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FOSSIL WOODS OF OREGON

By
Wallace Eubanks*

Oregon is noted for its abundance of fossil wood, or petrified wood, as it is commonly called. This silicified material is scattered through Tertiary volcanic and alluvial rocks; some of it is in place and some has been transported from its original source. Until fairly recently, interest in fossil wood was focused on its use as a decorative rock for gem stones and building materials. But with the increased appreciation for the value of fossil plants as an aid in dating geologic formations, the identification of fossil woods has taken on a new significance.

Many persons who visit the Department offices ask for information on how to identify fossil wood, and are usually disappointed to find that not only are there no books on the subject, but that it is a specialist's field requiring microscopic study and a knowledge of botany and wood structure. Consequently it seems desirable to call on one of the few fossil-wood specialists in this area to supply some basic information on fossil woods and their identification.

Mr. Wallace Eubanks, who is a forester by profession, has made the study of fossil woods a serious hobby. As a result, he has become something of an authority in the field, and his opinion on identification and age of fossil wood is sought by many. In this report he introduces the methods of wood identification and describes fossil woods he has identified from the Thomas Creek area in Linn County. Future studies by Mr. Eubanks on fossil woods in Oregon will be published in similar reports in THE ORE.-BIN. (Editor)

Identifying Fossil Woods

The purposes of identifying fossil woods are to aid in geological dating; to verify and supplement identification of fossil leaves, fruits, and flowers; to trace the movement of plant associations through time and across land areas; and to satisfy the curiosity of man.

Fossil wood, to be identifiable, must show clear and undistorted cell structure. Much of the fossil wood commonly collected in Oregon shows poor structure because the cells have been either crushed during geological changes in the earth or destroyed by chemical processes. In general, the ordinary grey-brown woods of western Oregon, as well as the black carbonized woods, have good cell structure. But most of the colorful eastern Oregon woods, which are usually highly agatized or opalized, have lost their identifiable characteristics. The wood best suited to polishing is usually the poorest for identification.

It should be pointed out at the start that identification of fossil woods is based entirely on comparison with living woods. No book on fossil-wood identification has as yet been published.

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Identifying fossil woods is a painstaking job and sometimes frustrating because many fossil woods have no exact living counterpart. Furthermore, they lack the useful characteristics of living woods, such as weight, color, odor, taste, and hardness.

Since the system of plant classification and nomenclature established for living plants is also used for fossil plants, standard textbooks of botany will supply this basic information. In addition, books on living woods will furnish detailed descriptions of wood anatomy and nomenclature (see bibliography).

Although it is possible, with a little practice, to recognize a few types of fossil woods without a microscope, comprehensive work requires magnification ranging from 30 to 400 power. The reason for this is that woods are differentiated on the basis of certain cell types and arrangements, and these features are visible only under considerable magnification. For example, the woods of Acer (maple) and Cornus (dogwood), which are very similar, can be distinguished only by examining the cells of the rays. Likewise, Pinus (pine) and Picea (spruce), which also look very much alike, can be distinguished only by observing the nature of the epithelial cells around the resin ducts.

In order to study the features of fossil wood with a microscope, it is first necessary to prepare thin sections of the three standard views of wood structure; namely, the cross, radial, and tangential sections (Fig.1). Orienting the cuts to obtain these three views of the cell structure is the most difficult part of making the thin sections. The cut sections are ground to a thickness of only one or two cells so that light will pass through and the details of each kind of cell will be made visible. All three views are then placed on one slide.

The next step is to determine whether the wood is hardwood or conifer by inspecting it under low magnification (Fig.2). After this distinction has been made, the minute details of cell arrangement are studied under the microscope. For most hardwoods, a microscope with 150 power is adequate, but for conifers, 350 to 400 power is necessary for observation of the cross-field pitting.

By means of keys to the features of wood anatomy, together with published descriptions and photomicrographs of known woods, it is possible to arrive at an identification of a particular piece of fossil wood. As a general rule, however, fossil-wood identification is limited to determination of genera only.

Fossil Woods of the Thomas Creek Area

The Thomas Creek area includes the Thomas Creek drainage and the Jordan Creek drainage above the confluence of those two streams in Ts.9 and 10 S., Rs.1 and 2 E., Linn County, Oregon (see map, p.68).

Fossil wood in this area is unique in that most of it is in place where it grew some thirty million years ago. Many stumps and logs ranging from 1 to 4 feet in diameter are imbedded in tuff exposed by erosion of the covering material. Some are carbonized while others are silicified or partly opalized. The stumps and logs occur as single scattered specimens and also in groups of two or three. In the bed of Thomas Creek there is one unusual group of 17 stumps.

