

07
p.2

The Ore Bin



DEC 4 1962

Vol. 24, No. 11
November, 1962

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

● The Ore Bin ●

Published Monthly By

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

Field Offices

2033 First Street
Baker

239 S. E. "H" Street
Grants Pass

Subscription rate 50 cents per year. Available back issues 5 cents each.

Second class postage paid
at Portland, Oregon

GOVERNING BOARD

Frank C. McColloch, Chairman, Portland
Fayette I. Bristol, Grants Pass Harold Banta, Baker

DIRECTOR

Hollis M. Dole

GEOLOGISTS IN CHARGE OF FIELD OFFICES

Norman S. Wagner, Baker Len Ramp, Grants Pass

Permission is granted to reprint information contained herein. Any credit given the Oregon State Department of Geology and Mineral Industries for compiling this information will be appreciated.

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 strand-line 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 (Snively 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 Snively 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, Norbistrath, 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 Snively

CORRELATION CHART

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

<u>Sample No.</u>	<u>Location</u>	<u>Permeability (md.)</u>	<u>Porosity (%)</u>
1	SE cor. sec. 20, T. 1 S., R. 4 W.	184	36
2	SE $\frac{1}{4}$ sec. 32, T. 1 S., R. 4 W.	202	32.2
3	NE $\frac{1}{4}$ sec. 16, T. 2 S., R. 4 W.	1,130	31.7
4	SE $\frac{1}{4}$ sec. 30, T. 3 S., R. 4 W.	812	41.3
5	SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 30, T. 3 S., R. 3 W.	736	41.2
6	NW $\frac{1}{4}$ sec. 24, T. 3 S., R. 4 W.	1,850	41.1
7	NE $\frac{1}{4}$ sec. 1, T. 3 S., R. 4 W.	2,200	40.7
8	NW $\frac{1}{4}$ sec. 15, T. 2 S., R. 4 W.	4,510	41.5
9	NE $\frac{1}{4}$ SE $\frac{1}{4}$ 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. Snively (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; Snively and others, 1958), where fossil control has been established, the sand is unquestionably upper Eocene.

