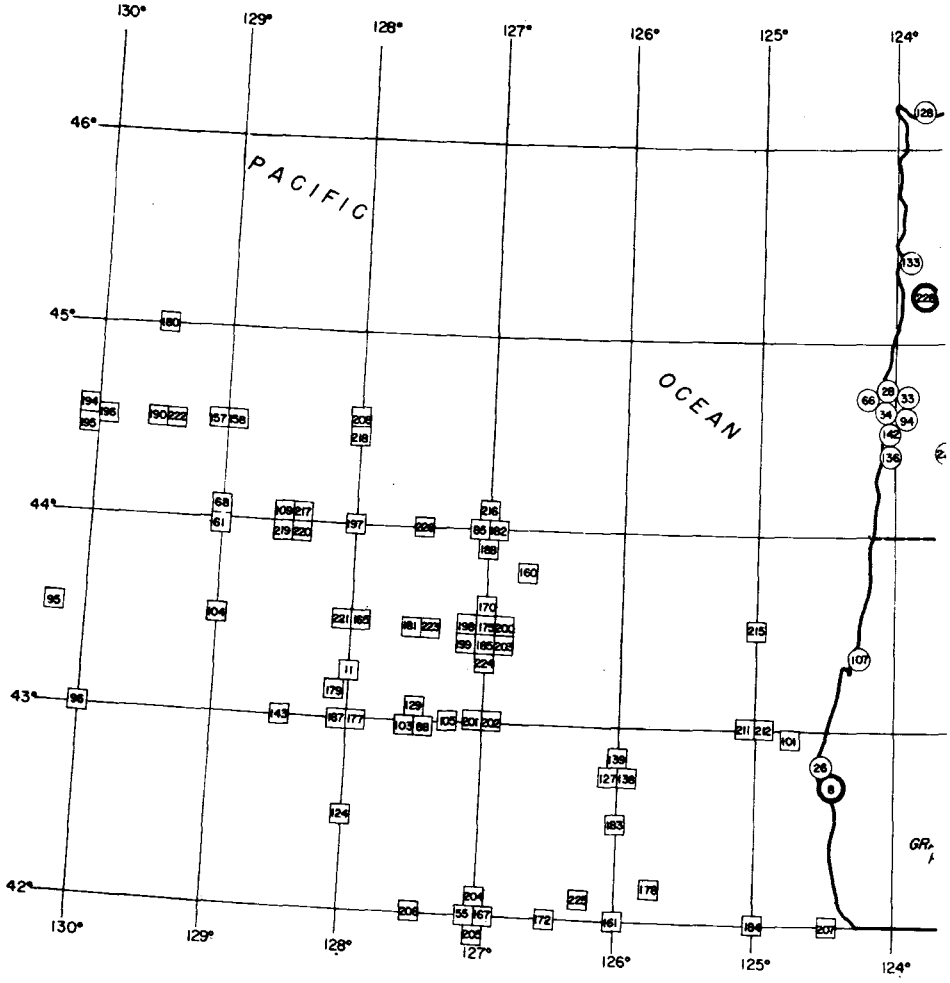
□ LOCATION OF SHOCK AT SEA

◌ EXACT LOCATION UNKNOWN.

O INTENSITIES GREATER THAN V

• CITY

0 10



URE I.

ND OFF THE COAST OF OREGON

HROUGH 1958

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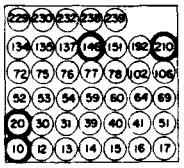
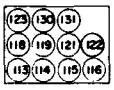
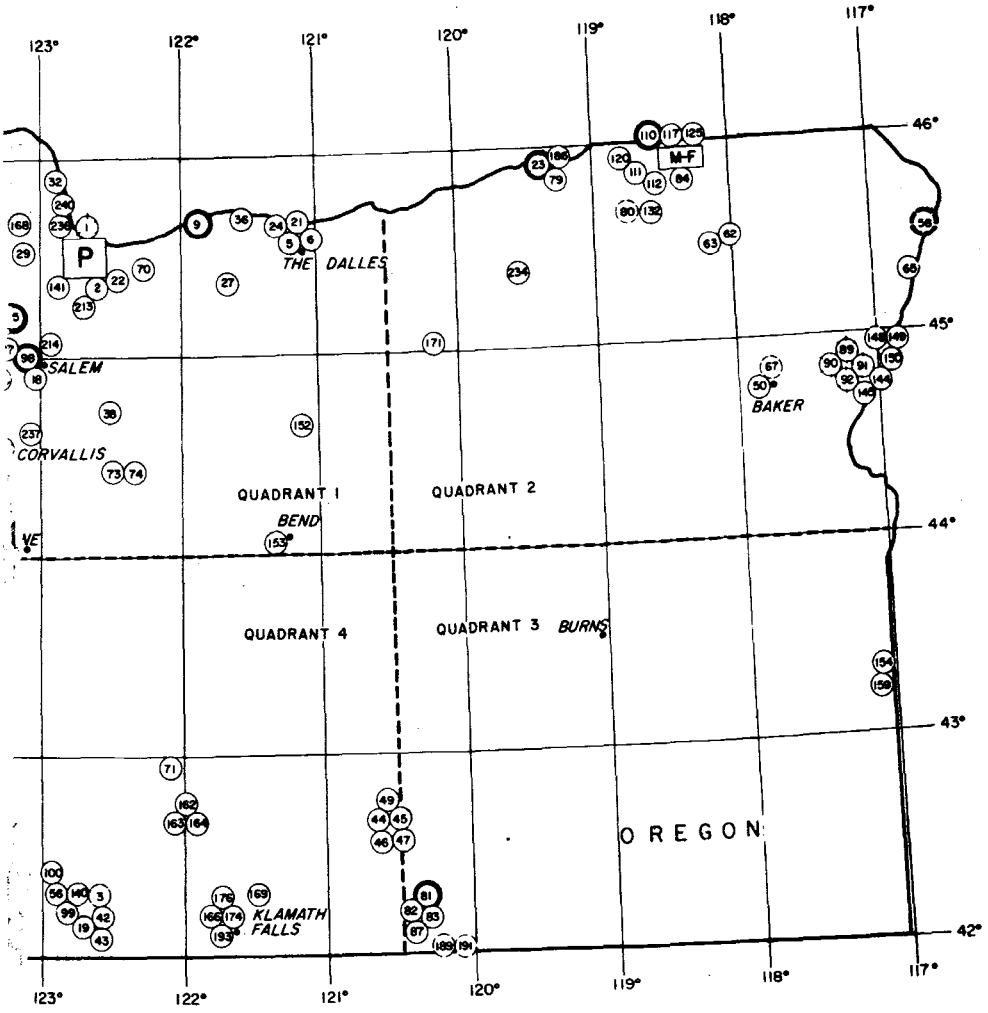
100
ES



BLOW UP OF
PORTLAND
(P)



BLOW UP OF
MILTON-FREEWATER
(M-F)



trends are shown on the map. The grouping of epicenters in the Klamath Falls, Grants Pass, Salem, Portland, The Dalles, Milton-Freewater, and Baker areas are, in the least, associated with the local faulting in these areas. The disclosure of any major trends of epicenters in Oregon will have to depend on more accurate and complete epicenter location.

The probable extension of the San Andreas Fault is clearly exhibited by the off-shore epicenters striking northwest off the coast of Oregon. Undoubtedly, some of the epicenters are associated with faults other than the main San Andreas Fault, but more data are needed to decipher any fault patterns.

In determining how complete Fig. 1 was with regard to the number of on-shore events, two Oregon newspapers, The Record-Courier of Baker and The Evening Herald of Klamath Falls, were investigated for reports of shocks in different 10-year periods. From this study, it is estimated that Fig. 1 is about 90 percent complete with regard to written records of earthquakes.

In Fig. 1, Oregon is divided approximately in the center into four quadrants, designated 1, 2, 3, and 4. These quadrants have been used in estimating the completeness of current earthquake reporting in the state. The percentage of Oregon population in each quadrant is compared with the percentage of the earthquakes that have been reported from that quadrant. Table 1 shows these results:

Table 1

Quadrant	Percent of total population (1940 Census)	Percent of total number of earthquakes (1841-1958)
1	66	51
2	8	25
3	3	5
4	23	19

From this statistic, it is evident that the number of earthquakes shown in Fig. 1 as having occurred in Oregon is dependent upon the population and the distribution of the population. This is a consequence, partially, of the average earthquake in the state being small (average intensity of IV), and the fact that many are not felt and, hence, not reported.

Figure 2 is a graph showing the number of earthquakes occurring in 10-year periods versus the population in Oregon for the same 10-year

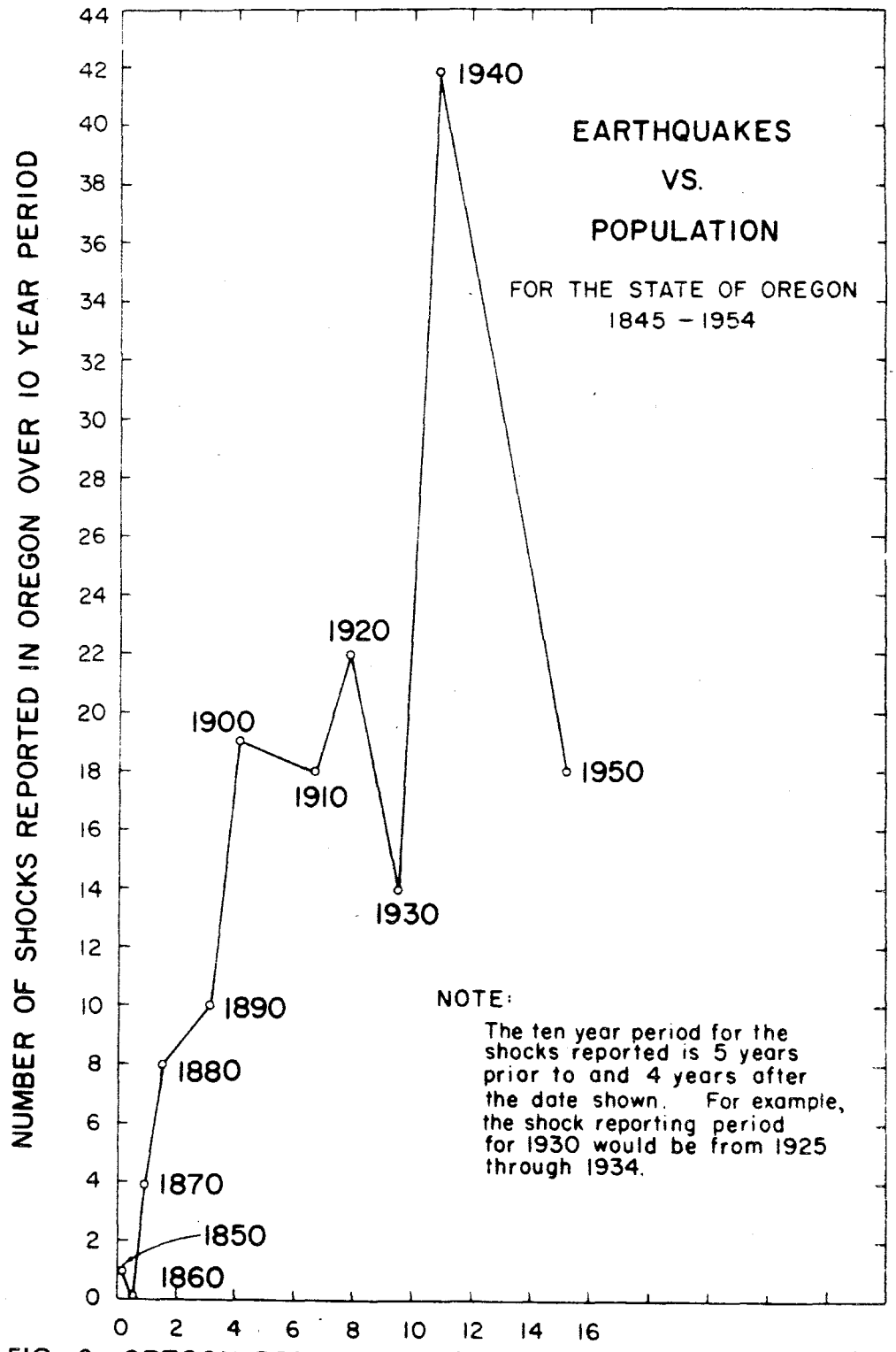

EARTHQUAKES
VS.
POPULATION
FOR THE STATE OF OREGON
1845 – 1954
NUMBER OF SHOCKS REPORTED IN OREGON OVER 10 YEAR PERIOD
OREGON POPULATION (HUNDREDS OF THOUSANDS)
1850
1860
1870
1880
1890
1900
1910
1920
1930
1940
1950
NOTE:
The ten year period for the shocks reported is 5 years prior to and 4 years after the date shown. For example, the shock reporting period for 1930 would be from 1925 through 1934.

FIG. 2

period. The number of earthquakes pertain to the state and not to those having occurred at sea. Scientifically, not too much importance should be attached to this plot of data. However, it is evident from Fig. 2 that as the population of Oregon increases so does the number of earthquakes reported as having occurred in Oregon.

This study indicates that earthquake reporting in the State of Oregon is not complete, and that increased instrumentation is needed in the state to better define the seismicity.

Acknowledgments

The writers wish to thank The Oregonian for the use of its library. We are especially indebted to those employed at The Oregonian library and to Mrs. Etta Judd of the Oregon State University library for their assistance. This work was partially supported by the Office of Naval Research under Contract Nonr 1286(02).

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The Gazette-Times, Corvallis, Oregon.
The Democrat-Herald, Albany, Oregon.
The Record-Courier, Baker, Oregon.
The Evening Herald, Klamath Falls, Oregon.

* * * * *

MORE LAND WITHDRAWALS IN DUNE AREA

The U. S. Bureau of Land Management has notified the Department that the U. S. Forest Service has applied for additional land (see The ORE BIN, July 1962) in the Dunes Area to be withdrawn from mineral entry. The application is for 209 acres, which makes a total of 21,333 acres that the Forest Service has asked to have withdrawn in this area so far this year. The reason given for the latest withdrawal is the same as used previously, that "The applicant desires the exclusion of mining activity to permit proper protection for the purpose of conserving, developing, and making accessible for the inspiration, enjoyment, and use of all American people of present and future generations the recreational and scenic resources of the area."

* * * * *

DRILLING PERMIT NO. 49 ISSUED

The Department issued a new drilling permit to John T. Miller of Hubbard, Oregon, on August 24, 1962 for a shallow oil test located about 2 miles south of the City of Dallas. Miller is a water-well contractor who has drilled shallow oil tests in Texas and Montana. He drilled holes in the Dallas area for the Miriam Oil Co. and Ross Miller & Associates in 1956 and 1959. The new drilling will be called "Ray Adams No. 1." Location was tentatively given as $SW\frac{1}{4}SW\frac{1}{4}$ sec. 11, T. 8 S., R. 5 W., Polk County. Elevation at ground level is approximately 280 feet.

* * * * *

STILL MORE WITHDRAWALS

The U.S. Department of the Interior has announced that all but 925 acres of public domain in Oregon west of R.8 E. is to be withdrawn from application under the nonmineral public land laws, except the Disposal of Materials Act, and also from leases, permits or easements, and the right-of-way laws. The total area to be withdrawn is approximately 242,417 acres. The Bureau of Land Management notified the public that it desires to use these lands to facilitate their management for multiple uses including sustained yield timber production. As interpreted by the State of Oregon Department of Geology and Mineral Industries, this land will still be open to mineral location and to leasing under the Disposal of Materials Act, but rights-of-way and easements will be curtailed.

The Bureau of Sports Fisheries and Wildlife is withdrawing 159 acres, which will include all of the islands in the Snake River in Oregon, from all forms of appropriation under the public land laws, except that hunting will be allowed and the area will be open to recreational uses. The land is desired for an addition to the Snake River National Wildlife Refuge as a refuge and breeding ground for migratory birds and other wildlife.

* * * * *

JURISDICTION OF FEDERAL DISTRICT COURTS ALTERED

On September 6 the Senate passed, with amendments, a bill (H.R.1960) to make it possible to bring actions against Federal Government officials and agencies in U.S. district courts outside the District of Columbia which, because of existing limitations, may now be brought only in the U.S. Distrist Court for the District of Columbia. House action on the amendments is necessary before the measure can be cleared for the President's action.

This legislation does not create new liabilities or new causes of action against the U.S. Government. In its report on the bill, the Senate Judiciary Committee pointed out that, to facilitate review by the Federal courts of administrative actions, it does these things: (1) It specifically grants jurisdiction to the district courts to issue orders compelling Government officials to perform their duties and to make decisions in matters involving the exercise of discretion, and (2) it permits an action to be brought against a Government official in a judicial district where defendent resides, or in which the cause of action arose, or in which any real property involved in the action is situated, or--if no real property is involved--where the plaintiff resides.

"The Committee is of the view," the report said, "that the current state of the law respecting venue in actions against Government officials is contrary to the sound and equitable administration of justice." Noting that U.S. attorneys are present in every Federal judicial district, the report said that requiring the Government to defend Government officials and agencies in places other than Washington, D.C., "would not appear to be a burdensome impositon."

The report continued: "On the other hand, where a citizen lives thousands of miles from Washington, where the property involved is located outside of the District of Columbia, where the cause of action arose elsewhere, to require that the action be brought in Washington is to tailor our judicial processes to the convenience of the Government rather than to provide readily available, inexpensive judicial remedies for the citizen who is aggrieved by the workings of Government." (American Mining Congress Bulletin Service, September 14, 1962).

* * * * *

HOUSE COMMITTEE APPROVES REVISED WILDERNESS BILL

The full House Interior Committee, after approving one amendment of particular interest to the mining industry, on August 30 ordered favorably reported the greatly revised Wilderness bill (H.R.776) endorsed earlier by its Public Lands Subcommittee. At the same time, the Committee directed its chairman, Rep. Wayne N. Aspinall (Colo.), to attempt to bring the bill up for a House vote under suspension of the rules, a procedure which limits debate to 40 minutes, bars amendment, and requires a two-thirds majority of those present for passage. No report has as yet been filed on this bill, and the date of the measure's consideration by the House is still in doubt.