A study of the fossil woods in this area has revealed 13 genera, 3 of which are conifers (Pinus, Sequoia, and Tsuga), while the remainder are hardwoods. They are listed below in alphabetical order with the common names added.

1. Alniphyllum - (Japanese)
2. Carpinus - hornbeam
3. Carya - hickory
4. Cinnamomum - cinnamon
5. Diospyros - persimmon
6. Fagus - beech
7. Fraxinus - ash
8. Pinus - pine
9. Platanus - sycamore
10. Quercus - oak
11. Reptonia - gargura (Indian)
12. Sequoia - redwood
13. Tsuga - hemlock

CROSS SECTIONS OF FOSSIL WOODS

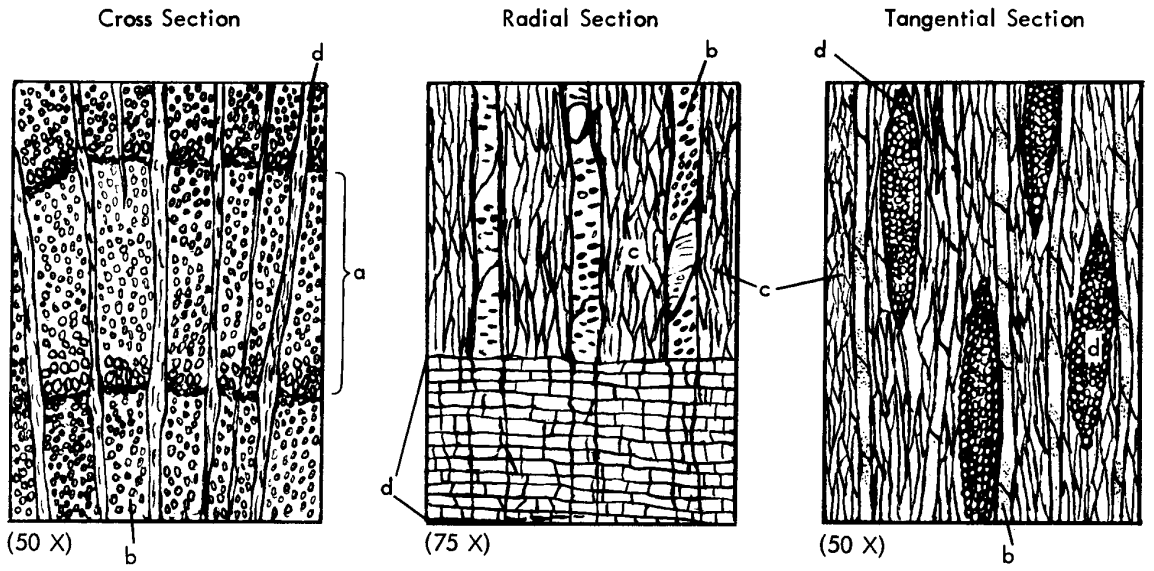


FIGURE 1: - Three standard views of Platanus (sycamore) wood: a) annual growth; b) vessel; c) fiber; d) multiseriate ray.