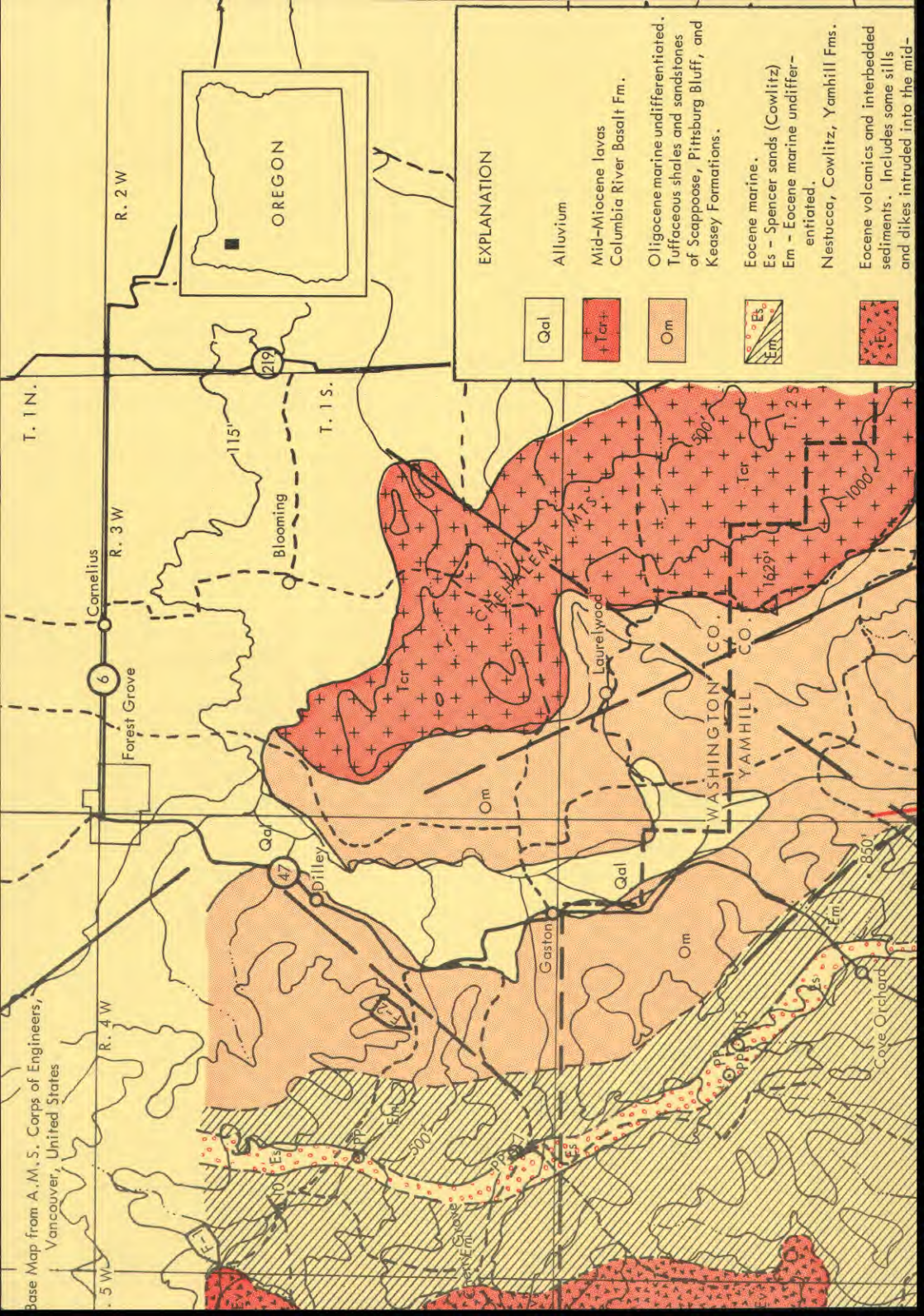
Summary and conclusions

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.

Bibliography

- Allison, Ira S., 1953, *Geology of the Albany Quadrangle, Oregon*: Oregon Dept. Geology and Mineral Industries Bull. 37.
- Baldwin, Ewart M., 1959, *Geology of Oregon*: Edwards Brothers, Inc., Ann Arbor, Michigan.
- _____, Brown, R. D., Jr., Gair, J. E., and Pease, M. H., Jr., 1955, *Geology of the Sheridan and McMinnville quadrangles, Oregon*: U. S. Geol. Survey Oil and Gas Inv. Map OM155.
- Chaney, Ralph W., and Sanborn, Ethel I., 1933, *The Goshen flora of west central Oregon*: Carnegie Inst. Washington Contr. to Paleont. Pub. 439.
- Cushman, Joseph A., Stewart, Roscoe E., and Stewart, Katherine C., 1947, *Five papers on Foraminifera from the Tertiary of western Oregon*: Oregon Dept. Geology and Mineral Industries Bull. 36, Pt. V., p. 95/96.
- Merriam, Charles W., and Turner, F. E., 1937, *The Capay middle Eocene of northern California*: Univ. California Pub., Bull. Dept. Geol. Sci., vol. 24, p. 99/114.
- Mundorff, Maurice J., 1939, *The geology of the Salem quadrangle, Oregon*: Oregon State Univ. master's thesis.
- Peck, Dallas L., 1961, *Geologic map of Oregon west of the 121st meridian*: U. S. Geol. Survey Misc. Geol. Inv. Map I-325.
- Schenck, Hubert G., 1933, *Stratigraphic and faunal relations of the Keasey Formation of the Oligocene of Oregon*: Geol. Soc. America Bull. vol. 44, pt. 1, p. 217.
- Snively, Farke D., Jr., and Vokes, H. E., 1949, *The coastal area between Cape Kiwanda and Cape Foulweather, Oregon*: U.S. Geol. Survey Oil and Gas Inv. Map OM 97.
- _____, Brown, R. D., Jr., Roberts, A. E., and Rau, W. W., 1958, *Geology and coal res. of the Centralia-Chehalis dist., Washington*: U.S. Geol. Survey Bull. 1053, 160 p.
- Stewart, R. E., 1956, *Stratigraphic implications of some Cenozoic Foraminifera from western Oregon*: Oregon Dept. Geology and Mineral Industries Ore-Bin, vol. 18, no. 7, p. 57/63.
- Turner, F. E., 1938, *Stratigraphy and mollusca of the Eocene of western Oregon*: Geol. Soc. America Spec. Paper no. 10, p. 23/24.
- Vokes, H. E., Snively, P. D. Jr., and Myers, D. A., 1951, *Geology of the southern and southwestern border area of the Willamette Valley, Oregon*: U.S. Geol. Survey Oil & Gas Inv. Map OM110.
- _____, Myers, D. A., and Hoover, Linn, 1954, *Geology of the west-central border area of the Willamette Valley, Oregon*: U.S. Geol. Survey Oil & Gas Inv. Map OM150.
- Warren, W. C., Norbistrath, Hans, and Grivetti, R. M., 1945, *Geology of north-west Oregon west of Willamette River and north of latitude 45°15'*: U.S. Geol. Survey Oil & Gas Inv. Map OM42.
- _____, and Norbistrath, Hans, 1946, *Stratigraphy of upper Nehalem River*