As approved by the Committee, the House bill is not nearly as restrictive nor does it embrace as large an over-all area as the Wilderness bill (S.174) passed last year by the Senate. Unlike the Senate measure, the House measure as approved by the full Committee would permit the location of mining claims in wilderness areas for 25 years to January 1, 1988 (the subcommittee had set this period at only 10 years); it would make reasonable provisions for prospecting and mining operations in the wilderness areas; it would set aside only 6.8 million acres (primitive areas are not included), and it would prohibit any additions to the wilderness except by positive Act of Congress. (American Mining Congress Bulletin Service, September 14, 1962).

* * * * *

SPARTA QUADRANGLE FIRST OF NEW MAP SERIES

The first of the department's new Geologic Map Series (GMS-1) is now available. It is "Geology of the Sparta Quadrangle, Oregon," by Harold J. Prostka, who mapped the area in 1959 and 1960 as part of a doctoral thesis in geology from Johns Hopkins University.

While Mr. Prostka's report was still in manuscript form, it was instrumental in the selection of the site for the Blue Mountains Seismological Observatory, which was dedicated September 22 near Sparta.

The Sparta quadrangle was named after the old gold camp of that name which lies about 30 miles northeast of Baker. It encompasses an area of approximately 220 square miles along the southern edge of the Wallowa Mountains. The multicolored map, accompanied by descriptive text, delimits 20 geologic units ranging in age from Paleozoic to Recent and includes igneous, sedimentary, and metamorphic rocks. It may be purchased from the department's offices in Portland, Grants Pass, and Baker. The price is $1.50.

* * * * *

CANADIAN LIMESTONE SHIPPED TO OSWEGO, OREGON

The arrival at Oswego on August 27 of the Island Exporter, the world's largest ocean-going deck cargo barge, with a cargo of 8,700 tons of limestone from Texada Island, British Columbia, marked the beginning of what promises to be a large movement of this material. Oregon Portland Cement Co. expects to import approximately 400,000 to 500,000 tons annually during the next 10 years for use in its Oswego cement plant. Next month a second barge, the Island Importer, will be placed in service to assure a 10,000-ton-a-week delivery schedule from Blubber Bay at the northern tip of Texada Island, 430 sea miles from Oswego.

Oregon Portland Cement Co. has been supplying its Oswego facility with high-grade limestone from a company-owned quarry adjacent to its cement plant located at Lime in Baker County. A considerable saving in freight prompted the switch to Canadian limestone. The plant at Lime will continue to use the limestone from the nearby quarry and shipments may be made to the Oswego plant as the occasion warrants.

To accommodate the huge barges at Oswego new unloading facilities had to be constructed and a 20-foot channel dredged from the Ross Island Bridge to Oswego.

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The ORE BIN
Volume 24, No. 10
October, 1962

JONES MARBLE DEPOSIT, JOSEPHINE COUNTY, OREGON

By Len Ramp*

Introduction

The economic geology of the Jones marble deposit is part of a larger study designed to gain more detailed information about the sedimentary portion of the extensive Upper (?) Triassic Applegate Group rocks (Figure 1) of southwestern Oregon. Detailed mapping in areas that contain limestone are thought to be the best possible sources for stratigraphic and structural evidence, and because nearby diorite intrusives may have been favorable host rocks for mineralization.

Location

The Jones marble deposit is located 4 miles west of Williams and 16 miles due south of Grants Pass, Oregon, in the NE$\frac{1}{4}$ sec. 31, T. 38 S., R. 5 W. (Fig. 1). The deposit lies between 2,300 and 2,900 feet elevation on the nose of a north-trending ridge. From Grants Pass it can be reached via Oregon highway 238 for 13 miles, south on Water Gap road 6 miles to Williams, then west on Kincaid road 3 miles to Marble Gulch and up the mine road about 1 mile. Total distance from the deposit to the railroad at Grants Pass is 23 miles. The area is on the Oregon Caves quadrangle 15-minute topographic map.

History

The deposit has been described by Winchell (1914), Hodge (1937), and Treasher (1952). According to Treasher, "The quarry was originally worked by Al and Lum Jones (deceased) as a source of monumental stone. They made a living for 30 years, quarrying the stone and dressing it by hand at their home." In 1934 the deposit was purchased by F.I. Bristol. Present owners are Mr. Bristol, Grants Pass, and T. T. Leonard, Salem.

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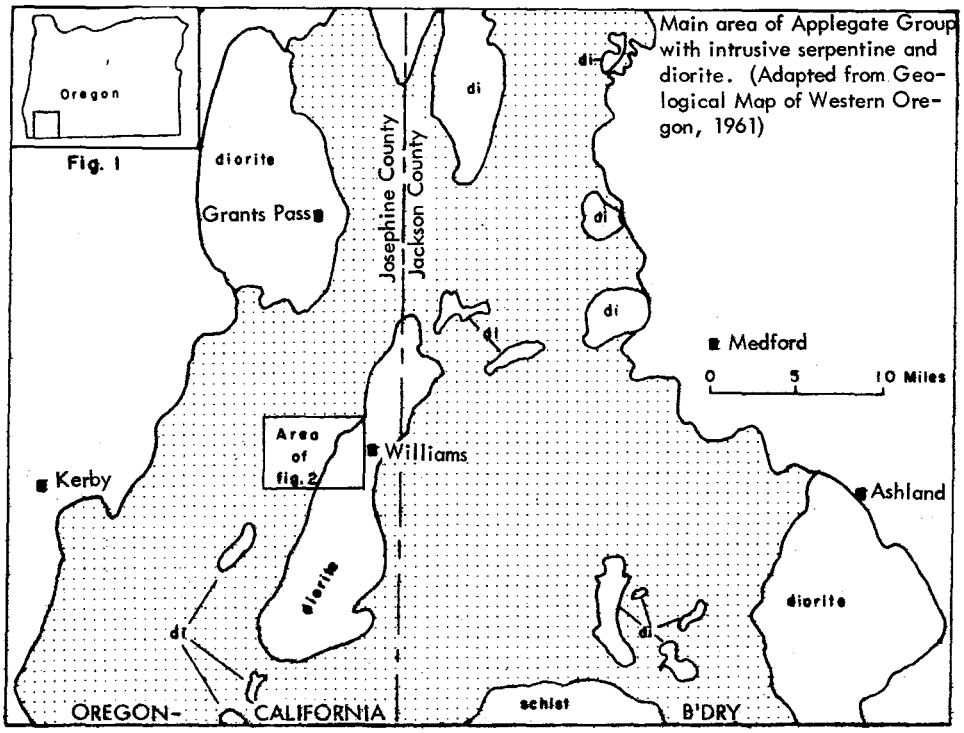
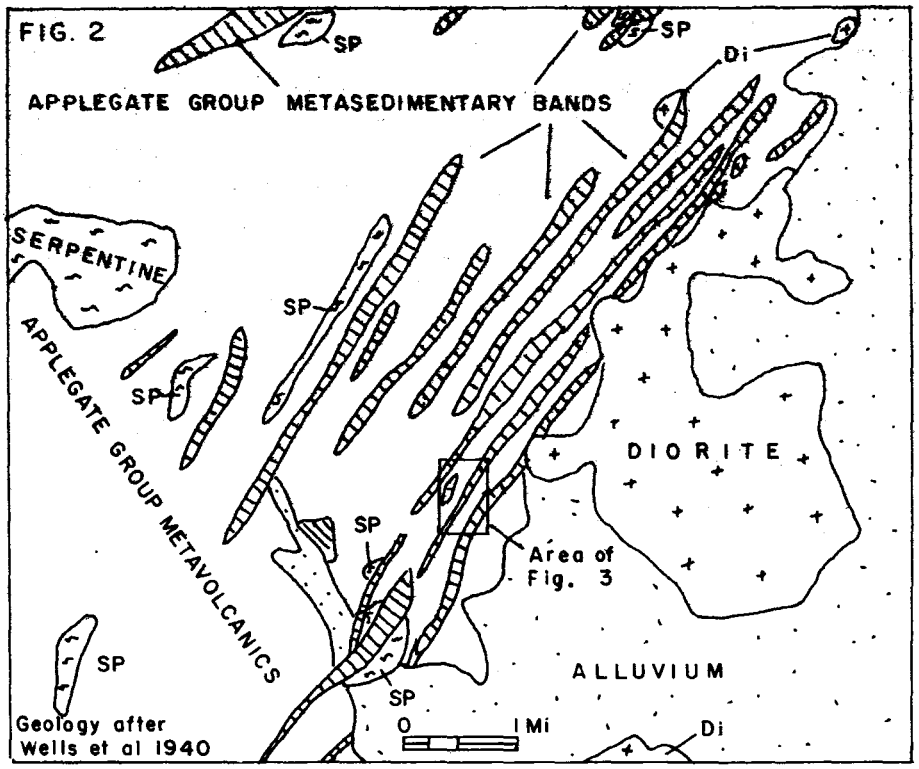
*Resident Geologist, State of Oregon Dept. Geology & Mineral Ind.



Main area of Applegate Group with intrusive serpentine and diorite. (Adapted from Geological Map of Western Oregon, 1961)



Geologic Map of a Portion of the Grants Pass Quadrangle

The former reported that about 5,000 tons were ground and shipped for agricultural lime in 1939-40.

Geologic setting

The area is mountainous and covered by fairly dense forest. The marble stands in relief with very little soil cover and sparse vegetation. The deposit is a lenticular interbed in the highly deformed and metamorphosed rocks of the Applegate Group of Upper (?) Triassic age. In addition to marble, rock types of the Applegate Group in the area include argillite, quartzite, sandstone, schist, gneiss, and metamorphosed tuffs and lavas. The metavolcanic rocks are difficult to recognize and distinguish, owing to metamorphism. Wells and others (1940) mapped the greater portion of the Applegate Group as metavolcanics (Figure 2). The area mapped in this study (Figure 3) appears to be underlain largely by metamorphosed sediments.

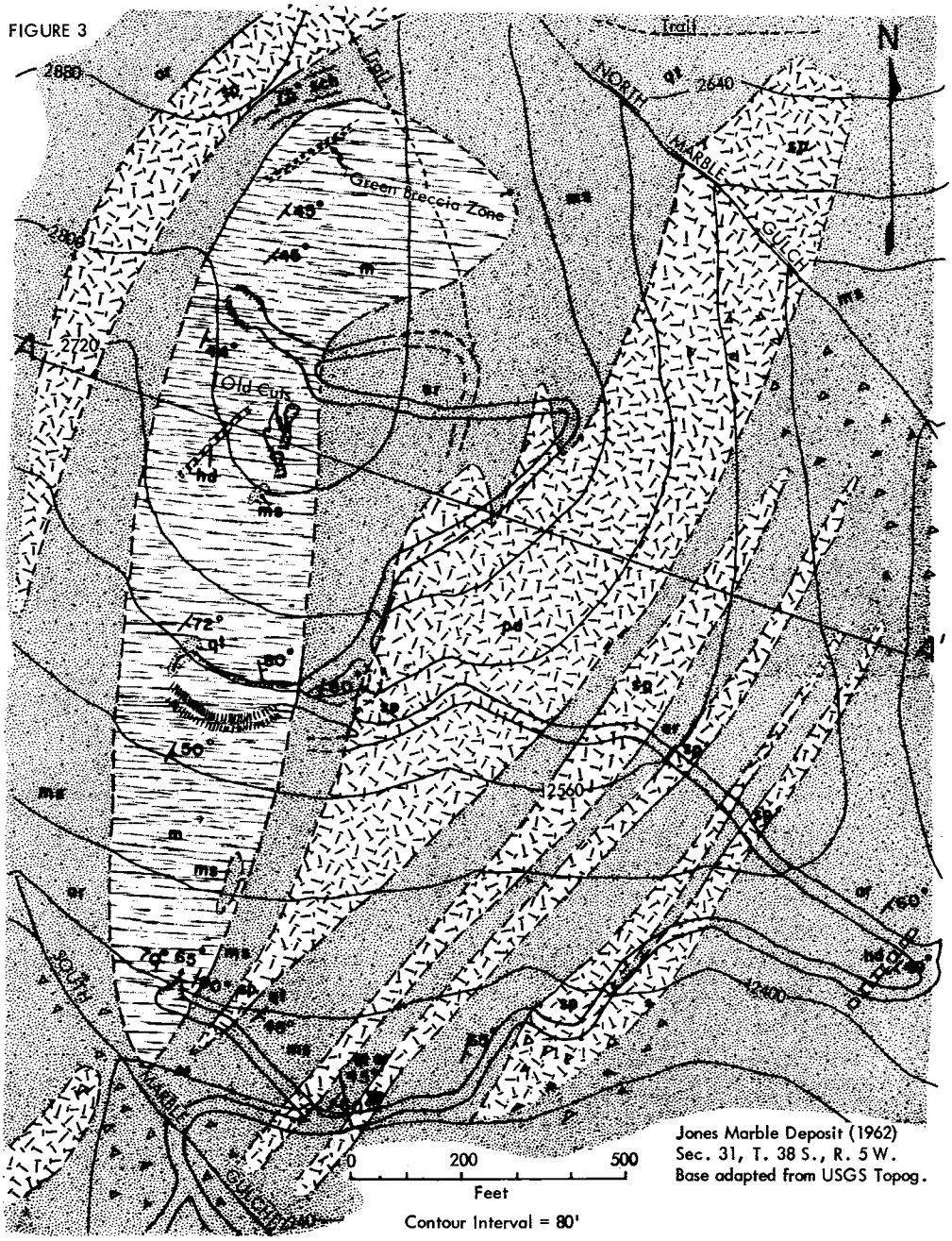
The marble deposit is less than a mile west of an elongate stock of diorite that underlies the Williams Valley, extends north across the Applegate Valley, and south into the rugged Sugarloaf-Grayback area of the Siskiyou Mountains. The area is also intruded by numerous sill-like serpentine bodies which appear to be more or less conformable to the deformed rocks of the Applegate Group. Later dikes of dioritic composition, probably related to the Williams diorite stock, are less common than the serpentine. Variable talcky alteration is found in the narrow serpentine bodies and along contacts of the larger bodies. Soapstone that is suitable for carving has been found in such areas.

Just to the south of the marble deposit, there is a band of limy quartzite as much as 400 feet wide. It contains numerous lenses and thin interbeds of recrystallized limestone which has similar texture to the Jones marble deposit. Although this limy quartzite layer has no surface connection with the marble deposit, it is parallel to it and may represent a folded limb of the same sedimentary horizon. The quartzite grades from a normal granular quartzite to a very fine-grained, banded chert that may have originated as a non-clastic precipitate more or less contemporaneous with the deposition of the limestone that later was converted to marble.

Structure

The layered rocks of the Applegate Group strike north to northeast and generally dip at high angles. Dips to the southeast are the most common in the area mapped. The attitude of the sill-like serpentine bodies

FIGURE 3



EXPLANATION

HORNBLENDE DIORITE

SERPENTINE AND PERIDOTITE

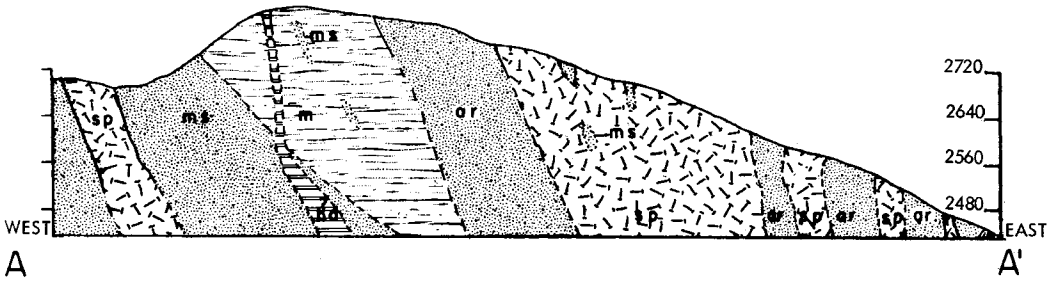
APPLEGATE GROUP

MARBLE

METASEDIMENTARY ROCK OTHER THAN MARBLE - INCLUDES ARGILLITE, QUARTZITE, ETC.

LANDSLIDE AREA

SECTION A-A' ACROSS MARBLE DEPOSIT



appears to be controlled by this predominant structural trend. This pattern is interpreted as a series of tight, isoclinal folds resulting in repeated exposures of a given horizon at various places across the section from west to east.

The marble deposit

The body of marble is lens shaped and is believed to be a squeezed segment of a former more extensive thin bed of limestone. The rock has been completely recrystallized to a granular white marble, with occasional gray streaks which give it a pleasing, variegated appearance. Individual calcite crystals in the marble range from 1/3 mm in diameter to 5 mm. The average diameter of the crystals is about 1 mm.

Important impurities in the deposit consist of occasional small lenses of quartzite and argillite and a hornblende diorite dike about 6 feet wide. Small streaks and knots of quartz occur at various places, usually aligned with the trend of the main body. A few sparse scatterings of pyrite also occur in the mass.

The lens or canoe-shaped body of marble is about 1,700 feet long and 300 feet wide, tapering rapidly at both ends. Residual layers, such as streaks of impurities or gray banding within the marble, dip from 45° SE to vertical. These layers appear to dip more steeply near the southern end than at the upper or northern end of the deposit. Also, dips observed near the western margin are generally less than those observed near the eastern margin. This implies a pinching of the deposit at depth as illustrated in cross-section A-A'.

A rough calculation of the available tonnage is based on the following rectangular average dimensions: length, 1,500 feet; width, 200 feet; and depth, 200 feet. Using a value of 12 cubic feet per ton, there are 5 million tons indicated in the deposit.