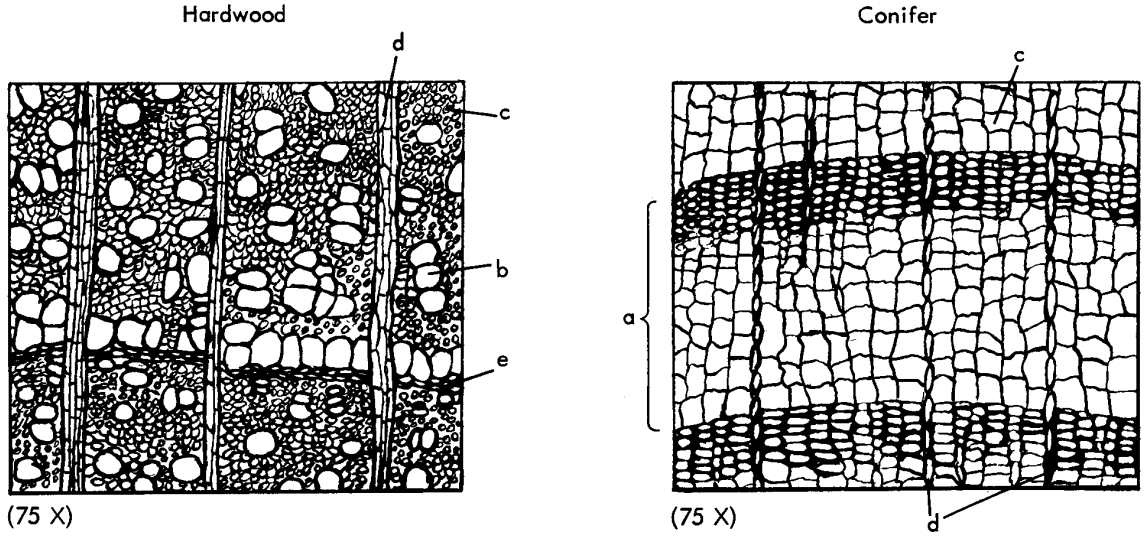
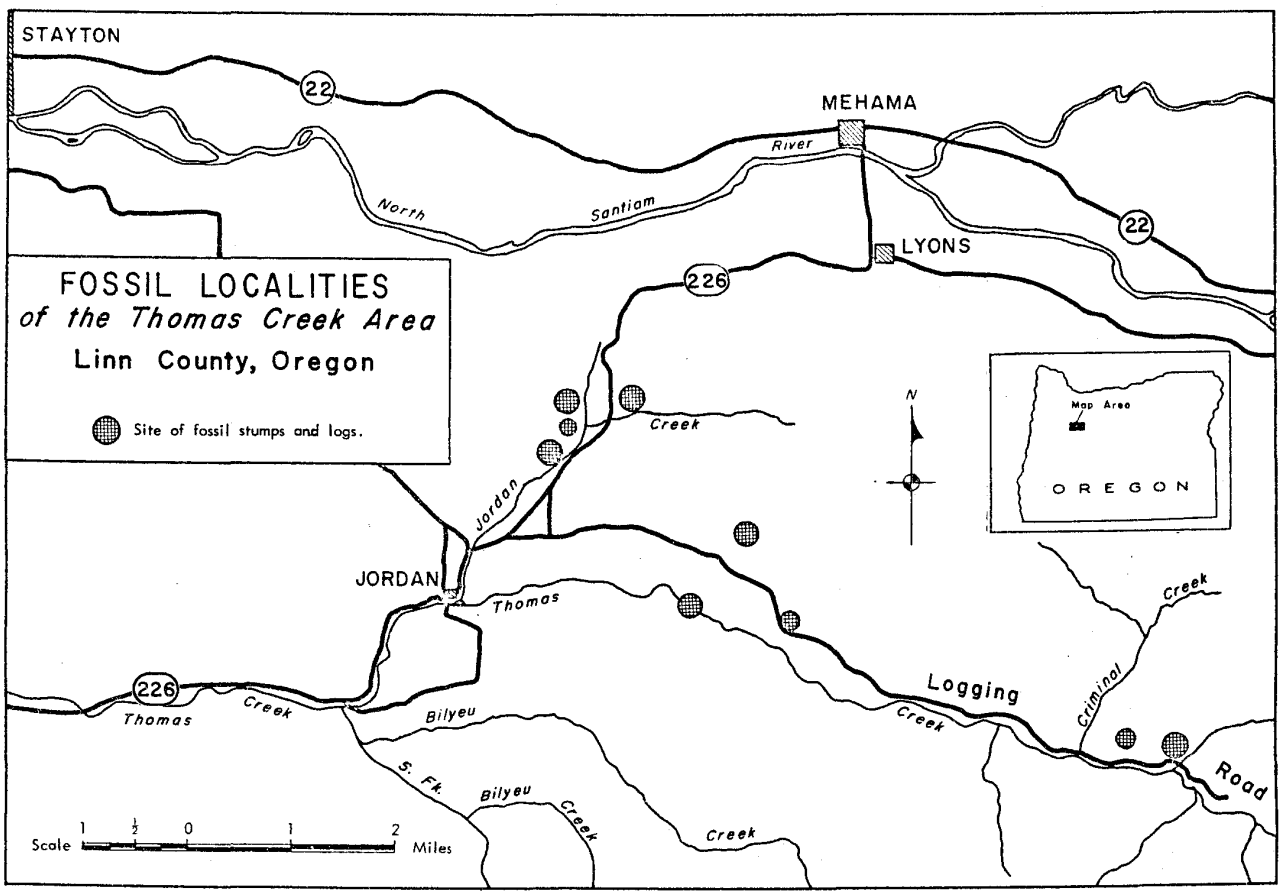


FIGURE 2: - Cross sections of typical conifer and hardwood: a) annual growth; b) vessel; c) fiber; d) multiseriate ray; e) parenchyma.



In addition to the genera listed, several other kinds of wood were found that could not be identified because of poor cell structure or because of lack of comparable living woods. Most of these are believed to be conifers.