EXPLANATION



Alluvium



Mid-Miocene lavas
Columbia River Basalt Fm.



Oligocene marine undifferentiated.
Tuffaceous shales and sandstones
of Scappoose, Pittsburg Bluff, and
Kearney Formations.



Eocene marine.
Es - Spencer sands (Cowlitz)
Em - Eocene marine undiffer-
entiated.
Nestucca, Cowlitz, Yamhill Fms.



Eocene volcanics and interbedded
sediments. Includes some sills
and dikes intruded into the mid-

Bibliography, Continued

- basin, northwestern Oregon: Am. Assoc. Petroleum Geologists Bull., vol. 30, no. 2, p. 213/237.
- Washburne, Chester W., 1914, Reconnaissance of the geology and oil prospects of northwestern Oregon: U.S. Geol. Survey Bull. 590.
- Weaver, Charles E., 1912, A preliminary report on the Tertiary paleontology of western Washington: Washington Geol. Survey Bull. 15.
- _____, 1930, Eocene lavas in western Washington: Geol. Soc. America Bull., vol. 41, p. 87.
- _____, 1937, Tertiary stratigraphy of western Washington and northwestern Oregon: Univ. Washington Pub. in Geology, vol. 4, June 1937.
- _____, 1945, Geology of Oregon and Washington and its relation to occurrence of oil and gas: Am. Assoc. Petroleum Geologists Bull., vol. 29, no. 10, p. 1377/1415.
- Wilkinson, W. D., Lowry, W. D., and Baldwin, Ewart M., 1945, Geologic map of the St. Helens quadrangle: Oregon Dept., Geology and Mineral Industries.

* * * * *

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 Mercalli 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.