Marble from the deposit is of high purity. Winchell (1914) quotes an analysis of this marble by R.C. Wells (1910), which showed 99.14 percent calcium carbonate and no magnesia. Analyses of 3 samples taken by a former department field engineer, E.A. Youngberg, in 1945 from eastern, western, and southern quarries on the Jones marble deposit all showed similar results. An average* of the analyses is listed below:

Silica (SiO_2)	0.71	Calcium carbonate ($CaCO_3$)	98.54
Iron (Fe_2O_3)	0.08	Magnesium carbonate ($MgCO_3$)	1.11
Alumina (Al_2O_3)	0.24	Phosphorus (P)	0.02

Possible utilization

The purity of the Jones marble deposit makes it acceptable for most uses. Stone for building purposes and monuments has already been produced in small amounts from this deposit. Possible use of the marble as rubblestone in walls in modern architecture offers a market for a limited yearly tonnage.

The Jones deposit has recently been considered as a possible source of lump lime for pulp and paper manufacturing. This use may be feasible, since there are pulp plants as close as Coos Bay and Springfield. Use of the powdered product as an opaque white filler in paint, paper, etc., may also be practicable.

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* Average of P-4113, P-4114, and P-4115. L. L. Hoagland, assayer-chemist, State of Oregon Dept. Geology and Mineral Industries.

TO HOARD GOLD IS NOW FASHIONABLE IN GERMANY*

Three ways to that type of expensive saving
Reasons and background for hoarding

In the U.S.A. reserves of gold are diminishing, but at the same time those in Europe are increasing. In the Federal Republic of Western Germany gold is eagerly asked for at all bank counters. Its shine tempts and many believe in its steady value. The private purchase of gold, which increased lately, has no connection whatsoever with technical currency questions, because gold is with us just an article of merchandise. The gold which is freely traded in our country is mainly mined in the Union of South Africa. But also many other countries sell gold.

At the present time more gold than ever is purchased. In a Swiss financial paper the following note appears: "It is remarkable as to the reasoning of the German gold hoarders, whose attitudes and experiences find their reasons in experiences of times of war and turbulent after-years, that they, without any regard to the comparatively high price, buy gold coins."

Indeed, it had not happened for a long time that in the Federal Republic gold coins and gold bars were bought in such large quantities as during these last weeks. The small savers especially are eager buyers.

Gold purchases were usually only transacted in times of war. Nobody likes to part without good reason with stock and shares, or liquidate bank savings. It seems that there is an important motive for the present "escape into gold" in finding that during these last months there was plenty of talk about the diminishing purchasing power of the D-mark**; the calls of warning of our Finance Minister have, without doubt, caused more unrest among the population than was expected.

To "keep gold in a stocking" seems to be fashionable today. The gold purchaser has three possibilities: gold coins, gold medals, and gold bars. The latter is the simplest. Added to this, bars can be had, in general, at a cheaper quotation. The smallest bar (10 grams) costs 55 DM, the 1000-gram bar 4800 DM. The heavier the bar, the relatively cheaper the purchase price.

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*Translation by Rudolph Zobl, Accountant, Oregon State Dept. Geology and Mineral Industries, of an article by Ernst Guenther Eack, economic contributor, Bonn, Germany, printed in Welt Am Sonntag, Frankfort am Main, Sept. 9, 1962.

**Value of D-Mark as of Oct. 1, 1962, about 25 cents American.

It is getting more complicated as to coins. Like stamp collectors, numismatists try to grab rare specimens. Star among those is the 5-mark gold coin (fineness close to 2 grams). It costs about 200 to 220 DM. The one-dollar gold coin (approximately the same size) costs about 120 DM. In times of hardship and need it would realize at the most 10 DM for its value of fine gold contents.

The public in general keeps away from the purchase of such items for those reasons. Its interest is more concentrated in the Swiss, or French 20-franc coin, toward the English pound, or the Italian 20-lira coin. The fact that those and a number of other coins can be bought for approximately 35 to 70 DM explains the wish and desire of so many families to make the "piggy-bank" the hoarding place for gold coins.

Medals of gold (Erhard, Adenauer, Pope Pius, and many others struck in gold) are comparatively expensive. Because as mainly private firms or organizations strike those medals, the profit margin lies in the price of 45 DM for the Berlin gold medal 1958 (weight 7.9 grams) up to the 50-ducats Martin Luther (175 grams) for which 1,250 DM is being asked.

Maybe the hunger for gold finds its explanation in the fact that ownership of gold was prohibited in Germany before the last war. Maybe it's simply the nice and grand feeling of being able to go to the bank counter and exchange paper money for pure gold.

* * * * *

DRILLERS TO TRY AGAIN FOR STEAM ON CRUMP RANCH, ADEL

The Nevada Thermal Power Co., exploratory division of the Magma Power Co. of Los Angeles, plans to drill another exploratory well in the Adel fault zone east of Lakeview in southcentral Oregon. This company put down a hole on the Crump Ranch about 3 years ago in an attempt to encounter super-heated steam greater than 300° F. for possible use in electric power generation. Temperatures as high as 250° were recorded in this test, but were judged as not hot enough for efficient operation of a steam power plant.

Drilling of the well caused a continuously spouting geyser (see The ORE BIN, September, 1959) that sent a column of steam and hot water in the air from the 20-inch casing to a height of 150 to 200 feet. At the end of 9 months the geyser had stopped spouting, partly because of the partial plugging of the vent by vandals. Even today the rumble of boiling water can be heard at the pipe.

* * * * *

BATHYMETRY OF CRATER LAKE, OREGON

By

John V. Byrne*

Crater Lake, Oregon, is unquestionably the deepest lake in the United States (1,932 feet), and in North America is exceeded in depth only by Great Slave Lake in northern Canada (2,014 feet). Depth measurements were first made in Crater Lake in 1886, again in 1938-40, and most recently during the summer of 1959. The recent study, carried out in great detail by the United States Coast and Geodetic Survey, made use of echo-sounding methods and was made under the supervision of R. E. Williams. This survey (U.S.C.& G.S. Hydro Survey No. 8498) provided the basis for the accompanying bathymetric chart, which is controlled by soundings at more than 4,000 individual locations.

The use of a 10-fathom (60-foot) contour interval makes several features of geologic interest apparent. As the runoff and amount of sediment supplied to the lake are limited, little modification of the original surface can have taken place by erosion or deposition, and the bathymetric chart, therefore, essentially represents the configuration of the original volcanic surface. Attention is directed to the lobe extending eastward from Wizard Island, undoubtedly a lava flow; to the conical mound at the inner edge of the lava flow, probably a volcanic cone which has been buried to some extent by the lava flow; and to the almost perfect cone rising to 81 fathoms in the north-central part of the lake. This cone has been named Merriam Cone by Howel Williams (1961) in a short article which includes a less-detailed chart of the lake based on the same survey. Southeast of Merriam Cone, the lake is deepest, 322 fathoms (1,932 feet), and has a flat bottom which Williams considers to be a lava plain smoothed somewhat by later ashfalls.

Rock samples dredged from the flank of Merriam Cone consist of hypersthene-augite andesite, whereas those dredged from the mound at the inner edge of the Wizard Island lava flow are vitrophyric hypersthene-hornblende dacite (Williams, 1961).

Of the great number of scientific articles written concerning Crater Lake, the few listed following the accompanying chart provide a summary of our scientific knowledge of this interesting area.

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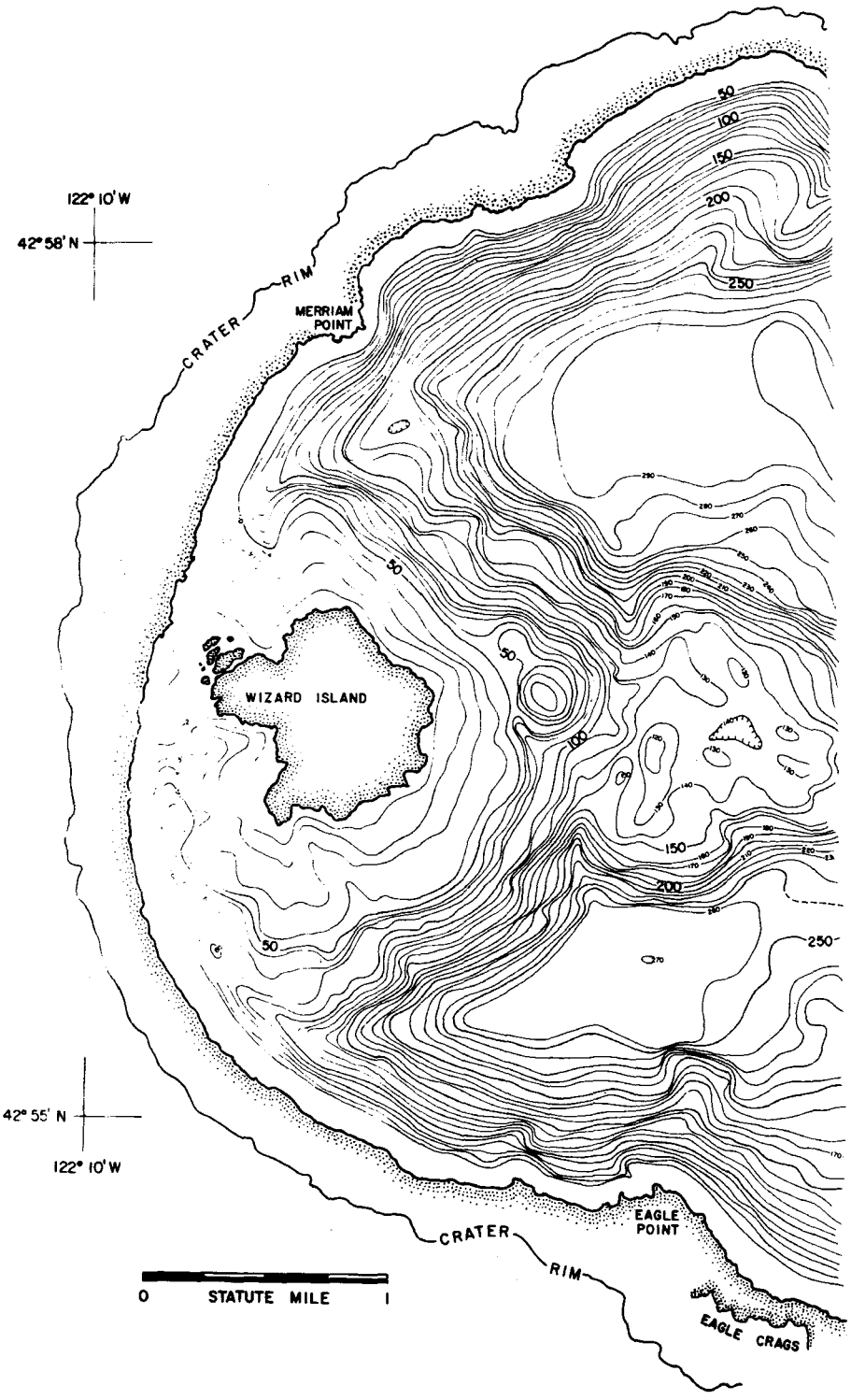
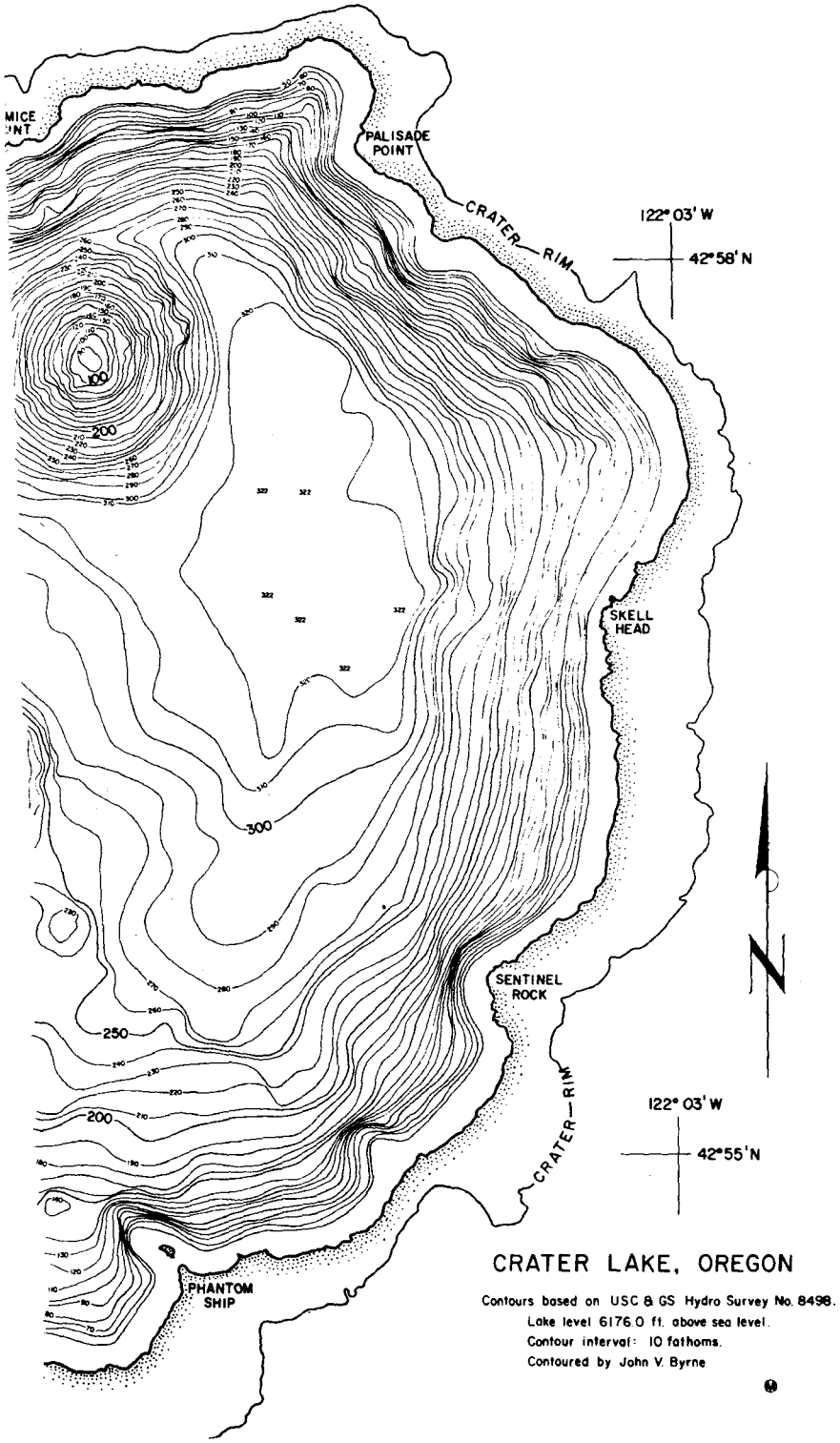
* Department of Oceanography, Oregon State University.


122° 10' W
42° 58' N
CRATER RIM
MERRIAM POINT
WIZARD ISLAND
50
100
150
200
250
42° 55' N
122° 10' W
EAGLE POINT
CRATER RIM
EAGLE CRAGS
0 STATUTE MILE 1



CRATER LAKE, OREGON

Contours based on USC & GS Hydro Survey No. 8498.
Lake level 6176.0 ft. above sea level.
Contour interval: 10 fathoms.
Contoured by John V. Byrne

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CORRECTION

In the article "Geology of the Cape Blanco Area" (The ORE BIN, August, 1962) belemnoids were incorrectly reported as having become extinct at the end of the Cretaceous period, according to R. H. Dott, Jr., the author. A few aberrant forms actually have been reported from Eocene rocks. This would extend the possible range of the "Upper Cretaceous Rocks" near Blacklock Point into the early Tertiary. However, the author still considers these strata to be Cretaceous (but younger than the Myrtle group) on the basis of the meager Foraminifera and petrology of the sandstones. Furthermore, the first belemnoid found in them was a large, massive form unlike those reported from the Eocene.

* * * * *

NEW DRILLING PERMIT ISSUED IN OCTOBER

The department issued Drilling Permit No. 50 to John T. Miller, Ross Mitchell & Associates on October 5, 1962. The new hole is located on the Bliven Ranch 240 feet north of John T. Miller "Ray Adams No. 1," which was drilled last month and abandoned September 24. The proposed depth of the "Bliven well" was 400 feet. The coordinates were given as approximately 670 feet north and 860 feet east of the southeast corner of sec. 11, T. 8 S., R. 5 W., Polk County. Elevation at ground level is about 285 feet.

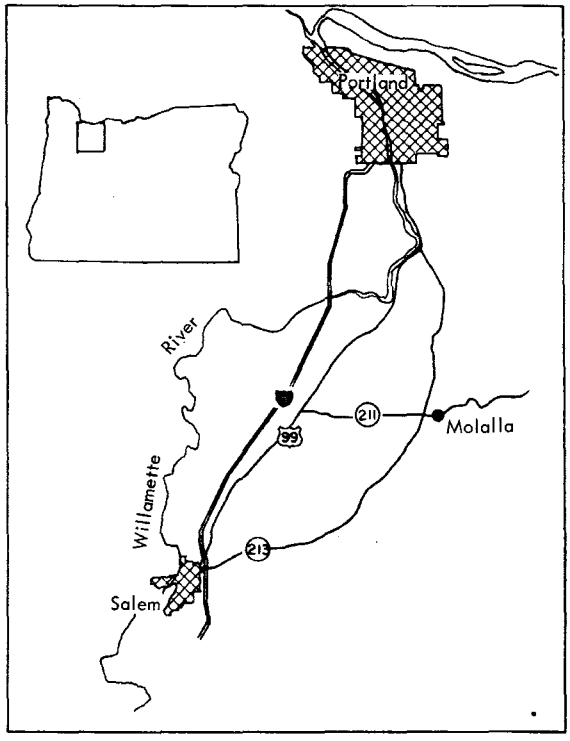
* * * * *

NITROGEN WELL AT MOLALLA

By Vernon C. Newton*

A flow of nitrogen gas was struck by the Westerberg Drilling Co. in August, 1962, while the company was drilling for water on the Walter Moehnke property, 3½ miles east of the Town of Molalla in the NE¼SE¼ sec. 13, T. 5 S., R. 2 E., Clackamas County (see index map). The gas was encountered at 260 feet, and the flow increased after drilling into what appeared to be a fault zone. Gas continued to blow from the 6-inch casing during the remainder of the drilling and until the well was abandoned at a depth of 450 feet. No appreciable decrease could be noted after nearly 3 weeks of flowing through the uncapped casing. Carl Westerberg, the driller, reported he got headaches while working around the gas and he finally was forced to install a fan to blow the gas away from the working area.