The most abundant fossil woods in the Thomas Creek area are Sequoia and Platanus. Indeed, it is a rare plant locality in western Oregon that does not produce these two woods. It should be noted, however, that the specimens of fossil wood identified as Sequoia may be instead Metasequoia, or dawn redwood, as the distinctive needles and cones of Metasequoia are frequently found in the fossil leaf beds of this region. The living woods of these two trees are nearly identical, and the fossil forms are rarely distinguishable. Although ginkgo leaves occur in the area, no fossil ginkgo wood was found among the identifiable material.

A significant change has occurred in the forests of the Thomas Creek area since the time when the fossil plants were growing there. Of the genera listed above, only ash, oak, and hemlock are now present in the Thomas Creek area; the remainder grow in other regions, some very distant. Metasequoia, the fossil remains of which are abundant in Oregon, lives today only in remote parts of China. Sequoia, or coast redwood, a common fossil in the western margin of the Cascade Range of Oregon, now grows only in the fog belt of northern California and extreme southwestern Oregon. The majority of the hardwoods listed now live in warm-temperate to semi-tropical climates, although there is considerable latitude in their natural habitat, depending on species. As a whole, the fossil woods of the Thomas Creek area indicate a mild, moist climate averaging somewhat warmer than at the present time.

Smith (1958) has studied the geology of part of the Thomas Creek area and has mapped the plant-bearing tuff as part of the Mehama formation of Oligocene to Miocene age. His dating was based on fossil leaf assemblages and stratigraphic relationships of the rocks. The present study of the fossil woods offers no reason to dispute this age interpretation.

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MINERS BEWARE

Two bills recently introduced into the Senate will be detrimental to the mining industry if passed. The bills, quoted from the American Mining Congress Legislative Bulletin for July, are as follows:

S. 3791 - Rights of Way over National Forest Lands - Magnuson (Wash.). Committee on Public Works. Would authorize the Secretary of Agriculture to (1) require payment of fees for use and maintenance of national forest roads and trails; (2) grant easements for specified periods of time or otherwise in, upon, across, and over lands administered by the Forest Service for rights of way for roads upon such terms and conditions as he may deem are in the public interest; and (3) enter into agreements to exchange hauling rights or rights of way and easements for roads with those who own, control, or use lands intermingled with or adjacent to lands administered by the Forest Service and where mutual needs for access exist and notwithstanding any other provisions of law, to condition the grant of any right of way or permission to cross Forest Service lands upon the granting to the United States of rights or permission to cross lands owned, controlled, or used by the applicant to the extent the Secretary deems necessary and to make or receive reasonable compensation for such rights or permission.

S. 3809 - Establish National Wilderness Preservation System - Murray (Mont.). Committee on Interior and Insular Affairs. Somewhat similar to S. 1123 by Senator Humphrey (Minn.) and 17 others, but incorporates various amendments offered during Committee consideration of S. 1123. Would establish a National Wilderness Preservation System "for the permanent good of the whole people" composed to a large extent of national forest areas which are now open to prospecting and mining under the general mining laws.

As in previous versions of Wilderness legislation, would provide that generally "no portion of any area constituting a unit of the Wilderness System shall be used for any form of commercial enterprise....within national forest areas included in the Wilderness System....the President may within a specific area and in accordance with such regulations as he may deem desirable, authorize prospecting (including exploration for oil and gas), mining (including the production of oil and gas)....upon his determination that such use or uses in the specific area will better serve the interests of the United States and the people thereof than will its denial."

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VACATIONERS WARNED ABOUT ABANDONED MINE WORKINGS

With the advent of the summer vacation period, Marling J. Ankeny, Director of the U.S. Bureau of Mines, cautions adventuresome persons to avoid exploratory trips into abandoned mines, regardless of type or location. Abandoned or idle mines can harbor pockets of dangerous gases and deep pools. They also can be deficient in life-giving oxygen and sometimes are frequented by poisonous snakes seeking refuge from the heat. Another hazard is that unsupported rock may give way without warning, injuring or trapping the unwary.

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NEW DRILLING PERMITS ISSUED

The Department issued drilling permit No. 41 to Ross R. Mitchell and Associates on July 5, 1960. The well will be another shallow test and the third drilling by Mitchell on the Bliven farm south of the town of Dallas. The surveyed location of the well site was given as 1290 feet north and 140 feet west from the southeast corner of sec. 10, T.8 S., R.5 W., Polk County.

Permit No. 42 was issued by the Department to the Humble Oil and Refining Company on July 6, 1960. The company will drill on a large block of land in southern Lake County which is combined into a Unit Lease Agreement. The drilling will be in the NE$\frac{1}{4}$ sec. 18, T.36 S., R.18 E., Lake County, and will be called Thomas Creek Unit, Block III, well No. 1.