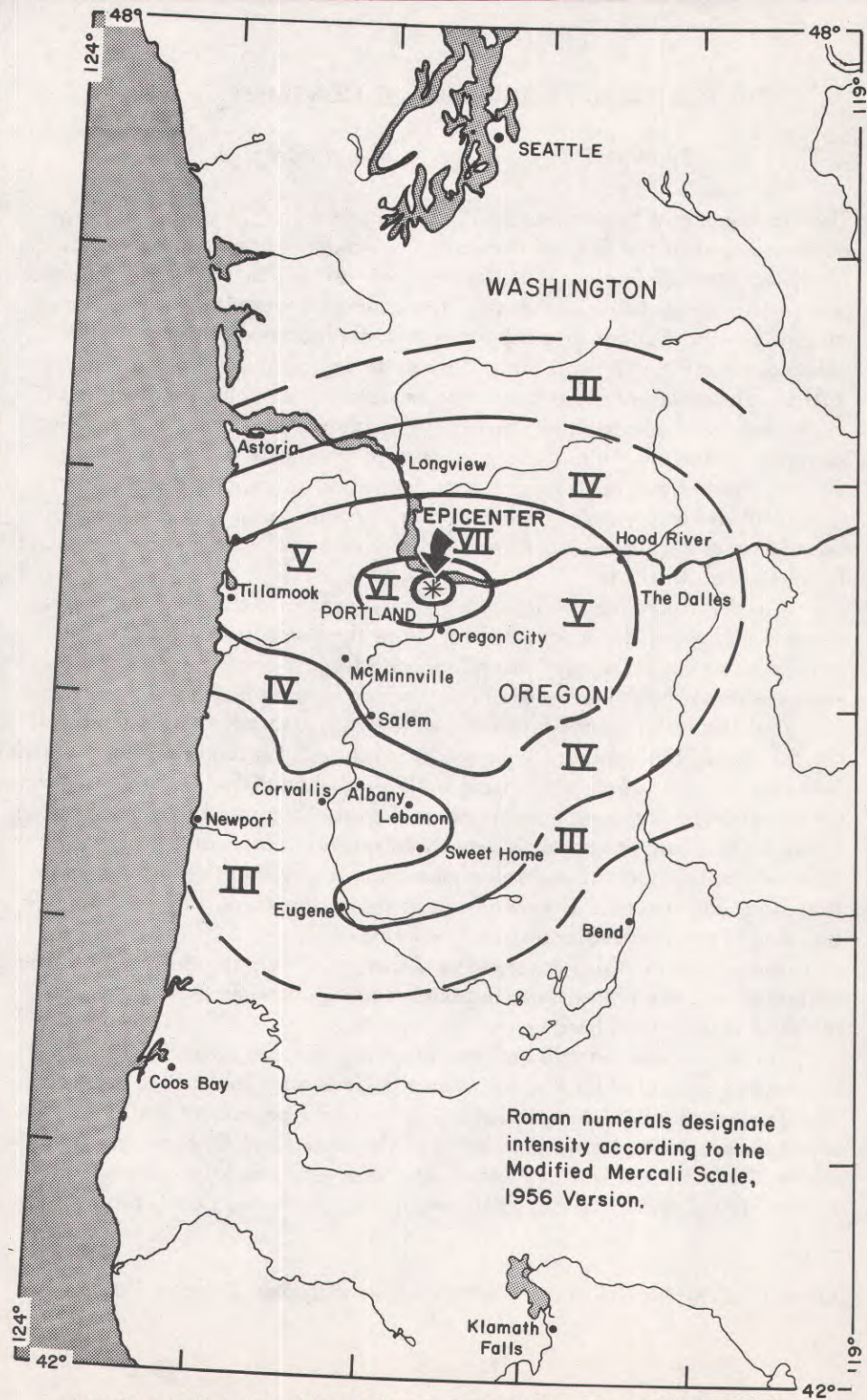
A group from Oregon State University went into the earthquake area the day following the shock to investigate the damage and obtain eyewitness accounts. Damage was minor, the largest occurring in Portland, where numerous chimneys were down, windows were broken, large cracks occurred in plaster, some furniture was moved, and advertising signs fell off buildings, but apparently no one was injured. A loud noise and thunder-like 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

*Geophysics Research Group, Dept. of Oceanography, Oregon State Univ.



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.

* * * * *

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.

* * * * *

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.

* * * * *

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 withholding 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.

* * * * *

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."

* * * * *

AVAILABLE PUBLICATIONS

(Please include remittance with order. Postage free. A complete list of publications will be mailed upon request.)

BULLETINS

8. Feasibility of steel plant in lower Columbia River area, rev., 1940: R.M. Miller	0.40
14. Oregon metal mines handbooks: by the staff	
C. Vol. II, Section 1, Josephine County, 1952 (2d ed.)	1.25
D. Northwestern Oregon, 1951	1.25
26. Soil: Its origin, destruction, preservation, 1944: W.H. Twenhofel	0.45
27. Geology and coal resources of Coos Bay quadrangle, 1944: Allen & Baldwin	1.00
33. Bibliography (1st supplement) of geology and mineral resources of Oregon, 1947: J. E. Allen	1.00
36. (1st vol.) Five papers on Western Oregon Tertiary foraminifera, 1947: Cushman, Stewart, and Stewart	1.00
(2nd vol.) Two papers on Western Oregon and Washington Tertiary foraminifera, 1949: Cushman, Stewart, and Stewart; and one paper on mollusca and microfauna, Wildcat coast section, Humboldt County, Calif., 1949: Stewart and Stewart	1.25
37. Geology of the Albany quadrangle, Oregon, 1953: Ira S. Allison	0.75
40. Preliminary description, geology of the Kerby quadrangle, Oregon, 1949: Wells, Hotz, and Cater	0.85
41. Ground-water studies, Umatilla and Morrow Counties, 1949: Norman S. Wagner	1.25
44. Bibliography (2nd supplement) of geology and mineral resources of Oregon, 1953: M. L. Steere	1.00
45. Ninth biennial report of the Department, 1952-54	Free
46. Ferruginous bauxite deposits, Salem Hills, Marion County, Oregon, 1956: R. E. Corcoran and F. W. Libbey	1.25
49. Lode mines, central Granite Mining District, Grant County, Oregon, 1959: Geo. S. Koch, Jr.	1.00
51. Twelfth biennial report of the Department, 1958-60	Free
52. Chromite in southwestern Oregon, 1961: Len Ramp	3.50