INDEX MAP



Eugene Hampton, geologist with the U. S. Geological Survey, Ground Water Branch, Portland, accompanied the writer to the site August 28. The gas was found to be nonflammable and odorless. Although the pressure appeared to be low, the volume of gas issuing from the open 6-inch casing was impressive, and the hissing could be heard more than 50 feet from the well. A sample of the gas was taken for analysis to the U. S. Bureau of Mines laboratory at Albany. Measurements were made of the pressure 2 days later, on August 30, so that volume calculations could be made.

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* Petroleum Engineer, Oregon Dept. Geology and Mineral Industries.

Westerberg capped the hole and left it unplugged until laboratory determinations could be made on the gas.

The log on the well, as compiled by the driller, is given below.

Material	From	To	Material	From	To
Top soil	0	1	Olive green formation, soft	251	253
Clay, tan	1	5	Rock, decomposed; blows	253	254
Rock, soft, gray	5	25	Rock, black; seems to be broken, caves some, quartz in strata	254	269
Clay, tan	25	31	Rock, black; cuttings coarse, some quartz	269	310
Rock, shot to get casing by	31	33	Rock, drills fairly fast, green color as claystone; also black cuttings	310	355
Clay, tan	33	35	Rock, hard; making 10' a day, caves at 385 to 387. Will not hold water	355	415
Rock, shot to get casing by	35	37	Rock, creviced at 435 to 437; will not hold water, blows hard	415	452
Clay, varicolored	37	223			
Gravel and blue clay; well blows in gravel. No water	223	240			
Clay, blue	240	251			

Geology of the area

The Town of Molalla lies in the foothills of the Western Cascades. The rocks in this region are dominantly lavas with associated pyroclastics and waterlaid sediments which range from late Eocene to Pliocene, the bulk of the section being Oligocene to Miocene in age. The formations dip gently eastward and broad open folds, sizable faults, and disconformities are present.

Sources of nitrogen gas

Nitrogen is a colorless, odorless gas making up about 78 percent of the earth's atmosphere. It is found as a minor constituent in nearly all natural gases. Gases occurring in nature originate from organic and inorganic processes within the crust of the earth. Generally inorganic gases are associated with volcanic activity and the organic gases with diagenesis of organic matter in sedimentary rocks. (See Table 1 for a selected list of some natural gases containing nitrogen.)

Inorganic gases escape from fissures and fumaroles in igneous rocks at various places on the surface of the earth. The gases were trapped as occlusions within openings in the rocks and released when heated by contact with magmatic masses; other gases formed from chemical reactions within magmas. Nitrogen is found to be one of the characteristic gases in volcanic emanations, along with hydrogen, carbon monoxide, and carbon dioxide. Geochemists believe that the earth's atmosphere has been enriched with nitrogen during past geologic time by such volcanic eruptions. Nitrogen has been noted in the gaseous portions of comets and in the atmospheres of the stars, sun, and planets.

Table 1. Selected list of some natural gases containing nitrogen.

Organic Gases	N_2	CO_2	CH_4	C_nH_{2n}*	O_2	CO	H_2	Remarks and References
Monongah Coal Mine West Virginia	77.77	0.16	1.59	--	20.48	0.0	--	U.S. Geol. Survey Bull. 383, p. 8
Darr Coal Mine Jacobs Creek, Pa.	77.00	2.31	6.01	0.31	14.09	0.28	--	Above reference, p. 9.
Shallow Well Bureau County, Ill.	85.83	0.10	13.97	--	0.05	0.05	--	U.S. Geol. Survey Mineral Resources of U.S.
Westbrook Field Mitchell County, Tex.	85-95	--	--	--	--	--	--	Leversen, p. 365. No petroleum associated.
McCamey Field West Texas	2.52	0.10	69.40	27.98	--	--	--	Univ. Texas Pub. 5716, p. 199.
Buena Vista Hills Kern County, Calif.	3.80	16.50	42.20	37.50	0.00	--	--	Rankama and Sahama, p. 362.
Oil Test Linn County, Oregon	50.4	0.50	48.0	1.10	--	--	--	Unpub. On file in Department. Low vol. flow.
Inorganic Gases								
Fumarole, Mt. Etna, Sicily	79.07	1.61	--	--	18.97	(0.35 H_2S)		Ley, p. 1062-63.
Mont Pelée, Martinique	54.94	15.38	5.46	--	13.67		8.12	Ley, p. 1062-63.
Well Harding County, N.M.	0.2	99.8	--	--	--	--	--	N.M. Bur. Mines Bull. 18.
Metal Mine Cripple Creek, Colo.	81.00	18.0	--	--	0.30	--	--	Ley, p. 1063.

Gases - Origin Unknown	N_2	CO_2	CH_4	C_nH_{2n}*	O_2	He	Remarks and References
Well Las Animas County, Colo.	79.71	12.19	0.00	0.00	0.92	7.18	Above reference, p. 1062.
Well Emery County, Utah	61.02	31.70	0.00	5.70	0.27	1.31	Above reference, p. 1062.
Well Cowley County, Kansas	82.70	0.00	14.85	0.41	0.20	1.84	Above reference, p. 1062.
Boiling Spring Abano, Italy	74.23	10.73	12.00	--	--	1.51	Above reference, p. 1063.

* Other hydrocarbons.

Some of the nitrogen derived from volcanic activity is generated by distillation when intruded magma contacts organic material in the surrounding rocks or in meteoric waters. Enrichment of nitrogen also occurs through chemical reactions between gaseous vapors and wall rocks.

Experiments have suggested another source for nitrogen in rocks where helium is a minor constituent of natural gas. The effect of radiation on animal and vegetable proteins was studied by several researchers, who discovered that nitrogen was rapidly released when the material was exposed to radiation. The experiment suggested that contact between basement rocks containing radioactive minerals and sedimentary rock containing organic remains could produce large amounts of nitrogen, with helium a by-product of radioactive disintegration.

The natural gas used commercially for fuel is of organic origin, formed by decomposition of organic debris buried in sedimentary basins. Methane is the most common constituent of organic gases with heavier hydrocarbons, carbon dioxide, and nitrogen as minor components. These gases are the product of decomposition of organic matter in a reducing environment (chemical reaction without the presence of much oxygen). Coals and peats are formed from decomposition of land and marsh vegetation, while organisms in stagnant waters of inland lakes or marine embayments produce hydrocarbons in a process called putrefaction. This is a process of slow distillation aided by bacterial action. Fats and oils are changed into organic compounds and gases consisting mainly of methane and smaller amounts of other hydrocarbons, carbon dioxide, and nitrogen. Both carbon and nitrogen are enriched during the putrefaction process.

The source of the nitrogen in the Moehnke well is not definitely known, because of insufficient knowledge concerning the lithology and chemical composition of the rocks that underlie the Molalla area. Beds of sub-bituminous coal crop out on the surface about 6 miles south of Molalla and this horizon, or another at about the same stratigraphic position, could possibly occur below the Moehnke well. Partially decayed plant debris is also fairly common in some of the waterlaid tuffs in this vicinity, and it could be that the nitrogen evolved from these sediments during the putrefaction process. Because of the generally low porosity and permeability of most tuffaceous beds, the gas would be allowed to escape only where fracture zones in the rock extend to the surface or are encountered in well borings.

Volume calculations on the Moehnke well

Volume calculations were made on the Moehnke well in September,

1962. Measurements were made, using a choke nipple arrangement and a U-tube manometer filled with mercury. The general choke nipple gas flow formula used to estimate the rates is:

$$Q = \frac{CP}{\sqrt{GT}}$$

Q = rate in 1000 cu ft per day (24 hours)
C = orifice coefficient
P = backpressure (Psia)*
G = specific gravity of gas (0.90)
T = temperature absolute, degrees F

Choke Nipple Flow Measurements
(Shut-in press. = 16.87 psia)

Choke Size	Coefficient	Pressure(psia)	Spec.Grav.	Temp.(°Fabs)	Est. Vol.
1/4"	26.51	16.72	0.90	519.5	20 MCF/D**
5/16"	43.64	16.69	0.90	518.	33 MCF/D
3/8"	61.21	16.67	0.90	517.	47 MCF/D
1/2"	112.72	16.38	0.90	517.	85 MCF/D

The calculated absolute open flow potential of the well is roughly 200 MCF/D.

An estimate of the rate was also made using the side static pressure method. The rate was estimated to be about 150 MCF/D through a 1-inch pipe, but the value is questionable, because the side static method is inaccurate at low pressures.

The well was allowed to blow for 30 minutes through open-end 6-inch casing and then closed in. No appreciable drawdown in pressure could be detected. The driller, Carl Westerberg, reported that he could not detect any decrease in flow volume at the end of the 3-week period that the well was allowed to blow to air. The reservoir containing the gas must be an open fracture system to have such high permeability.

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* Thousand cubic feet per day. **Pounds per square inch absolute.

Analysis of gas from the Moehnke well

	CO_2	N_2	CH_4	C_nH_{2n}	O_2	CO	H_2	He
Sample No. 1*								
Chemical analysis	0.1-	98.8	0.5-	0.0	0.1-	0.1-	0.1-	Not determined
Sample No. 2**								
Gas Chromatograph	1.0-	93.4	1.0-	0.0	- -	tr.	4.7	0.0

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* U. S. Bureau of Mines, Analytical Laboratory, Albany, Oregon, September 10, 1962.

** Humble Oil & Refining Co., "R. B. Perry No. 1", Borst & Giddens Logging Unit, Chehalis, Wash., October 5, 1962.

AEROMAGNETIC MAPS AND PROFILES IN OREGON

The index map of Western Oregon on page 172 shows the location of airborne magnetic surveys flown by the U. S. Geological Survey for which results are available to the public. The supplemental list of publications or open-file releases given below is keyed to the index map.

1. Total intensity aeromagnetic profiles of west-central Oregon (open-file report, 1957).
2. Preliminary interpretation of an aeromagnetic map of the Albany-Newport area, Oregon, by R. W. Bromery (open-file report, 1962).
3. Aeromagnetic map of the Kerby and part of the Grants Pass quadrangles, Josephine and Curry Counties, Oregon, by J. R. Balsley, R. W. Bromery, E. W. Remington, and others (GP 197, 1960, scale 1:96,000. 50 cents).
4. Geologic interpretation of the aeromagnetic map of the Lebanon quadrangle, Linn and Marion Counties, Oregon, by R. W. Bromery (GP 212, 1962, scale 1:62,500. 50 cents).

The publications listed as Geophysical Investigations Maps (GP), may be purchased for the price indicated from the U.S. Geological Survey, Denver Federal Center, Denver, Colorado. Open-file data are not available for sale or for public distribution, but may be examined or copied at the Portland office of the State Department of Geology and Mineral Industries or in certain West Coast offices of the Federal Survey.

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NATIONAL AWARD MINERALS EXHIBITED

Currently on display in the department's museum is the Albert and Stella Keen exhibit, which won the national award for mineral crystals at the American Federation of Mineralogical Societies convention at Des Moines, Iowa, this past summer. The colorful exhibit includes 25 specimens having perfect crystal structure. Included in this select group are some very large stibnite crystals unique to a locality in Japan, a giant malachite pseudomorph after azurite from South West Africa, and a variety of other minerals from different parts of the world. The Keens, who live in Portland, are members of the Oregon Agate and Mineral Society and have won many awards for their outstanding exhibits. Another collection of some of their minerals was shown in the department's museum a year ago.

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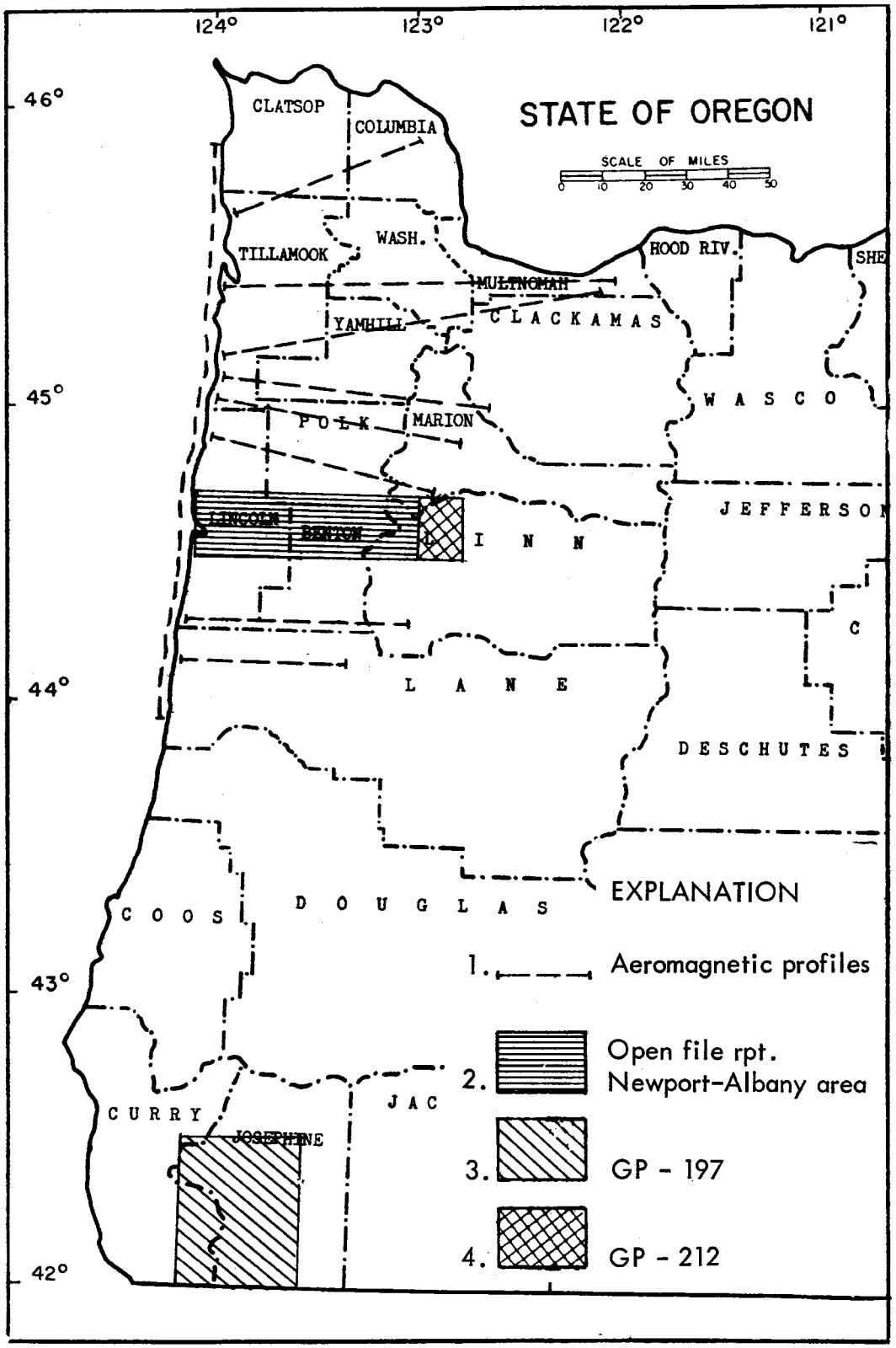
124°
123°
122°
121°
46°
45°
44°
43°
42°
STATE OF OREGON
SCALE OF MILES
0 10 20 30 40 50
CLATSOP
COLUMBIA
TILLAMOOK
WASH.
HOOD RIV.
SHE
MULTNOMAH
CLACKAMAS
YAMHILL
POLK
MARION
WASCO
LINCOLN
BENTON
LINN
JEFFERSON
C
LANE
DESCHUTES
COOS
DOUGLAS
CURRY
JAC
JOSEPHINE
EXPLANATION
1. Aeromagnetic profiles
2. Open file rpt. Newport-Albany area
3. GP - 197
4. GP - 212

The ORE BIN
Volume 24, No. 11
November, 1962

THE OCCURRENCE OF SPENCER SANDSTONE IN THE YAMHILL QUADRANGLE, OREGON

By H. G. Schlicker*

Introduction

The purpose of this paper is to report on some of the preliminary findings resulting from the geological study of the northwestern part of the Willamette Valley, Oregon. Of particular interest is the occurrence of a strandline sandstone of upper Eocene Spencer age which can be traced from north to south through the Yamhill quadrangle (see geologic map). Similar sands are extensively exposed along the western edge of the Willamette Valley. Sands have also been reported in the Chehalis basin of Lewis County, Washington (Snavely and others, 1958), where the enclosing foraminiferal shales indicate a similar upper Eocene age. The apparent regional distribution of this sand unit in Oregon suggests that it can be used as a marker horizon for further work along the west side of the Willamette Valley.

Location

The Yamhill 15-minute quadrangle lies in Washington and Yamhill Counties between 45°15' and 45°30' north latitudes and 123°00' and 123°-15' west longitudes (see index map). The center of the area lies about 25 miles southwest of Portland. The principal towns are Carlton, Cherry Grove, Gaston, Laurelwood, and Yamhill.