Permit No. 43 was issued to Ross R. Mitchell and Associates on July 12, 1960. The drilling is a continuation of Mitchell's shallow exploration program. It will take place on the Raymond H. and Millie L. Adams property. The survey shows the location to be 3725 feet west and 475 feet south from the northeast corner of sec. 15, T.8 S., R.5 W., Polk County, and is called the Adams - Bliven No. 4.

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OPEN-FILE REPORT ON GEOLOGY OF WESTERN CASCADES

The Department has recently received an unpublished open-file report from the United States Geological Survey entitled "Geologic reconnaissance of the Western Cascades in Oregon north of latitude 43 degrees," by Dallas L. Peck. The report has 232 typewritten pages, a geologic map, cross sections, and numerous figures and tables. It may be consulted at the Department's office, 1069 State Office Building.

The project of mapping the Western Cascades is part of a long-range cooperative program between the USGS and the Department to prepare a geologic map of Oregon. Field work was done between 1954 and 1957 by Peck and others, utilizing parts of earlier geologic mapping where such was available. Mr. Peck's detailed report, which covers stratigraphy, structure, economic geology, petrography, and other aspects of the Western Cascades rocks, served also as his doctoral thesis at Harvard University.

In the summary of his report, Peck outlines the geology of the area as follows: "The volcanic rocks of the Western Cascades consist of deformed and partially altered continental flows and pyroclastic rocks, the ages of which range from late Eocene to late Miocene, as determined chiefly from fossil plants from more than 50 localities. The volcanic rocks overlie or interfinger westward with marine sedimentary rocks, and in the southwestern part of the map area overlie pre-Tertiary plutonic and metamorphic rocks of the Klamath Mountain province."

Persons consulting this report may find the terminology somewhat confusing because well-established formational names such as Fisher, Mehama, and Rhododendron have been replaced by the less familiar names of Colestin, Little Butte, and Sardine.

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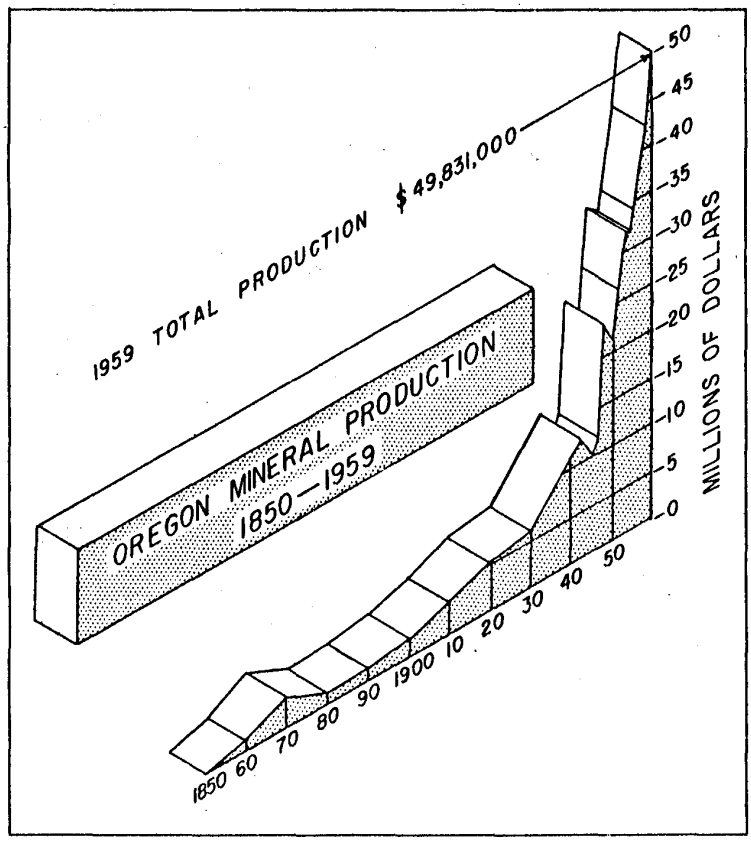
STATE MINERAL PRODUCTION CONTINUES TO RISE

By Ralph S. Mason*

The value of Oregon's mineral production in 1959 increased a healthy 10 percent over the previous year, figures just released by the U.S.Bureau of Mines reveal (see Table 1, next page). This is in sharp contrast to the decline reported by the federal bureau at year's end. The revised total of $49,800,000 raises the value of the mineral industry in the state to the highest point ever.