GEOLOGIC MAPS

Prelim. geologic map of Sumpter quadrangle, 1941: J.T. Pardee and others	0.40
Geologic map of the Portland area, 1942: Ray C. Treasher	0.25
Geologic map of the St. Helens quadrangle, 1945: Wilkinson, Lowry, & Baldwin	0.35
Geologic map of the Dallas quadrangle, Oregon, 1947: E. M. Baldwin	0.25
Geologic map of the Valsetz quadrangle, Oregon, 1947: E. M. Baldwin	0.25
Geologic map of Kerby quadrangle, Oregon, 1948: Wells, Hotz, and Cater	0.80
Geologic map of Albany quadrangle, Oregon, 1953: Ira S. Allison (also in Bull. 37)	0.50
Geologic map of Galice quadrangle, Oregon, 1953: F.G. Wells & G.W. Walker	1.00
Geologic map of Lebanon quadrangle, Oregon, 1956: Allison and Felts	0.75
Geologic map of Bend quadrangle, and reconnaissance geologic map of central portion, High Cascade Mountains, Oregon, 1957: Howel Williams	1.00
Geologic map of the Sparta quadrangle, Oregon, 1962: Harold J. Prostka	1.50
Geologic map, Mitchell Butte quadrangle, Oregon, 1962: R.E. Corcoran et al.	(In press)
Geologic map of Oregon west of 121st meridian (over the counter)	2.00
folded in envelope, \$2.15; rolled in map tube \$2.50	

(Continued on back cover)

Dr. James L. Calver, State Geologist
 Virginia Division of Mineral Resources
 Box 3667, University Station
 Charlottesville, Virginia

State of Oregon
 Department of Geology & Mineral Industries
 1069 State Office Bldg., Portland 1, Oregon
 POSTMASTER: Return Requested

The Ore Bin

Available Publications, Continued:

SHORT PAPERS

2. Industrial aluminum, a brief survey, 1940: Leslie L. Motz	0.10
4. Flotation of Oregon limestone, 1940: J.B. Clemmer & B.H. Clemmons	0.10
7. Geologic history of the Portland area, 1942: Ray C. Treasher	0.25
12. Prelim. report, high-alumina iron ores, Washington County, Oregon, 1944: Libbey, Lowry, and Mason	0.15
13. Antimony in Oregon, 1944: Norman S. Wagner	0.25
17. Sodium salts of Lake County, Oregon, 1947: Ira S. Allison and Ralph S. Mason	0.15
18. Radioactive minerals the prospectors should know (2d rev.), 1955: White and Schafer	0.30
19. Brick and tile industry in Oregon, 1949: J.E. Allen and R.S. Mason	0.20
20. Glazes from Oregon volcanic glass, 1950: Charles W. F. Jacobs	0.20
21. Lightweight aggregate industry in Oregon, 1951: Ralph S. Mason	0.25
22. Prelim. report on tungsten in Oregon, 1951: H.D. Wolfe & D.J. White	0.35
23. Oregon King Mine, Jefferson County, 1962: F.W. Libbey & R.E. Corcoran	1.00

MISCELLANEOUS PAPERS

1. Description of some Oregon rocks and minerals (to accompany school mineral sets), 1950: Hollis M. Dole	0.40
2. Key to Oregon mineral deposits map, 1951: Ralph S. Mason	0.15
3. Facts about fossils (reprints), 1953	0.35
4. Rules and regulations for conservation of oil and natural gas (rev.ed.), 1955	0.50
5. Oregon's gold placers (reprints), 1954	0.25
6. Oil and gas exploration in Oregon, 1954: R. E. Stewart	1.00
6. (Supplement) Oil and gas exploration in Oregon, 1960: V.C. Newton, Jr.	0.35
7. Bibliography of theses on Oregon geology, 1959: H. G. Schlicker	0.50
8. Well records of oil and gas exploration in Oregon, 1960: V.C. Newton, Jr.	0.25

MISCELLANEOUS PUBLICATIONS

Oregon mineral deposits map (22 x 34 inches) rev., 1958	0.30
Oregon quicksilver localities map (22 x 34 inches) 1946	0.30
Landforms of Oregon: a physiographic sketch (17 x 22 inches) 1941	0.25
Index to topographic mapping in Oregon, 1958	Free
Index to published geologic mapping in Oregon, 1960	Free
Geologic time chart for Oregon, 1961	Free