Acknowledgements

The writer is indebted to the following persons for their assistance in the field and for contributing discussions concerning the field mapping correlations. Members of the department gave freely of their time and experience in field inspections and in preparation of the manuscript. Parke Snavely of the U. S. Geological Survey spent one day visiting the area

*Geologist, State of Oregon Dept. of Geology & Mineral Industries.

and made helpful suggestions concerning the field mapping. He arranged for microfauna dating through the Survey. Dr. Weldon Rau of the Washington Division of Conservation, Department of Geology and Mines, provided several microfauna datings. Prof. Ewart Baldwin, Department of Geology, University of Oregon, identified several megafaunal collections from the area. Paul Day and Mick Lachenbruch of Gulf Oil Corp. spent a day in the field assisting the writer and in addition furnished the results of four permeability and porosity samples of the sandstone. The writer greatly appreciates the help of Robert Deacon, consulting geologist, for his assistance in the field. The department appreciates the cooperation of Fred Yarbrough and Don Collins of the Oregon State Highway Department for sieve analysis of sand samples.

Historical review

The occurrence of sand has been described in the upper Eocene Cowlitz Formation of Oregon and Washington and in the Nestucca, Spencer, and Helmick Formations of Oregon (see correlation chart, page 176). These formations occupy a similar stratigraphic position and follow the same northerly trend as the sands of the Yamhill area. Charles E. Weaver (1912, 1937) describes the upper Eocene Cowlitz Formation as being composed of brackish water and marine sandstones, shales, conglomerates, and subordinate shaly limestone associated with basalt and coal beds. Brackish water mollusks are abundant, and at least 45 species of shark teeth were found in the Cowlitz Formation of Washington.

F. E. Turner (1938) correlates the sandstones, tuffs, shaly silts, and micaceous sandstones of the Comstock Formation, more recently mapped as the Spencer Formation by Vokes and others (1951), at Coyote Creek south of Eugene with the Tejon-Cowlitz age rocks of California and Washington on the basis of marine fauna. He also describes marine and brackish water sandstone of the coal-bearing Coaledo Formation in the Coos Bay area as containing Tejon-Cowlitz faunas.

Maurice J. Mundorff (1939) describes the Helmick beds at Helmick Hill and Buena Vista in Polk County as a micaceous sandstone. Shark teeth are abundant in a roadcut near the Luckiamute River just north of Helmick Park on U.S. Highway 99-W. Mundorff concluded that the megafauna and the structural and stratigraphic relationships relegate these beds to the upper Eocene. His age dating was confirmed by Cushman, Stewart, and Stewart (1947). They state that the Helmick Formation contains a typical upper Eocene microfauna correlative with the lower Coaledo Formation of Oregon and the Cowlitz Formation of the Lewis River in Washington.

Vokes, Meyers, and Hoover (1954) mapped the Spencer Formation in the Camp Adair area just south of Helmick Hill and state that it can be traced south to the type location of the Spencer Formation. They likewise correlate the fauna of the Spencer Formation with Tejon-Cowlitz age rocks.

Warren, Norbisrath, and Grivetti (1945) describe the Cowlitz Formation as surrounding the Tillamook Volcanics of the Coast Range on the west, north, and east. The eastern exposures apparently extend southeastward into the Yamhill quadrangle.

Stratigraphy

The formations exposed within the mapped area have not been differentiated, with the exception of the Eocene Spencer sandstone and the mid-Miocene Columbia River Basalt (see geologic map). The contact between Eocene and Oligocene age rocks has been only approximately located.

The oldest exposed rocks are along the western edge of the mapped area and are middle Eocene volcanics and interbedded sediments. These rocks have been intruded by dikes and sills of basaltic to gabbroic composition. The sills range in thickness from about 50 feet to more than 200 feet.

Work to date indicates that the Eocene marine sediments shown in the Yamhill quadrangle can be split into several formations and dated if more precise faunal control is obtained. The lowermost sediments belong to the Yamhill Formation of upper middle Eocene age, according to microfauna identified by Rau (see fossil localities F-1 and F-3 [Baldwin and others, 1955, and published mapping]). In the mapped area, the Yamhill age rocks are composed of siltstone and shales. They may be as much as 2,000 feet thick; however, the contact with the overlying upper Eocene shales has not been delineated.

The upper Eocene sediments are shale and interbedded sandstone of the Spencer Formation. Neither the lower contact nor the upper contact has been precisely located. The interbedded sandstone is fine grained and occurs in beds ranging from a few feet to about 30 feet thick. The sandstone unit may be as much as 200 feet thick, and the thickness of the enclosing shales has not been determined but could possibly be as much as 1,000 feet or more. In some areas in the uppermost part of the sandstone is interbedded pebble conglomerate. The upper Eocene rocks in the Sheridan quadrangle (Baldwin and others, 1959) to the southwest contain interbedded volcanics and correlate both lithologically and faunally with the type Nestucca Formation mapped in the coastal section by Snavely

CORRELATION CHART

Area		Pacific Coast standard section*	Oregon Coast adapted from P. D. Snavely, Jr.	Southwest Washington adapted from Snavely (1958)	Northwest Oregon adapted from Warren & Norbisrath (1946)	Willamette Valley adapted from Peck (1961)
Middle	Miocene	Briones Fm.	Miocene Volcanics	Columbia River (?) Basalt	Columbia River Basalt	Columbia River Basalt
Lower	Miocene	Temblor Fm. Vaqueros Fm.	Astoria Fm. Nye Fm.	Astoria (?) Fm.	Astoria Fm.	
Upper	Oligocene	Blakeley Fm.	Yaquina Fm.	Blakeley Fm.	Scappoose Fm.	Scappoose Fm
Middle	Oligocene	Lincoln Fm.	Alsea Fm.	Lincoln Fm. of Weaver	Pittsburg Bluff Fm. (Gries Ranch fauna)	Eugene Fm.
Lower	Oligocene	Keasey Fm.	Alsea Fm.		Keasey Fm.	Little Butte Volcanics
Upper	Eocene	Tejon Fm.	Nestucca Fm.	Northcraft Volcanics Skookumchuck Fm.	Goble Volcanics Cowlitz-Nestucca Fms.	Spencer Fm. (Helmick Fm.)
Middle	Eocene	Domengine Fm.	Tyee Fm.	McIntosh Fm.	Yamhill Fm. Tyee Fm.	Yamhill Fm.
Lower	Eocene	Capay Fm.	Siletz River Volcanics Umpqua Fm.	Metchosin Volcanics	Tillamook Volcanics	Siletz River Volcanics

* From: Western Cenozoic Subcommittee, Charles E. Weaver, Chairman, Correlation of the Marine Cenozoic Formations of Western North America: Geol. Soc. America Bull., vol. 55, p. 569/598, May 1944.

and Vokes (1949). The upper Eocene sandstones in the Yamhill quadrangle are more like the Spencer Formation, and thus this name has been used.

The rocks mapped as Oligocene undifferentiated are composed of two and possibly three formations. It has not been established that the Keasey Formation of lower Oligocene age extends as far south as the Yamhill quadrangle. There are approximately 1,500 feet of shales between the Pittsburg Bluff basaltic sandstone containing Gries Ranch fauna of middle Oligocene (fossil locality F-2) age and the underlying Eocene shale. This section could represent the Keasey Formation in this area.

The lowermost part of the Pittsburg Bluff Formation, composed of basaltic sandstone and conglomerate, is estimated to be at least 1,500 feet thick in this area if beds have not been repeated by faulting.

Overlying the basaltic sandstone are tuffaceous sandstones and shales containing microfauna of questionable Eugene Formation age (see fossil localities F-4 and F-5) according to Rau (written communication, 1962). Stratigraphic position and lithology would make these rocks most likely correlative with marine formations exposed in the McMinnville and Salem quadrangles to the south (Baldwin and others, 1955; Peck, 1961).

The uppermost Oligocene is predominantly silty and tuffaceous. Lithologically and srratigraphically it appears most likely equivalent to the Scappoose Formation of northwest Oregon; however, faunal dating is lacking.

The Columbia River Basalt is composed of several basalt flows having a maximum thickness of about 300 feet. It caps the Chehalem Mountains and the Red Hills of Dundee. The uppermost surface exposures are weathered to a red lateritic soil and partially covered by Pleistocene(?) silt. The weathering and silt cover (not shown on the map) varies from a few feet to possibly as much as 50 feet thick. The basalt dips northeastward in the Chehalem Mountains and southeasterly in the Red Hills of Dundee. It also occurs as several small erosional remnants surrounded by the marine shales and sandstones.

The dikes shown on the map in red are fine grained and basaltic in composition. They appear similar to the Columbia River Basalt and probably represent feeders. Two of the dikes have been quarried for road metal.

Description of the Spencer sandstone unit

Occurrence: The sandstone beds making up the unit crop out in roadcuts and in stream valleys along a persistent trend for a distance of about 17 miles in the Yamhill quadrangle, and the outcrop belt is as much as a

quarter of a mile in width. The sandstone is discontinuous for short intervals, possibly because of alluvial cover or faulting. Many good exposures, however, do occur throughout the area. The best outcrops can be seen along Patton Valley road at the eastern edge of sec. 32, T. 1 S., R. 4 W., and along a county road in the NW$\frac{1}{4}$ sec. 15, T. 2 S., R. 4 W.

Lithology: The unit is thinly interbedded with shales at the top and bottom contacts, but it is massive and occasionally cross bedded near the middle. Several areas have coal beds associated with the sandstone. One area adjacent to the sand outcrop contains considerably silicified and carbonized wood. The sandstone beds range in thickness from 2 feet where interbedded with shales of similar thickness up to massive sandstone beds of more than 30 feet in thickness, which are separated by thin shale beds of only a few inches. The sandy unit may be as much as 200 feet thick if minor shale beds are included. The thick beds of sandstone are uncemented to weakly cemented. Above and below the sandstone unit the material becomes predominantly shale.

In the hand speciment the sand is mostly very fine grained. At most outcrops it is tan, but in certain areas of recent roadcuts it is blue-gray and unoxidized.

Petrographically the sand is composed of about 40 percent quartz, 55 percent plagioclase feldspar, and 5 percent muscovite, biotite, and chlorite. The chlorite, altered from biotite, is usually bent and relatively soft. The mica contains approximately equal proportions of muscovite and biotite-chlorite. Lithologically the sandstone can be classified as feldspathic sandstone.

This sand is believed to represent a beach or strand-line sand deposit. Areas along the trend not having sand could be attributed to deposition adjacent to steep shore-line topography, or at the mouth of a river. Coal beds may represent a lagoon environment associated with sand dunes. Since the younger beds are apparently off-lapped to the east, it seems reasonable to assume that the main body of the upper Eocene and Oligocene sea was to the east of the Spencer sands and apparently occupied the Willamette Valley in Oregon and probably extended northward into the Chehalis basin of Washington, where similar sandstone beds are found.

Lithologically these sands appear to have been derived from an older formation, possibly the Tyee or the Yamhill Formation.

Sieve analysis: The results from a wet sieve analysis run on six random samples taken throughout the outcrop area indicate that the material is predominantly very fine sand (Wentworth classification). The spread in

the individual analyses was slight. The average of the analyses indicates that 5 percent is fine sand, 70 percent very fine sand, and 25 percent silt. If clay is present, it represents less than 2 percent of the sample.

Permeability and porosity: Nine samples were tested for permeability and porosity (see map for location of samples). The results indicate that the sand has good permeability and porosity.

Sample No.	Location	Permeability (md.)	Porosity (%)
1	SE cor. sec. 20, T. 1 S., R. 4 W.	184	36
2	SE¼ sec. 32, T. 1 S., R. 4 W.	202	32.2
3	NE¼ sec. 16, T. 2 S., R. 4 W.	1,130	31.7
4	SE¼ sec. 30, T. 3 S., R. 4 W.	812	41.3
5	SW¼NW¼ sec. 30, T. 3 S., R. 3 W.	736	41.2
6	NW¼ sec. 24, T. 3 S., R. 4 W.	1,850	41.1
7	NE¼ sec. 1, T. 3 S., R. 4 W.	2,200	40.7
8	NW¼ sec. 15, T. 2 S., R. 4 W.	4,510	41.5
9	NE¼SE¼ sec. 32, T. 1 S., R. 4 W.	3,510	32.9

Note: Samples No. 1-4 courtesy of Gulf Oil Corp. Samples No. 5-9, obtained by H. G. Schlicker and R. J. Deacon, were tested by Oil Well Research Laboratories, Long Beach, California.

Geologic structure

The structure of the sand unit and adjacent shales is predominantly that of a monoclinal dip averaging about 15° E. The strikes range from northwest to northeast, indicating some easterly plunging folds. Lineation of the topography suggests that faulting has been quite extensive throughout the area. There are two distinct fault trends, one about No. 40° W. and the other N. 35° E. (see map).

Age and correlation

Fossil information is incomplete at present; however, identification of faunas from several areas places the sand horizon between the Yamhill Formation of Eocene age and sediments containing Gries Ranch fauna of Oligocene age. In the bed of Scoggin Creek a mile and a half west of the sandstone outcrop, a shale sample collected by Snavely (fossil locality #1 on map) has been identified by Rau as containing microfauna similar to

those found in the Yamhill Formation in the Mill Creek section. Rau states the assemblage is diagnostic of Laiming's upper A-2 age. Megafauna from the basaltic sandstone unit 2 miles east of the sand locality on Scoggin Creek (fossil locality #2 on map) were identified by Baldwin as Gries Ranch fauna. This age is identical to that given by Warren and others (1945) in the Scoggin Creek sandstone quarry. The dips in the Yamhill Formation here average about 10° E.; therefore, a maximum of 1,500 feet of shale occurs between the Spencer sand and the shales containing Yamhill age microfauna. Snavely (oral communication, 1962) states that this intervening shale has lithologic similarities to the Nestucca Formation.

The Spencer sand unit and overlying shaly material dip approximately 15° E., which gives a calculated 1,500 feet of sediments between the sand and the beds containing Gries Ranch fauna. If the Keasey Formation is present, it most certainly will be in this horizon. Since the top of the sand occurs beneath these shales, it can be no younger than upper Eocene.

In other areas outside the Yamhill quadrangle (Baldwin and others, 1955; Snavely and others, 1958), where fossil control has been established, the sand is unquestionably upper Eocene.

Summary and conclusions

Stratigraphic position, similar lithology, and continuity of this upper Eocene sandstone with the Spencer Formation farther south in the Willamette Valley near Helmick Hill and exposures mapped as far south as Eugene and Cottage Grove indicate that this is a singular unit. It is therefore proposed that this predominantly sandstone unit and associated upper Eocene shales in the Yamhill quadrangle be known as Spencer Formation. The type section of the Cowlitz Formation, although lithologically and stratigraphically similar to the Spencer Formation, is somewhat remote for definite correlation purposes.

The persistent trend of a mappable sandstone unit appears to have significance as a marker bed in an area composed largely of shales. This particular sandstone unit will give more precise information on the structure. It also appears to have significance as a marker horizon in the subsurface of the western Willamette Valley area. In the Cooper Mountain well 15 miles to the northeast, Texaco Cooper Mountain No. 1, a sandstone unit of upper Eocene age was penetrated from 3,420 feet to 3,570 feet, which appears to correlate with the Spencer sands cropping out in the Yamhill quadrangle.