Bureau personnel, in explaining the $10,000,000 discrepancy between the two figures, pointed out that several state and federal agencies which were large users of crushed stone, rip-rap, fill material, and sand and gravel for dam and highway construction during the year did not report their consumption figures until after the Bureau had published its preliminary annual report in mid-December.

A 73-percent increase in the use of sand and gravel pushed the state total output of this commodity to slightly over 18 million tons valued at $15½ million, an increase of $5.3 million over 1958. Dam construction by the U.S.Army Corps of Engineers was largely responsible for the increase. Production of stone, while decreased in tonnage, showed a gain of $600,000 due to increased cost of production. This trend was in contrast to that reported for sand and gravel, which showed a decrease in unit value of over 12 percent. Use of large quantities of low-cost fill material in dam construction reported as sand and gravel accounts for the decreased value per ton.



Employment in the mining and metallurgical industries in the state during 1959 was 10,191, the Oregon Employment Department reported (see Table 2, next page). This figure does not represent the entire number of persons engaged in these industries, however, as it includes only those covered by unemployment compensation in job classifications such as miners, muckers, and mill men. The total number of workers who earn their living directly from the mining and metallurgical industry is not known, but it would be much larger than the figures reported. If the wages of those workers who are indirectly employed by the industry were also added, the total would be nearer $100 million than the $61,431,000 reported for 1959.

A breakdown of the Employment Department figures for last year shows that employment payrolls in mining decreased about 6 percent; production of stone, clay, cement, and similar products increased 10 percent; smelting, rolling, and finishing of primary metals increased 15.6 percent; and the state total gained 10.8 percent.

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

In reviewing the above figures the Department realizes that an apparent disparity exists between the value of the state's mineral production of nearly $50 million and the reported total payrolls figure of $61.4 million. One reason for this lies in the fact that the figure for mineral production does not include the value of any metals or electric furnace products processed in the state, while the payroll total includes a portion of the workers engaged in producing these materials. Products falling into this category are nickel, aluminum, silicon, hafnium, zirconium, tantalum, columbium, titanium, uranium yellow cake, calcium carbide, and ferrosilicon. The Department also believes that the value figures released by the Bureau of Mines are more nearly preresentative of raw costs than value at point of use or point of sale. A more realistic picture of the state's mining and metallurgical industry would be presented if the latter values were used.

Table 1

Mineral Production in Oregon, 1958 - 1959 1/

Mineral	1958 Short tons (unless otherwise stated)	1958 Value (thousands)	1959 Short tons (unless otherwise stated)	1959 Value (thousands)
Chromite - gross weight	4,133	2/	-	-
Clays - thousand short tons	252	$293	294	$308
Copper (recoverable content of ores, etc.)	10	5	-	-
Gold (recoverable content of ores, etc.) - troy ounces	1,423	50	686	24
Lead (recoverable content of ores, etc.)	1	3/	-	-
Mercury - 76-pound flasks	2,276	521	1,224	278
Nickel (content of ore and concentrate)	12,697	2/	12,374	2/
Pumice and volcanic cinder - thousand short tons	138	331	2/	2/
Sand and gravel - thousand short tons	10,464	10,265	18,087	15,506
Silver (recoverable content of ores, etc.) - troy ounces	2,728	2	242	3/
Stone - thousand short tons	4/ 15,077	4/ 15,621	13,341	16,126
Value of items that cannot be disclosed: Carbon dioxide, cement, diatomite, gem stones, iron ore (pigment material) 1959, lime, uranium (1959), and values indicated by footnote 2.		19,311		18,596
Total 5/		4/ 45,190		49,831