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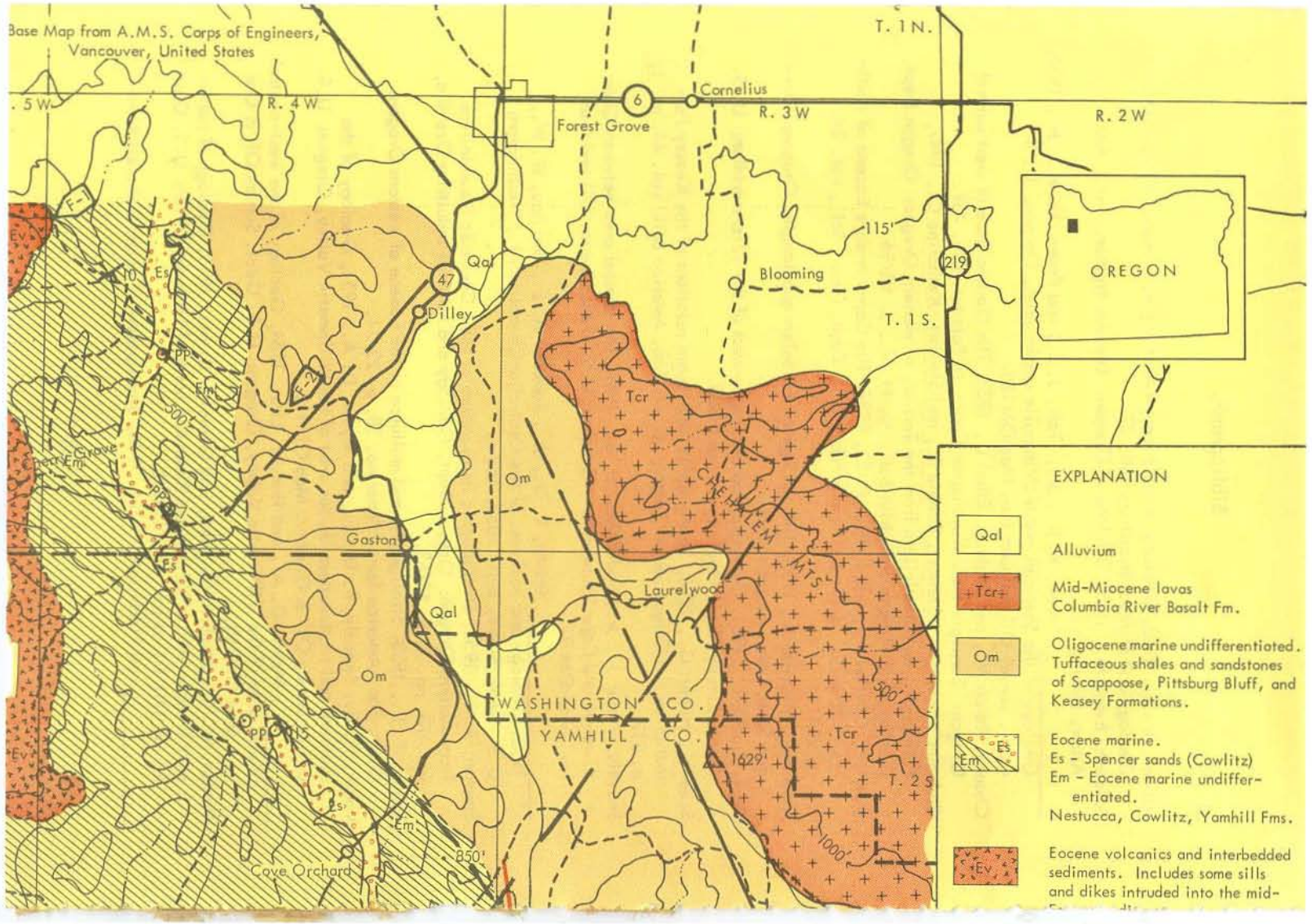
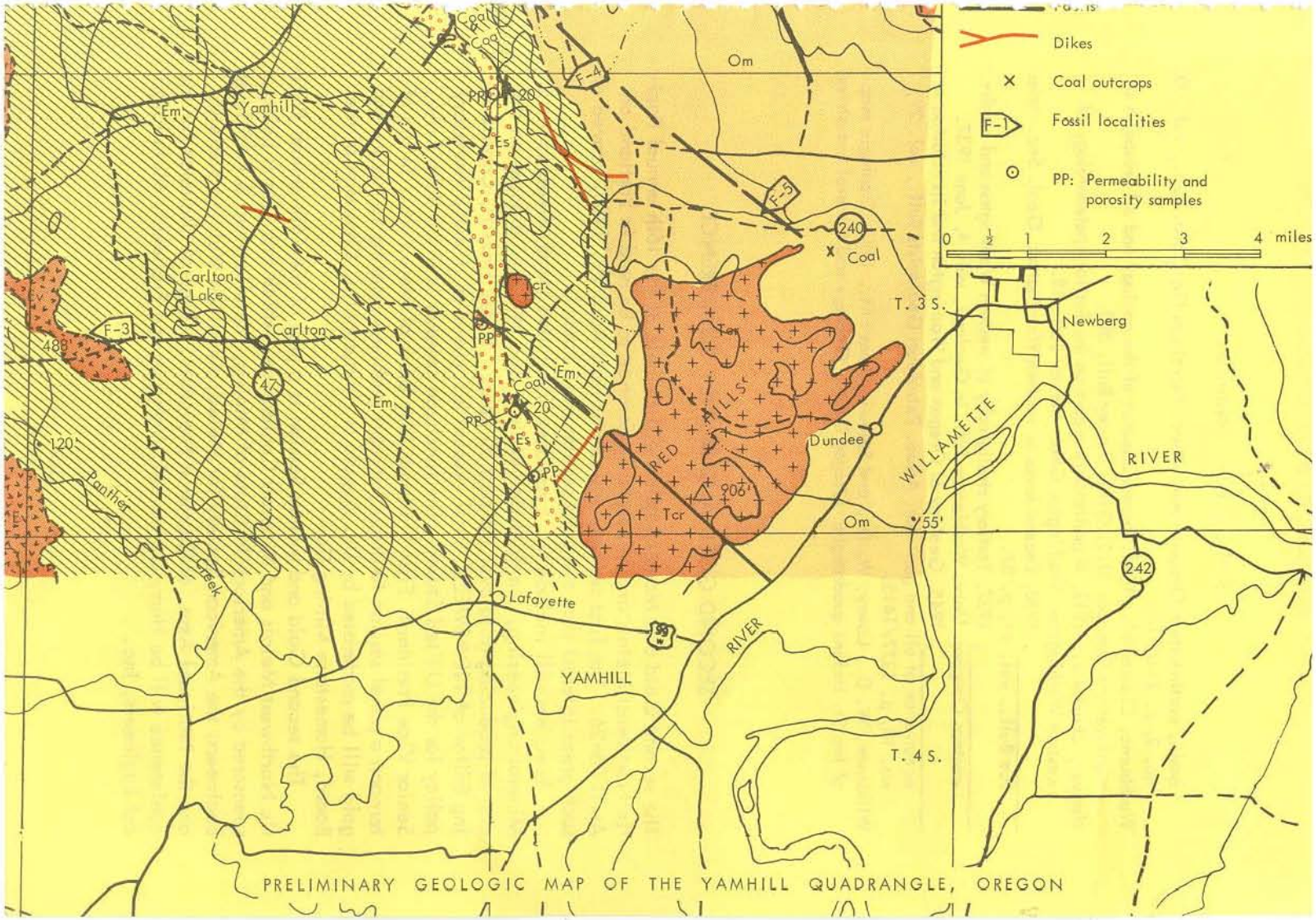

Base Map from A.M.S. Corps of Engineers, Vancouver, United States
T. 1 N.
R. 4 W
R. 3 W
R. 2 W
Cornelius
Forest Grove
Blooming
Dilley
Gaston
Laurelwood
Cove Orchard
T. 1 S.
T. 2 S.
OREGON
WASHINGTON CO.
YAMHILL CO.
Qal
Om
Tcr
Em
Es
Ev
EXPLANATION
Alluvium
Mid-Miocene lavas Columbia River Basalt Fm.
Oligocene marine undifferentiated. Tuffaceous shales and sandstones of Scappoose, Pittsburg Bluff, and Keasey Formations.
Eocene marine.
Es - Spencer sands (Cowlitz)
Em - Eocene marine undifferentiated.
Nestucca, Cowlitz, Yamhill Fms.
Eocene volcanics and interbedded sediments. Includes some sills and dikes intruded into the mid-



PRELIMINARY GEOLOGIC MAP OF THE YAMHILL QUADRANGLE, OREGON

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SECOND GOLD AND MONEY CONFERENCE

The second Gold and Money Session will be held at the 16th annual Pacific Northwest Metals and Minerals Conference to be held in Portland on April 25-26. The first session, which was held April 29, 1960, proved of such great interest that a second session was planned.

Speakers will include Dr. Evan Just (Executive Head, Department of Mineral Engineering, Stanford University), who will give a paper on the cost of producing gold over the past 50 years. Henry Hazlitt, Contributing Editor of NEWSWEEK, will present his views on a sound monetary policy for the United States. The luncheon speaker is to be John Exter, Senior Vice President, First National City Bank of New York. In the afternoon a panel session to discuss current problems relating to money and gold will be moderated by Dr. Donald H. McLaughlin, Chairman of the Board, Homestake Mining Co.

The second Gold and Money Session is a part of the 16th annual Pacific Northwest Metals and Minerals Conference, which this year is being sponsored by the American Institute of Mining, Metallurgical & Petroleum Engineers; the American Society for Metals; American Welding Society; and the National Assn. of Corrosion Engineers. General chairman for the conference will be Harry Czyzewski, Manager and President, Metallurgical Engineers, Inc.

* * * * *

THE PORTLAND EARTHQUAKE OF NOVEMBER 5, 1962

By Peter Dehlinger and Joseph W. Berg, Jr.*

The earthquake of November 5, 1962, occurred at 7:36 p.m., PST; the epicenter was in the City of Portland. A maximum intensity of VII (on the Modified Mercali Scale, 1956 version) was felt in Portland, and the shock was felt as far as 150 miles away. The estimated magnitude was 5, based on energy calculations of the P wave arrivals recorded on long-period seismograms at the Oregon State University Seismograph Station in Corvallis. The depth of focus could not be determined, but the shock is estimated to have been shallow, probably less than 10 kilometers below the surface. After the main quake a number of smaller aftershocks occurred. Some of these have been recorded at permanent seismograph stations in Corvallis and at Longmire and Tumwater, Washington, and by a portable seismic recording crew, operated in the vicinity of Portland by the Stanford Research Institute.

A group from Oregon State University went into the earthquake area the day following the shock to investigate the damage and obtain eyewitness accounts. Damage was minor, the largest occurring in Portland, where numerous chimneys were down, windows were broken, large cracks occurred in plaster, some furniture was moved, and advertising signs fell off buildings, but apparently no one was injured. A loud noise and thunderlike roar was also reported. Some individuals had difficulty standing and others reported dizziness. An isoseismal map, illustrated in the following figure, was constructed. This was based on field observations and on local newspaper accounts and telephone calls to pertinent cities and towns that were not visited. The map is nevertheless based on limited information and it portrays regional isoseismal lines only.

The earthquake was recorded at a number of seismic stations, and the recorded data are presently being analyzed. A preliminary summary of the data is described here.

The shock was recorded at the following stations, with initial P arrival times indicated by Pacific Standard Time (see Table 1).

The event was also recorded at more distant permanent stations. The seismogram amplitudes were so large at the stations in Oregon and Washington that only the initial P wave was observed, not later phases. The initial ground motion at Corvallis was down, north, and east; the records

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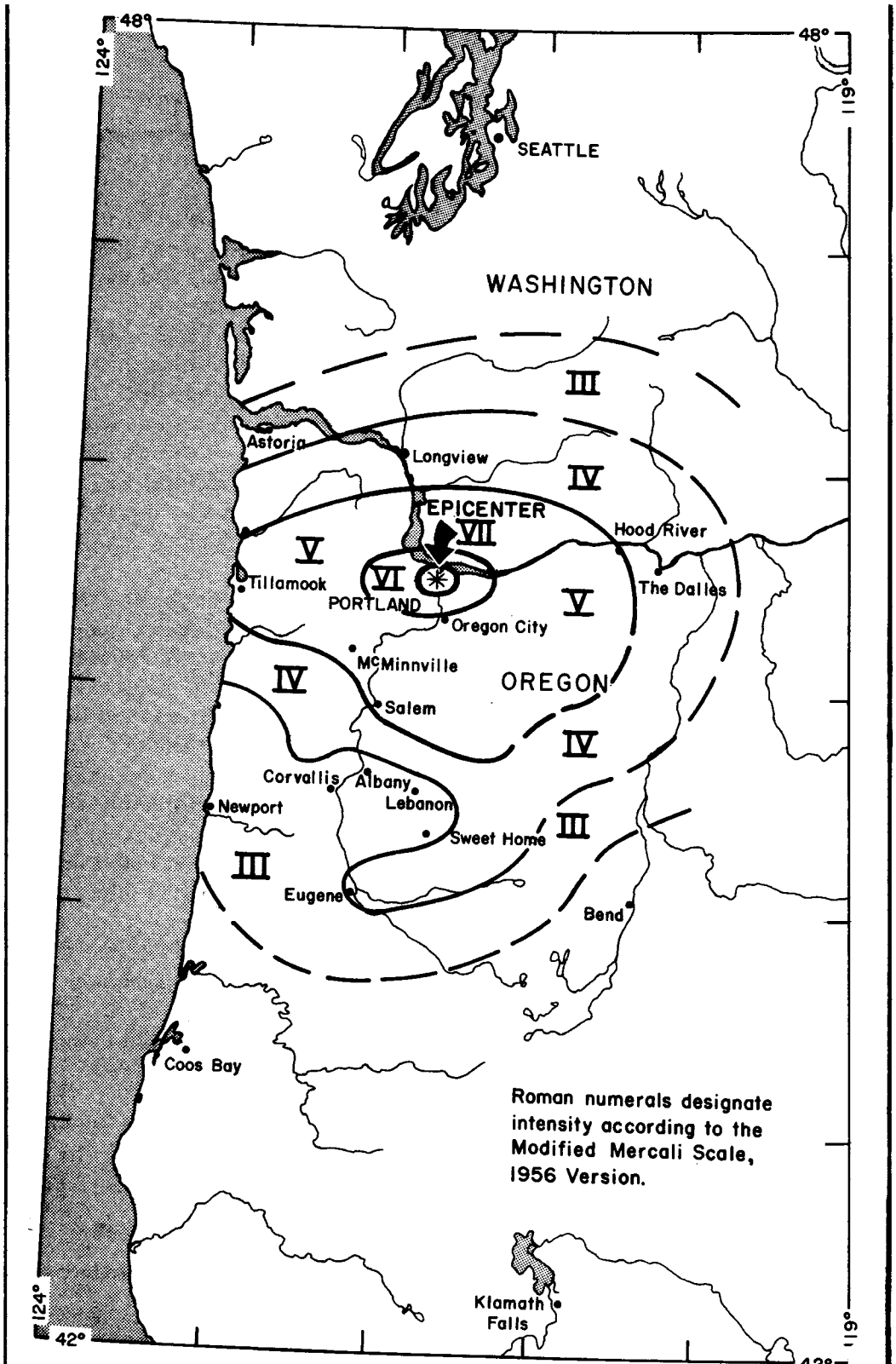

Isoseismal Map of the Portland Earthquake November 5, 1962.

from the other stations have not been studied by the authors. From the known arrival times, the shock origin time is estimated to be 19 hours, 36 minutes, 43 seconds, accurate to ±0.5 seconds.

	hr min sec		hr min sec
Corvallis, Ore.	19:37:03.6	Seattle, Wash.	:37:18.5
Baker, Ore. (Blue Mt. Seis. Obs.)	:37:42.6	Hailey, Idaho (Mobile Station)	:38:17.4
Pendleton, Ore. (Mobile Station)	:37:26.0	Winnemucca, Nev. (Mobile Station)	:38:10.8
Longmire, Wash.	:37:05.5	Berkeley, Calif. (Strawberry Station)	:38:40.9
Tumwater, Wash.	:37:06.3	Calistoga, Calif.	:38:29.2
		Point Reyes, Calif.	:38:37.3

Table 1. Selected P wave arrival times.

A number of aftershocks have occurred near the epicenter of the main shock. These ranged up to barely felt in the Portland area. Three aftershocks were recorded at Corvallis within 10 hours of the main shock. The first was at 39.1 min., the second at 1 hr. 14.7 min., and the third at 9 hrs., 51.3 min. after the main shock. The first two were also recorded at Longmire and the first at Tumwater, Wash. Later aftershocks were recorded at Corvallis: one each November 8, 9, 12, and 15. On all aftershocks the S minus P times at Corvallis were 16 to 17 seconds, the interval corresponding to that for an epicenter in Portland. Where aftershock first motions were observable at Corvallis, they were in agreement with those from the main shock--down, north, and east--indicating that the aftershock fault movements were consistent with that of the main shock.

The Standard Research Institute mobile seismic crew arrived in the Portland area on November 9 to record aftershocks and determine their epicentral locations; it began operations on the 10th. A number of aftershocks have been recorded by this crew, two of which were strong enough to be recorded also at Corvallis (November 12 and 15). The aftershock data will be studied in detail and described at a later time by Stanford Research Institute.

The seismic data from the earthquake and aftershock sequence are providing significant information on the broad crustal structure of Oregon and adjacent regions, and on some geologic problems in and around Portland. The most significant contribution concerns construction of local travel-time curves for Oregon. These will be of great importance, both for studying anomalous crustal structures and in locating accurately epicenters of other shocks, particularly those off the coast or in uninhabited land areas. The aftershock data provide significant information on active faulting in the focal region, both in identifying the existence of faults and in determining their directions of movement.

The detailed results from this shock will be reported upon at a later time. Results so far have already verified the previously suspected fact that the travel times in the Pacific Northwest vary appreciably with

azimuth, demonstrating that the region includes sharply anomalous crustal structures. This shock is the first in northwest Oregon to be recorded by the modern, uniformly calibrated, seismic instrumentation installed at several locations in the Pacific Northwest in 1962. Additional permanent seismic stations will be needed in Oregon, however, to obtain more reliable data on future shocks and to investigate adequately the anomalous regional geologic features of the Pacific Northwest.

Acknowledgments

Arrival time data supplied by the following people is gratefully acknowledged: Ray Reakes of the Blue Mountain Seismological Observatory at Baker, Oregon; Dr. E. Kaersberg of the University of Washington in Seattle; Dr. D. Tocher of the University of California at Berkeley; Warren H. Westphal of the Stanford Research Institute. Results provided by the Geotechnical Corp. of Dallas, Texas, particularly arrival times by their mobile seismological stations, have been most valuable. Discussions with Hollis M. Dole, Director of the Oregon State Department of Geology and Mineral Industries, on the geology in and around Portland have been much appreciated.

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WELL RECORDS RELEASED

The department released the Humble Oil & Refining Co. "Thomas Creek Unit" well records from its confidential files on December 8, 1962. This drilling was made in the Fremont National Forest approximately 25 miles northwest of Lakeview. Total depth reached was 12,093 feet.

* * * * *

STATE BUILDING USES OLDEST STONE IN AMERICAS

Visitors to the Portland State Office Building occasionally inquire of the Geology Department staff what the red stone that faces the lower part of the building is. The stone comes from the famous Morton Quarry in Minnesota and is a metamorphosed granite, or gneiss. Technically the proper term for the stone is a migmatite. Recent age-dating by the U.S.Geological Survey reveals that the stone is 3.2 billion years old, making it the oldest stone in the Western Hemisphere.

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LUCKY LASS URANIUM ORE SHIPPED

Loading of ore at Lakeview from the Lucky Lass uranium mine nearby began November 14. According to Don Lindsey, one of the owners, sufficient ore was stockpiled to fill four railroad cars for shipment to Vitro Chemical at Salt Lake City for reduction.

Most of the stockpiled ore had been taken from the mine during the summer and fall. A new open pit has been excavated to reach ore bodies located last spring by drilling. By mid-November the pit had reached the level of last year's mining operation. Any pay dirt found during the excavating is being stockpiled for shipment.

The Lucky Lass owners are Lindsey, Bob Adams, Clair D. Smith, and Choc Shelton. (Information from Lake County Examiner, Nov. 15, 1962.)