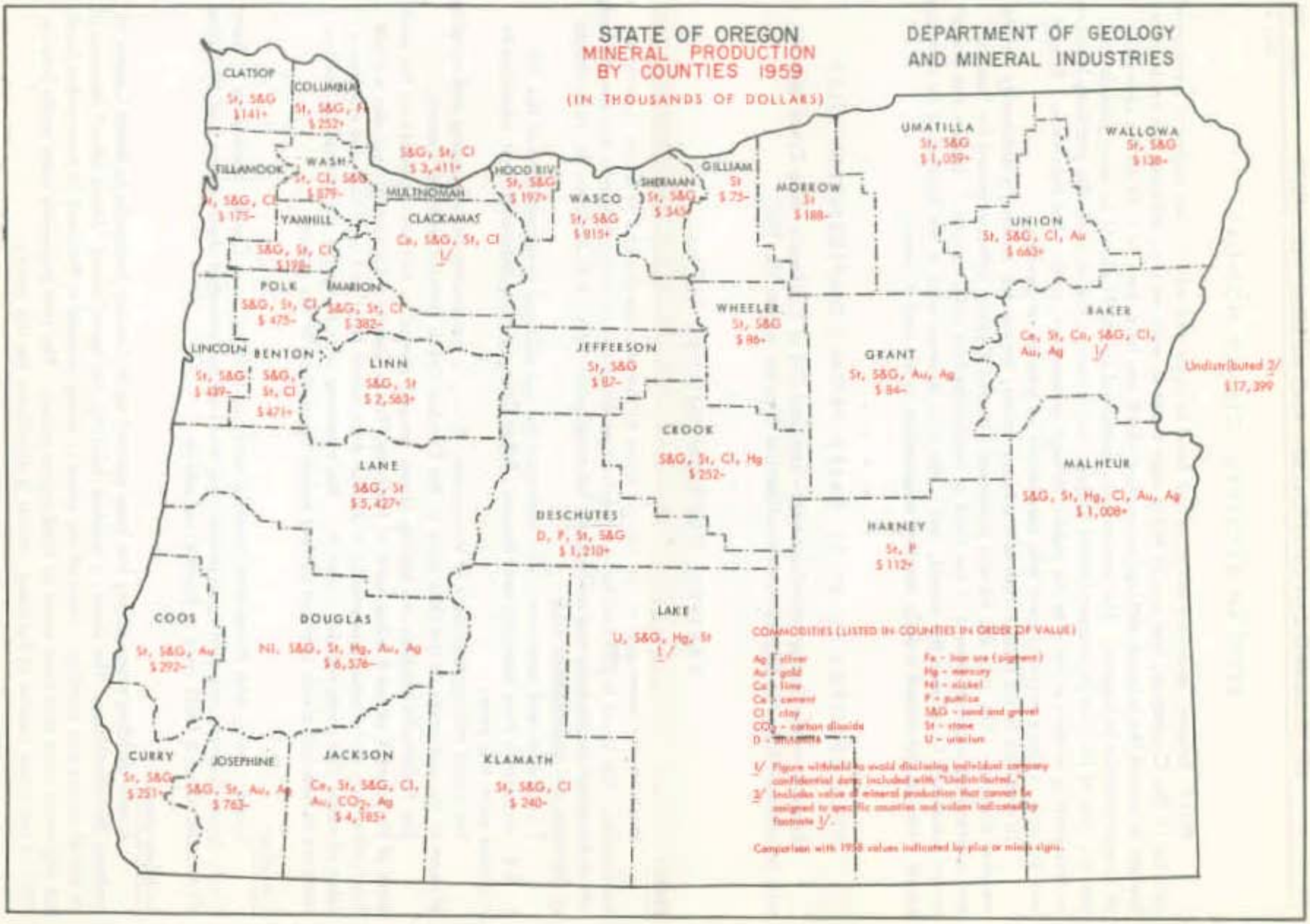
1/ Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
2/ Figure withheld to avoid disclosing individual company confidential data.
3/ Less than $500.
4/ Revised figure.
5/ Total adjusted to eliminate duplicating value of clays and stone.

Table 2

Oregon Mineral Industry Employment and Payrolls*

	1958 Employment	1958 Payrolls	1959 Employment	1959 Payrolls
Mining	1,330	$7,381,000	1,227	$6,955,000
Mineral manufacturing	2,500	13,140,000	2,552	14,341,000
Primary metals	5,023	30,814,000	5,650	35,586,000
Miscellaneous	736	4,089,000	762	4,549,000
Totals	9,589	$55,424,000	10,191	$61,431,000

* Oregon State Unemployment Compensation figures.