* * * * *

ADVISORY COUNCIL ELECTS OFFICERS

At a meeting of the Western Governors Mining Advisory Council in San Francisco September 25, J. B. Pullen, who is assistant general manager of Phelps Dodge Corp., Douglas, Arizona, was elected chairman of the council for 1963. Hollis M. Dole, Director, State of Oregon Department of Geology and Mineral Industries, was elected vice chairman, and DeWitt Nelson, Director, Department of Conservation, Sacramento, California, was elected secretary. The council decided to hold a meeting early in 1963, possibly in San Francisco.

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WITHDRAWALS CONTINUE

Since the last report in the September ORE BIN, the Bureau of Land Management has notified the department that an area in excess of 3,600 acres has been proposed for withdrawal in the State of Oregon. The withdrawals have been for the following purposes: 2,808 acres for reclamation purposes in the Illinois Valley and Evans Valley divisions of the Rogue River Basin project; 120 acres for administrative sites in the Whitman National Forest; 726 acres for 7 administrative sites in the Umatilla National Forest; and 30 acres for the Federal Aviation Agency. All withdrawals eliminate appropriation of the lands by the general mining laws.

* * * * *

NEW THESES LISTED

Enrichment of the department's reference material on the state's geologic past has been made by the acquisition of 11 graduate theses since the start of 1962. These are listed below:

Beeson, Marvin Howard, The geology of the north-central part of the Sawtooth Creek quadrangle: University of Oregon master's thesis, 92p.

Graham, Alan Keith, The Sucker Creek-Trout Creek Miocene floras of southeastern Oregon: University of Michigan doctoral thesis, 411p.

Hauck, Samuel M., Geology of the southwest quarter of the Brownsville quadrangle: University of Oregon master's thesis. 82p.

Jarman, Gary Davis, Recent foraminifera and associated sediments of the Continental Shelf in the vicinity of Newport, Oregon: Oregon State University master's thesis. 110p.

Kaiser, William R., The late Mesozoic geology of the Pearse Peak diorite, southwestern Oregon: University of Wisconsin master's thesis. 75p.

Kittleman, Laurence Roy, Jr., Geology of the Owyhee Reservoir area: University of Oregon doctoral thesis. 174p.

Lawrence, John Knowlton, The Geology of the southern third of the Sutherlin quadrangle: University of Oregon master's thesis. 100p.

Lukanuski, James Nick, Geology of part of the Mitchell quadrangle, Jefferson and Crook Counties: Oregon State University master's thesis. 90p.

McMurray, Jay Maurice, Geology of the Freezeout Mountain area, Malheur County: University of Oregon master's thesis. 87p.

Nelson, Carlton Hans, Geological limnology of Crater Lake: University of Minnesota master's thesis. 175p.

* * * * *

SUPREME COURT AFFIRMS LAKE COUNTY OWNERSHIP

Lake County's ownership of "coal, oil, gas, and other minerals on, in, or under" tax foreclosed lands sold by the county has been sustained by the Oregon Supreme Court in an order upholding a declaratory decree entered in 1961 by Circuit Judge Charles H. Foster. The decree held that Lake County has sovereign immunity against being sued in the matter without its

consent; that earlier default decrees against the county were not binding; and that, therefore, Lake County still owns the mineral rights to the lands in question.

The Supreme Court's order was written by Justice O'Connell and filed November 7. The case was that of Kern County Land Co. and Sinton & Brown Co. versus Lake County. The plaintiffs appealed to the Supreme Court, where their attorney, T. R. Conn, presented arguments October 2.

Starting in 1940, acting under a 1937 law, the Lake County court began witholding the mineral, gas, and oil rights on lands which the county foreclosed and resold. Such lands were involved in suits to quiet title brought against the county in 1946 and 1953 by the Chewaucan Land & Cattle Co., and in 1958 by the Kern County Land Co. In those cases, default decrees were entered which held that, by defaulting, the county no longer held the mineral rights and these passed to the land owners. (From an article in the Lake County Examiner for November 15, 1962.)

* * * * *

AMC ELECTS WESTERN GOVERNORS

At the American Mining Congress mining show held in San Francisco on September 24 to 27, the following were elected to the Western Board of Governors from Oregon: Fayette I. Bristol (President, Bristol Silica Co., Rogue River); Frank E. McCaslin (President, Oregon Portland Cement Co., Portland); and Veryl Hoover (Vice President, Pacific Power & Light Co., Portland).

The 1963 mining convention will be held in Los Angeles September 15 to 18, and Portland will be host to the September 13 to 16, 1964, meeting.

* * * * *

MORE WITHDRAWALS

The latter part of November, the Bureau of Land Management notified the department that 200 acres in Crook County were proposed for withdrawal from mining location and entry for "the preservation of the antiquities or archaeological values contained in the land by preventing depredations through the location of mining claims that might contain deposits of agate and jasper."

This land is in T. 19 S., R. 19 E., at the head of Camp Creek, approximately 75 miles southeast of Prineville.

* * * * *

OREGON KING MINE MAKES FIRST ORE SHIPMENT

The first carload of crude ore to be mined from the Oregon King property in Jefferson County since 1947 (see The ORE BIN for July 1962) has recently been shipped to the A.S.& R. smelter in Tacoma, Washington. According to A. R. Paige, geologist for the Glacier Bay group currently investigating the economic potential of the mine, the ore was taken from a high-grade pocket on the 200 level.

The group is in the process of clearing out the old timbers in the blocked shaft below the 200 level and is dewatering the mine in the hope that larger untapped ore bodies may be found at lower depths.

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BUREAU OF MINES ISSUES TWO PUBLICATIONS

Two publications of interest to metallurgists and mineral producers in the Pacific Northwest have just been issued by the U.S. Bureau of Mines. Information Circular 8073, "The Pacific Northwest Steel Industry," lists 21 plants which either forge, cast, or roll steel. Statistics on their production, marketing, and consumption of raw materials is given. Information Circular 8112, "Industrial Silica Deposits of the Pacific Northwest," reviews the markets, specifications, and supply of raw material. Promising deposits located in Oregon, Washington, Montana, and Idaho are covered in the report. Copies of the publications may be obtained from the Superintendent of Documents, Washington 25, D.C; I.C.8073 costing 35 cents and I.C. 8112 costing 40 cents.

* * * * *

WILDERNESS BILL DIES

When the second session of the 87th Congress adjourned on October 13, the Wilderness Bill was one of many pieces of legislation left on the table. This legislation was passed by the Senate 78 to 8 in the form of S. 174. The House of Representatives Interior Committee reported the bill out in a greatly altered form in H.R. 776, but it was never brought to the floor for vote. Wilderness legislation will undoubtedly be reintroduced in the 88th Congress. The Interior Secretary, Stewart L. Udall, has already served notice that the Administration "will press vigorously next year for action on such key conservation items of legislation as the Wilderness Bill."

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The ORE BIN
Volume 24, No. 12
December, 1962

The following two articles on the mineral clinoptilolite are significant from three standpoints: (1) the possible start of a new mining operation in Oregon; (2) the ever-widening use of minerals by science and industry today; and (3) the value of geologic mapping.

Clinoptilolite was no more than a mineralogical curiosity prior to the recent discovery of its usefulness for extracting cesium from radioactive wastes. It will be seen from reading the report by Randall E. Brown that its use could well be of great significance in helping to reduce pollution from nuclear reactors. This new application of a mineral is a very sophisticated step from the first use of mineral products by early man, who employed stones to get food and to protect him from his enemies.

The discovery of an important use for this heretofore unnoteworthy mineral exemplifies how difficult it is to evaluate realistically the mineral resources of an area. What new turn science and technology will take next and what their demands on the mineral industry will be is impossible to predict. If clinoptilolite, as it occurs in Oregon, is found suitable for the purposes described by Mr. Brown, there apparently is an enormous reserve in our state, since its host formation, the John Day tuff beds, are distributed over many thousands of square miles in central Oregon.

It is fortunate that research on the mineralogy of these beds had been done by Prof. R. V. Fisher, for without this knowledge the initial inquiry from the General Electric scientists at Hanford could not have been answered by affirmative action.

Hollis M. Dole

THE USE OF CLINOPTILOLITE

By Randall E. Brown*

Clinoptilolite**, a common but generally unrecognized zeolite mineral closely akin to heulandite, may be one answer to a vexing problem of the nuclear industry. That is waste disposal. Clinoptilolite's value lies in its ability to adsorb radioactive cesium from liquid solutions, so that the effluent can in some cases be safely discharged to the environment. Clinoptilolite then may provide the following opportunities for use: (1) a means

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**Pronounced Cly-no-ty'-lo-lite.

of removing radiocesium from wastes for more efficient and economical storage, (2) a means of isolating radiocesium in a solid form for safe storage, and (3) a form for shipping cesium to a storage or processing site.

Many radioactive wasfe streams are concentrated solutions of primarily non-radioactive salts used in chemical separations processes. Radioactive elements are chemically only trace concentrations although they pose greater disposal problems than the non-radioactive elements. Removal of the radioisotopes from high-salt wastes by normal precipitation reactions or exchange processes often is defeated by competition from the nonradioactive ions. Much of the reaction in such cases involves ions of little or no concern.

Some minerals have an affinity or selectivity for specific ions, probably because of a coincidence of size and charge of the ion and an approximate dimension of the mineral lattice. Thus, in addition to the external surface area available for adsorption, some clays and zeolites possess a large adsorption capacity on internal surfaces. Competition by non-radioactive ions for available deposition sites there is minimized. To date, the affinity of clinoptilolite for cesium appears the most important. Cesium-137, a fission product isotope prevalent in radioactive wastes, has a 30-year half-life and a low permissible body burden. Its removal from wastes and concentration in solids for maximum containment is highly desirable.

Test performance of clinoptilolite

The potential use of clinoptilolite in decontaminating radioactive wastes of Cs^{137} was first recognized by Ames [1,2] in 1959, in studies with clinoptilolite from Hector, California. Its application in permitting disposal of effluents to the environment was quickly recognized. Subsequent work by Ames, Nelson, Mercer, Haney and Honstead [3,4,5,6] demonstrated the selectivity and applicability of clinoptilolite over a wide range of conditions and for a wide variety of waste solutions. Honstead, Ames, and Nelson[6], for instance, described some laboratory experiments with simulated low-level wastes as follows:

> "...a bed of the mineral received more than 50,000 bed volumes of 'waste' and gave no cesium breakthrough. The solution used was ordinary tap water (containing 24 p.p.m. calcium, magnesium and sodium) traced with Cs^{137}. The influent was charged at a flow rate of 3 gal/ft^2 per min. The cesium capacity of the mineral in this case was more than 30 times that of the best non-specific commercial ion-exchange resin which we have examined."

Appreciable strontium decontamination of wastes was also recognized in the Hanford experiments and is ascribed in part to a replacement reaction with a small amount of calcite present in the ore. Other radioisotopes were also removed from the waste in varying degrees, probably because they reacted with impurities (montmorillonite, plagioclase feldspar, mica) and the external surfaces of the clinoptilolite.

Mathers and Watson [7] of Chalk River, Canada, extended some of the Hanford tests and achieved comparable results with higher level wastes. Two tons of clinoptilolite were used to concentrate 400 curies of Cs^{137} and 300 curies of Sr^{90} from 8200 liters of solution. The clinoptilolite, previously crushed, screened, elutriated and acid-washed, presumably contained no calcite, but achieved appreciable decontamination of Sr^{90}.

Clinoptilolite will also concentrate the Cs^{137} from high-level wastes to reduce its storage volume. Honstead, Ames, and Nelson [6] report that the cesium from 27 to 31 bed volumes of high-level waste was concentrated on a clinoptilolite bed. Neutralized high-level wastes, because of the high content of sodium salts, cannot be reduced to this volume even by evaporation to complete dryness. Moreover, indications are that clinoptilolite, a silicate, will not be adversely affected either by the radiation or heat generated by the amount of Cs^{137} that can be concentrated on it.

The concentration of cesium on clinoptilolite then offers another opportunity for use. The bed or column, suitably encased, can serve as a shipping container for subsequent storage or recovery of the cesium for commercial use. The cesium can be readily leached from the clinoptilolite by chemical treatment and the clinoptilolite regenerated. Preliminary tests indicate little degeneration with repeated cycling. The leach rate of cesium from clinoptilolite by water is, advantageously, from 1/2 to 1/10 that of cesium from some tested synthetic exchange materials. Should a container of clinoptilolite become involved in an accident, the cesium will be eluted at a slower rate than from other tested products.

Preparation and beneficiation of clinoptilolite

Clinoptilolite forms in large part by alteration of volcanic glass at low temperatures[8]. It accordingly has been found throughout the western United States where volcanic tuffs were deposited and subsequently altered. Tonnages available are huge. However, the chemical composition and physical properties of clinoptilolite, including cesium capacity and specificity, undoubtedly vary greatly from deposit to deposit, bed to bed, and even within a bed. Fortunately, clinoptilolite in some instances forms nearly monomineralic deposits of considerable regularity. Concentrations

of 80 to more than 95 per cent are not unusual. Where this occurs, the clinoptilolite need only be crushed and ground to a 10- to 50-mesh size range, screened and washed. This size range permits suitable flow-through rates and maximum use of the cesium capacity.

Mathers and Watson, and Hanford researchers, found that extensive washing and acid treatment is necessary for ores containing carbonate and water-soluble salts. Acid wastes attack the carbonates, cause gas evolution and the release of fine particles of clay and clinoptilolite, evidently held by the carbonates and salts. The fines slowly decrease the flow rate (or increase the pressure drop) and change the operating characteristics of the column prior to optimum cesium saturation. Clinoptilolite itself is markedly acid resistant compared to tested synthetic zeolites; hence, it is usable over a wider range of pH values.

Friable ores that break to smaller than 50-mesh size or that disintegrate with use because of the impurities may be finely ground and pelletized. Careful selection of the binder is important to maintain the clinoptilolite selectivity adsorption and kinetics, particularly with acid waste streams. Synthesis of clinoptilolite also is promising. However, the best or ideal clinoptilolite is not yet defined; indeed several varieties may be necessary for different waste streams. Attempts to synthesize clinoptilolite have resulted in the formation of similar or related minerals rather than clinoptilolite[9]. This suggests that clinoptilolite may be comparatively unstable, or at least that its relationships to analcite, heulandite, and montmorillonite are not yet adequately understood.

Conclusions

Clinoptilolite possesses characteristics potentially of value to the nuclear industry. Conceivably, these characteristics may be the basis of a new mining industry that would include other minerals that are specific for radioisotopes other than cesium. These minerals can not be regarded as a panacea for nuclear waste problems, but they are an important addition to waste-treatment methods available for consideration.

The work outlined in this report was performed under Contract No. AT(45-1)-1350 between the Atomic Energy Commission and General Electric Co.

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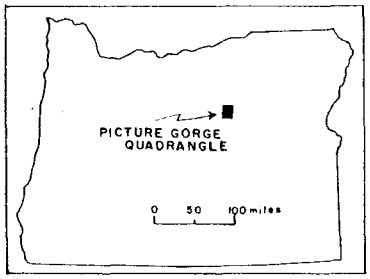
CLINOPTILOLITE TUFF FROM THE JOHN DAY FORMATION, EASTERN OREGON

By Richard V. Fisher*

A lenticular but persistent coarse-grained tuff composed almost exclusively of zeolitized shards occurs within the middle member of the John Day Formation, Picture Gorge quadrangle, of eastern Oregon. The zeolite which replaces the original glass of the shards is clinoptilolite, a sodium- and silica-rich variety of heulandite. This zeolite is of interest because of its ability to capture Cesium-137 from radioactive waste products.

The map area is located in the north-central part of the Picture Gorge quadrangle in Wheeler and Grant Counties, Oregon (Ts. 10 and 11 S., Rs. 25 and 26 E.). Accessibility to exposures of the map area is easy from Oregon Highway 19, which bisects the Picture Gorge quadrangle (see geologic map, pages 200 and 201).

*Assistant Professor of Geology, University of California at Santa Barbara, University, California.



The Deep Creek Tuff, so named for thick exposures in the vicinity of Deep Creek, is composed of more than 95 percent shards altered to clinoptilolite. It varies in thickness from one or two feet to as much as 25 feet in comparatively short distances within the central part of the Picture Gorge quadrangle. Exposures of the tuff occur in Kahler Basin (secs. 33 and 27, T. 7 S., R. 25 E.) and in the Sheep Rock area some 30 miles south of the Kahler Basin exposures. It has been observed in the Rudio Creek area (sec. 6, T. 10 S., R. 27 E.), about 6 miles east of the map area, and about 17 miles west of Rudio Creek within the Richmond quadrangle. Its minimum extent, therefore, is about 500 square miles, but doubtless extends over a far wider area. A similar thick tuff layer within about the same stratigraphic horizon crops out near Logan Butte some 50 miles to the south.

This report is an outgrowth of a study being conducted on the John Day Formation under National Science Foundation Grant No. G18642.

Stratigraphy

The John Day Formation (Oligocene? to lower Miocene) was originally divided into a lower, a middle, and an upper member by Merriam (1901). Coleman (1949) in the Picture Gorge quadrangle agreed with this general subdivision. Fisher and Wilcox (1960) in the Monument quadrangle also recognized three major members, but used slightly different stratigraphic criteria for delimiting them. Current mapping by the writer in the Kimberly and Picture Gorge quadrangles extends these members westward from the Monument quadrangle.

The John Day Formation is overlain unconformably by a thick sequence of Picture Gorge Basalt*, and south of the map area lies unconformably on Cretaceous (?) sedimentary and pre-Cretaceous (?) metamorphic rocks. Deep red volcanic siltstones of the lower member do not crop out in the map area, but, since they occur within slide blocks immediately south, they probably are not far below the prominent green-colored John Day exposures in $NE\frac{1}{4}NE\frac{1}{4}$ sec. 6, T. 11 S., R. 26 E.

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*Waters (1961) recognizes sufficient variation in the lithology of Columbia River Basalt to segregate two mappable units, the lower one of which he calls "Picture Gorge Basalt."

The green beds of the middle member, as much as 700 feet thick in the map area, are fine- to coarse-grained tuffs composed of shards and pumice fragments altered to zeolite and clays. Predominating crystals are sodic plagioclase, clinopyroxene, and magnetite. Green colors are caused by the secondary clay minerals, celadonite, and iron-rich montmorillonite. Coarse-grained tuffs within the section, except for the Deep Creek Tuff, are invariably mixed with abundant fine-grained clays.

The upper member of the formation, about 100 feet thick within the map area, is composed of massive gray volcanic siltstones overlain by cross-bedded sandstones and conglomerates. These rocks contain glass shards slightly altered to gray montmorillonite. In places, the erosion surface above the John Day Formation cuts through the formation and the overlying basalts rest directly upon the middle member.

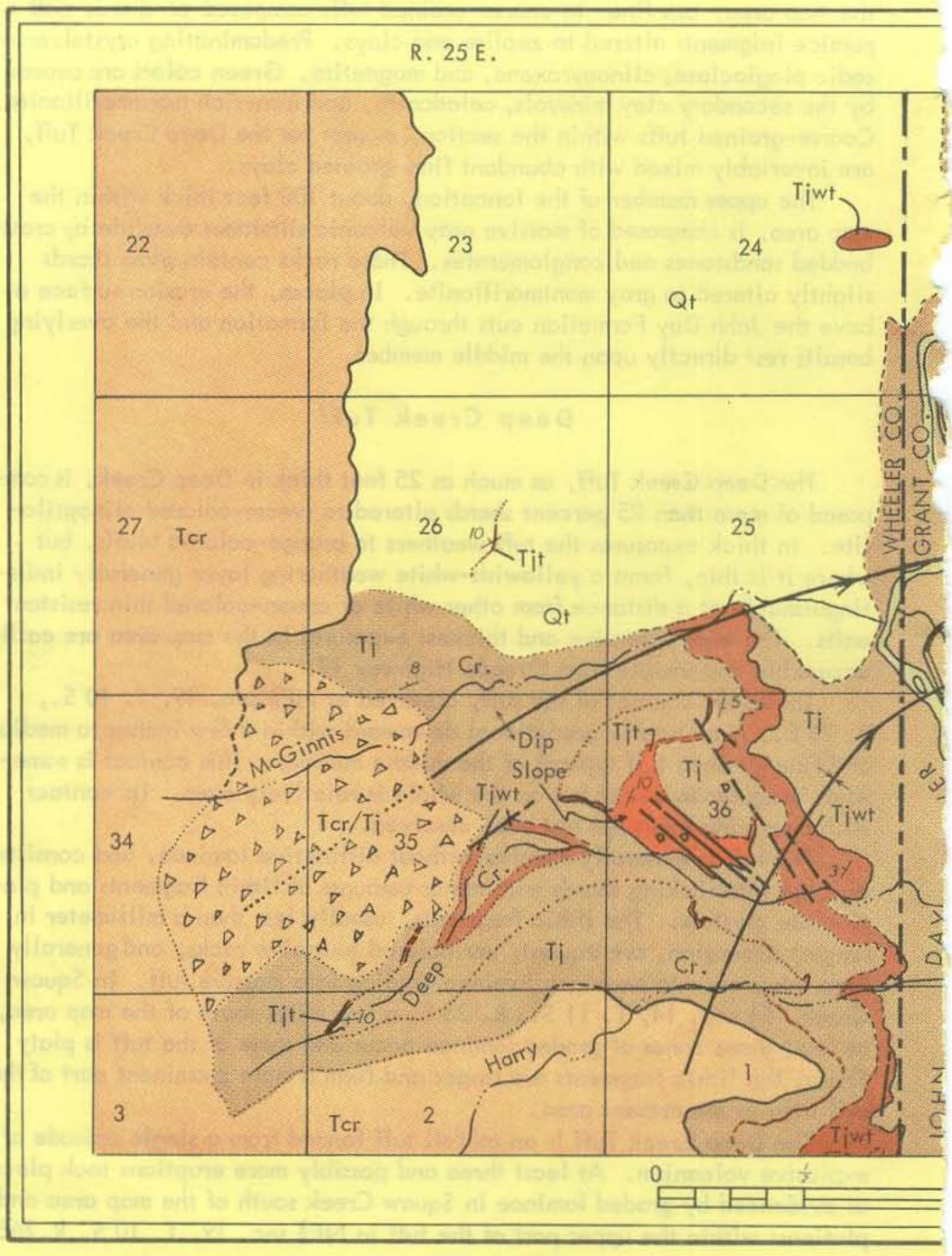
Deep Creek Tuff

The Deep Creek Tuff, as much as 25 feet thick in Deep Creek, is composed of more than 95 percent shards altered to cream-colored clinoptilolite. In thick exposures the tuff weathers to orange-colored bluffs, but where it is thin, forms a yellowish-white weathering layer generally indistinguishable at a distance from other white or cream-colored thin resistant units. The most extensive and thickest exposures in the map area are easily accessible and visible from Oregon Highway 19.

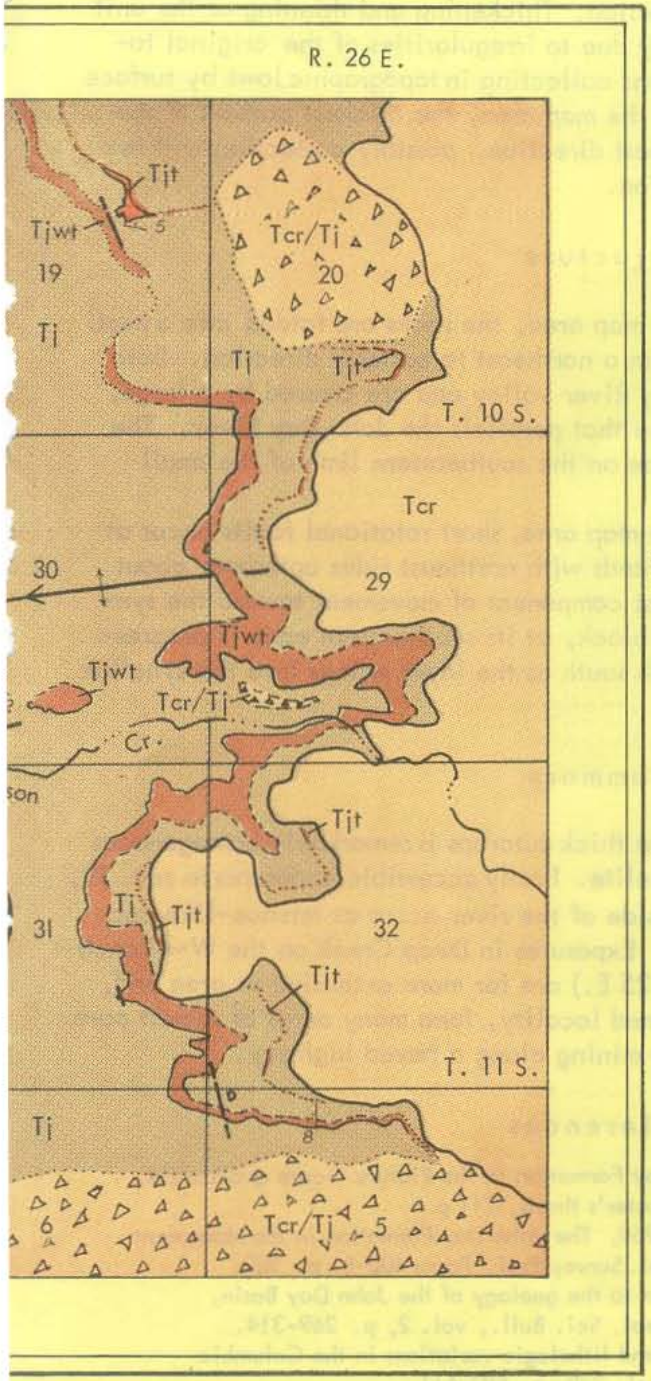
The lower contact of the tuff, observed at NE$\frac{1}{4}$ sec. 19, T. 10 S., R. 26 E., is texturally gradational downward within a few inches to medium- and fine-grained tuff typical of the middle member. This contact is somewhat irregular in detail but on the whole is relatively even. Its contact with overlying rocks has not been observed.

The tuff is generally massive without distinctive laminae, and consists of large interlocking shards with minor amounts of lithic fragments and plagioclase crystals. The lithic fragments, usually less than a millimeter in longest dimension, are equant, varicolored extrusive rocks, and generally form thin, one- to two-inch laminae grading into massive tuff. In Squaw Creek, S$\frac{1}{2}$ sec. 14, T. 11 S., R. 25 E. a few miles south of the map area, at least three zones of graded laminae occur and some of the tuff is platy. There, the lithic fragments are larger and form a more prominent part of the tuff than in the present area.

The Deep Creek Tuff is an ashfall tuff formed from a single episode of explosive volcanism. At least three and possibly more eruptions took place, as evidenced by graded laminae in Squaw Creek south of the map area and platiness within the upper part of the tuff in NE$\frac{1}{4}$ sec. 19, T. 10 S.,R.26E.



Geologic map showing distribution of



LEGEND

Quaternary

Qt

Tcr/Tj

Landslides. Other Quaternary deposits not shown.

UNCONFORMITY

Middle Miocene

Tcr

Picture Gorge Basalt

UNCONFORMITY

Lower Miocene

Tjt
Tj
Tjwt

John Day Formation Volcaniclastic rocks, Tj; welded tuff, Tjwt; Deep Cr. (Clinoptilolite) Tuff, Tjt.

Anticline showing axial trace and direction of plunge

Syncline showing axial trace and direction of plunge

D

Fault. D; downthrown side.

inoptilolite tuff.

The tuff is coarser in Squaw Creek than in the map area, suggesting that its source was from a southerly direction. Thickening and thinning of the unit within short distances is probably due to irregularities of the original topography, with thickened portions collecting in topographic lows by surface creep, rainwash, and wind. In the map area, the thickest portion of the tuff trends in a northeast-southwest direction, possibly collecting within a "valley" with the same orientation.

Structure

In the southwest part of the map area, the rocks are folded into a small anticline and syncline trending in a northeast to easterly direction. Both folds die out across the John Day River valley and are crossed by a large, later-formed north-south syncline that parallels the John Day River. The Deep Creek Tuff forms a dip slope on the southeastern limb of the small anticline.

In sections 35 and 36 of the map area, short rotational faults occur at nearly right angles to the fold trends with northeast sides upthrown about 20 to 30 feet and with the largest component of movement toward the synclinal trough. Each small fault block, at its southeastern end, is progressively higher than the next block south as the layer swings into the syncline (see photographic panorama).

Summary

The Deep Creek Tuff in most thick outcrops is remarkably homogeneous and remarkably rich in clinoptilolite. Easily accessible exposures in sec. 19, T. 10 S., R. 26 E. on the east side of the river occur as terrace-like cappings on softer John Day rocks. Exposures in Deep Creek on the W-4 Ranch (secs. 35 and 36, T. 10 S., R. 25 E.) are far more extensive in area and, together with the above-mentioned locality, form many acres of almost pure clinoptilolite available for strip mining along a paved highway.

References

Coleman, R. G., 1949, The John Day Formation in the Picture Gorge quadrangle, Oregon: Oregon State Univ. master's thesis, 211 p.

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Merriam, J.C., 1901, A contribution to the geology of the John Day Basin, Oregon: Calif. Univ. Dept. Geol. Sci. Bull., vol. 2, p. 269-314.

Waters, Aaron, 1961, Stratigraphic and lithologic variations in the Columbia River Basalt: Am. Jour. Sci., vol. 259, p. 583-611.

↑ Photograph showing small, gentle syncline and step faults in its trough. Rock layer capping terraces in foreground is Deep Creek Tuff. Dip slope on southeast limb of anticline as marked. John Day Formation shows as light-colored slopes beneath darker layers of capping Picture Gorge Basalt. View is north down John Day River valley, toward the town of Kimberly.

← Massive bed of Deep Creek Tuff showing gradation downward into finer grained middle member at NE¼ sec. 19, T. 19 S., R. 26 E.

RUSSIANS REPORTED DUMPING CHROME ORE IN U.S.

The Russians have launched what producers term economic warfare in chrome ore. It has been estimated that between 70,000 to 100,000 tons have entered the U.S. over the last three months at prices far below production costs (i.e.$15.50 l.t. for chemical grade). It is rumored that the U.S. trading companies importing the ore are doing so under private barter arrangements.

The motive behind the Russian action is unknown, but the effect is clear. Free World producers maintain they will not long be able to keep their mines operating in the face of such unfair competition. (E&MJ Metal and Mineral Markets, v. 33, no. 50, Dec. 13, 1962).

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NORTHWEST METALS AND MINERALS CONFERENCE

The 16th annual Pacific Northwest Metals and Minerals Conference will be held in Portland at the Multnomah Hotel, April 25-27, 1963. The conference will be sponsored jointly by the American Institute of Mining, Metallurgical, and Petroleum Engineers; the American Society for Metals; the American Welding Society; and the National Association of Corrosion Engineers. Technical sessions on Thursday and Friday will be divided into Minerals Branch and Metals Branch programs. Field trips to local metallurgical plants and testing laboratories and a full social schedule round out the conference program.

The success of the first Gold and Money Session, when the conference was last held in Portland in 1960, has prompted a second meeting, with Hollis M. Dole as chairman and Pierre Hines, vice-chairman. Speakers for the Gold and Money Session include: Evan Just, Head of the Department of Mineral Engineering, Stanford University; Henry Hazlitt, Contributing Editor, Newsweek Magazine; John Exter, Senior Vice-President of the National City Bank of New York; and Dr. W. J. Busschau, Chairman, Gold Fields of South Africa, Ltd. Donald H. McLaughlin, Chairman of the Homestake Mining Co., will act as moderator for the panel session on Friday afternoon. The high calibre of the Gold and Money speakers has already attracted considerable attention in gold-mining and financial circles.

Technical sessions will be devoted to a wide variety of subjects, including nuclear metals, space-age and missile metals, semi- and superconductors, the wake (or wake-up) of the domestic mining industry, transportation of industrial minerals, stockpiling of nickel, lunar geology,

oceanographic prospecting, and opportunities for the small miner. Central theme for the conference, which rotates between Portland, Spokane, and Seattle annually, is SENT - Science, Engineering, New Technologies. Harry Czyzewski of Metallurgical Engineers, Inc., is general conference chairman.

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TAX COMMISSION STUDY

The State Tax Commission has just completed a study on the taxation of severed mineral interests. The study by Donald H. Burnett, Assistant Attorney General assigned to the Tax Commission, reviews the taxation of mineral deposits of 34 states and discusses alternatives that might be explored in correcting the difficult administrative problems arising from Oregon's present system of ad valorem taxation of severed mineral interests. The study is 21 pages in length, with an 18-page appendix summarizing the 34 taxation laws. It includes Opinion 5441 by the Attorney General, which states that reserved mineral interests must be separately listed and assessed for tax purposes. The State Tax Commission's office is 412 State Office Building, Salem 10, Oregon.

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LIME PLANT TO BE BUILT IN PORTLAND AREA

Ash Grove Lime & Portland Cement Co. of Kansas City, Missouri, one of the oldest producers of burnt lime in the United States, has announced plans to erect a $3.5 million plant in the River Gate Industrial Center in the St. Johns district of Portland. The plant will have a capacity of 250 tons of lime daily. Raw material will be barged in from Texada Island, British Columbia, the same source from which Oregon Portland Cement Co. gets limestone for its Oswego cement plant.

Ash Grove plans to manufacture a complete line of burnt and hydrated lime products for existing and potential basic industries in the area. Approximately 35 persons will be employed when the plant is completed early in 1963. The new plant will be the second lime producer in the state. Chemical Lime Co. at Baker has been producing a high-quality chemical lime from limestone quarried at nearby Marble Mountain for the past 5 years.

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RECORD YEAR FOR CANADIAN EXPLORATION

This has been a record year for prospecting and exploration activity in Canada's Pacific Northwest, Thomas Elliott, manager of the British Columbia & Yukon Chamber of Mines, disclosed at the Northwest Mining Association Convention in Spokane. He said Canada's mining laws have a great deal to do with this by offering the maximum amount of encouragement both to the individual prospector and the large company.

Some 500 prospectors were active in search for new mineral deposits, he said. Many were employed by the 50 exploration companies that are spearheading the intensive program at a cost of about $5 million each year.

Twenty-five helicopters, in addition to numerous airplanes, were used to transport men and materials into isolated sections of the country, he said.

Some 50 prospectors received financial assistance under the British Columbia Prospectors' Grubstake Act and 23 two-men parties in the Yukon were given aid under a new program introduced by the Department of Northern Affairs & National Resources, Ottawa, he said.

More than 16,000 mining claims were recorded in British Columbia in the first 10 months of this year, he said.

This also has been a successful year from the standpoint of new discoveries, he said. One of the "most significant mineral discoveries ever made in Western Canada" was the finding of a large sedimentary deposit of hematite iron ore in Yukon's Snake River area, he said.

British Columbia mineral exports to Japan continue to grow, he said, and are expected to total $40 million this year. (Wallace Miner, Dec.6, 1962)

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DEPARTMENT PUBLISHES BIBLIOGRAPHY SUPPLEMENT

"Bibliography of the Geology and Mineral Resources of Oregon, Third Supplement," has been published by the department as Bulletin 53. It covers the 5-year period from January 1, 1951, to December 31, 1955. The compilers, Margaret L. Steere and Lillian F. Owen, have included all available published and unpublished reports on Oregon geology and mineral resources for this period. The 97-page bulletin contains, in addition to the bibliography, a list of the sources consulted and a subject index. Bulletin 53 may be obtained from the department's offices in Portland, Baker, and Grants Pass. The price is $1.50 postpaid.

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