STATE OF OREGON
MINERAL PRODUCTION
BY COUNTIES 1959
(IN THOUSANDS OF DOLLARS)
DEPARTMENT OF GEOLOGY
AND MINERAL INDUSTRIES
CLATSOP
St, S&G
$141+
COLUMBIA
St, S&G, P
$252+
S&G, St, Cl
$ 3,411+
TILLAMOOK
WASH.
St, Cl, S&G
$ 879-
MULTNOMAH
HOOD RIV.
St, S&G
$ 197+
WASCO
St, S&G
$ 815+
SHERMAN
St, S&G
$ 345
GILLIAM
St
$ 75-
MORROW
St
$ 188-
UMATILLA
St, S&G
$ 1,059+
WALLOWA
St, S&G
$ 138-
St, S&G, Cl
$ 175-
YAMHILL
CLACKAMAS
Ca, S&G, St, Cl 1/
UNION
St, S&G, Cl, Au
$ 663+
S&G, St, Cl
$ 198+
POLK
S&G, St, Cl
$ 475-
MARION
S&G, St, Cl
$ 382-
WHEELER
St, S&G
$ 86+
BAKER
Ca, St, Co, S&G, Cl, Au, Ag 1/
LINCOLN
St, S&G
$ 439-
BENTON
S&G, St, Cl
$ 471+
LINN
S&G, St
$ 2,563+
JEFFERSON
St, S&G
$ 87-
GRANT
St, S&G, Au, Ag
$ 84-
Undistributed 2/
$ 17,399
CROOK
S&G, St, Cl, Hg
$ 252-
LANE
S&G, St
$ 5,427+
MALHEUR
S&G, St, Hg, Cl, Au, Ag
$ 1,008+
DESCHUTES
D, P, St, S&G
$ 1,210+
HARNEY
St, P
$ 112+
COOS
St, S&G, Au
$ 292-
DOUGLAS
Ni, S&G, St, Hg, Au, Ag
$ 6,576-
LAKE
U, S&G, Hg, St 1/
CURRY
St, S&G
$ 251+
JOSEPHINE
S&G, St, Au, Ag
$ 763-
JACKSON
Ca, St, S&G, Cl, Au, CO_2, Ag
$ 4,785+
KLAMATH
St, S&G, Cl
$ 240-
COMMODITIES (LISTED IN COUNTIES IN ORDER OF VALUE)
Ag - silver
Au - gold
Ca - lime
Ce - cement
Cl - clay
CO_2 - carbon dioxide
D - diatomite
Fe - iron ore (pigment)
Hg - mercury
Ni - nickel
P - pumice
S&G - sand and gravel
St - stone
U - uranium
1/ Figure withheld to avoid disclosing individual company confidential data; included with "Undistributed."
2/ Includes value of mineral production that cannot be assigned to specific counties and values indicated by footnote 1/.
Comparison with 1958 values indicated by plus or minus signs.

BROGAN RECEIVES SCIENCE HONORS

Phil F. Brogan, associate editor of The Bend Bulletin and well-known author of geological articles in The Oregonian, was one of thirty west-coast science writers, editors, and broadcasters invited to attend the science writing conference which was held June 16 - 18 on the University of Oregon campus in Eugene. The conference, sponsored by the National Science Foundation, was the first of its kind in western United States. Its objective was to study the problems involved in interpreting modern science to the public through newspapers, radio, and television. Brogan was the only science writer present who specializes in articles on geology.

In addition to his recognition as a science writer, Brogan has become a nationally known weather observer. On July 22, he was presented with the Thomas Jefferson award for "unusual and outstanding accomplishment in the field of meteorological observations." Brogan was one of seven volunteers to receive the award, and is the only observer west of the Rockies to be so recognized. He has not missed a daily weather observation in the past 37 years.

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WELL RECORDS TO BE RELEASED FROM CONFIDENTIAL FILES

Records on the Sunray Mid-Continent - Standard Oil of California "Bear Creek Unit No. 1" will be released from the Department's confidential files on August 13, 1960.

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EASTERN OREGON MINING NEWS

Gold:

Work on the lower adit at the Buffalo Mine in the Granite District of Grant County is continuing. The level is 250 feet below previous workings and is being driven to tap the ore body which has supplied shipping and milling ore for many years. Mr. J.P.Jackson, Jr, is in charge of the mine and development work.

T.D.French and associates, who revamped the old mill and reopened some of the old E. & E. and North Pole workings near Bourne, Baker County, have indicated their intention to continue work this year.

The Regal Mining Company of Vancouver, B.C., is continuing the reopening and sampling of some of the old works at the Ibex mine in the Cracker Creek District of Baker County.

The McDonald brothers are testing placer ground owned by Milton Steinmetz on the west bank of Pine Creek about 6 miles north of Halfway, Baker County. Equipment includes a slack line cable-way and slusher powered by a double drum diesel hoist and a grizzly and sluiceway setup of about 500 yards per day capacity. The operators plan to sample the ground by cutting trenches to bedrock which is about 65 feet below the surface of the gravels.

Cinnabar:

Robert Hulin, who discovered cinnabar early in 1959 on Cave Creek, a tributary of Burnt River, Baker County, has continued prospecting and now has cinnabar showings on 9 of 10 claims distributed along a fault zone in Burnt River schists.

Building stone:

A new building stone quarry has been opened up on Dooley Mountain in Baker County by Anthony Brandenthaler. The stone, a banded rhyolite, has been named "Moon Mesa" because of its pastel colors and banding. Most of the stone is being trucked to Portland in twenty-ton loads, but shipments have also been made to Washington points. The first shipments were made late in 1959 to the Stone Center in Portland, which is distributor for the quarry.

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