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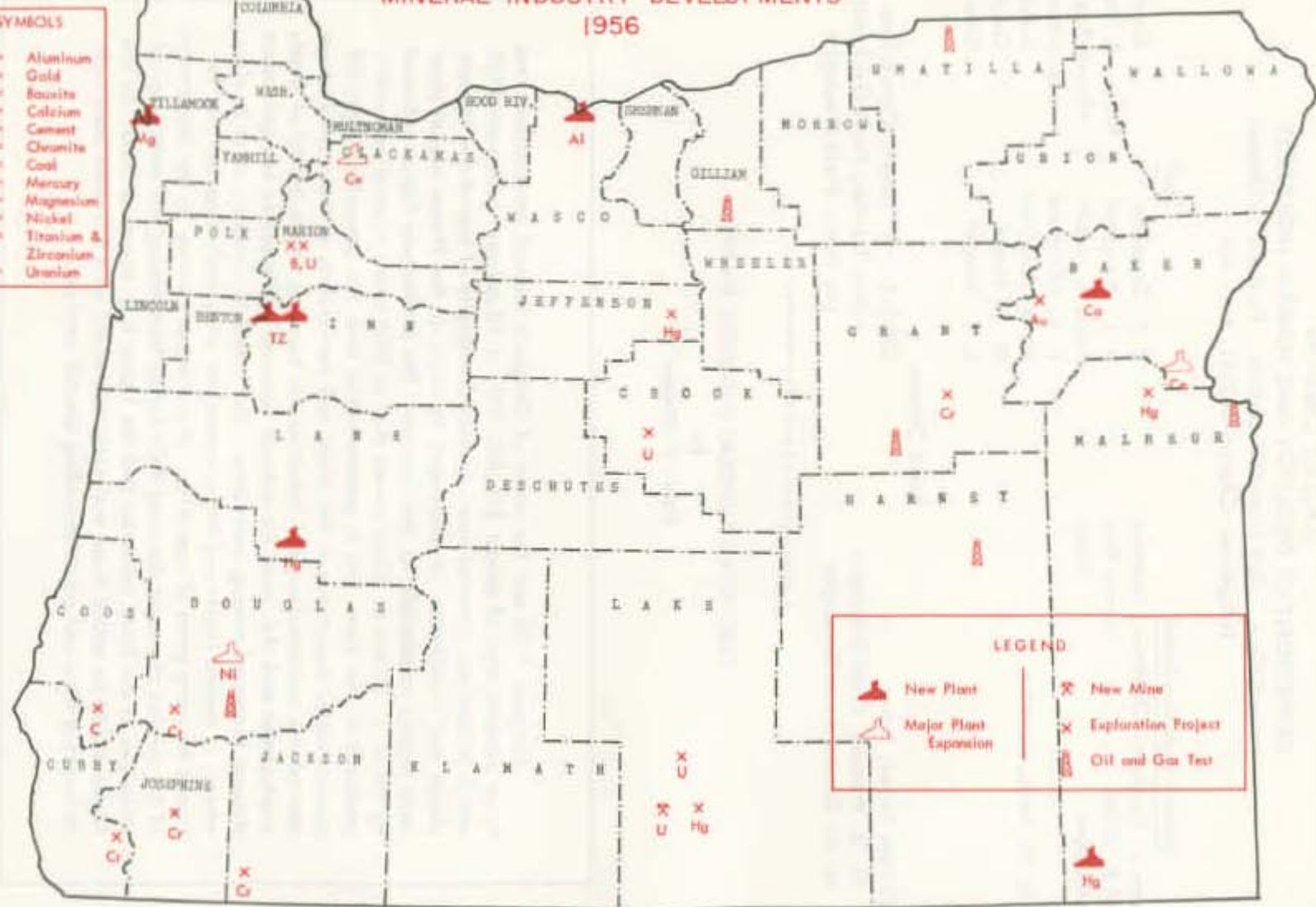
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OREGON'S MINERAL INDUSTRY IN 1956

By
Ralph S. Mason*

The year 1956 saw the value of Oregon's mineral production climb to an all-time high of almost \$35,000,000, a 10 percent gain over 1955 which in turn was a record year. Increased capacity of two of the cement plants and installation of additional furnaces at the Hanna nickel plant were largely responsible for the increase. The preliminary figures released by the U. S. Bureau of Mines reveal that in 1956 every mineral commodity produced in the State had a greater value than the preceding year. Of perhaps equal importance to the State, and particularly to those areas where new mining and metallurgical industries are locating, is the impact of steady employment and the need for related services and supplies brought about through increased mining activities. The trend in Oregon, as it is elsewhere, is toward larger and larger operations adequately financed and designed for many years of operation. A preliminary survey by the Department of the number of people deriving their living from mining and metallurgical industries in the State indicates that the figure is in excess of 3000. To this figure should be added those indirectly connected on a full-time basis such as trucking firms and others providing special services.

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

DEPARTMENT OF GEOLOGY
AND MINERAL INDUSTRIES

	New Plant		New Mine
	Major Plant Expansion		Exploration Project
			Oil and Gas Test

Major Developments

Coal. Pacific Power & Light Company has been pushing rapidly ahead with exploration of the Eden Ridge coal deposits and feasibility studies for a steam-electric generating plant in the Coos County area since the public announcement of its investigations (see The Ore.-Bin, August 1956). The mine-mouth plant would be teamed with a hydroelectric development on the South Fork of the Coquille River to combine steam and hydro generation. Applications have been filed with both the Federal Power Commission and the Oregon Hydroelectric Commission for preliminary permits to investigate feasibility of the hydro phases.

Core drilling was conducted through the fall and winter to establish the extent of the sub-bituminous grade coal deposits and depth, continuity, and attitude of the seams. Six drilling rigs working two shifts each were in the area through the fall and most of the winter. Sixteen holes have been completed and 10,484 linear feet of drilling logged. Geological studies based on the core data and laboratory analyses and firing tests on the coal samples are under way. Studies directed at the most economic methods of mining and location of the steam plant have included inspection tours in western Pennsylvania coal fields, and visits to mines and cleaning plants located near steam electric plants.

Drill crews and geologists are housed during the winter at a camp established near the location because of the difficulty of access to the area from Powers, the nearest community. The company has financed the installation of four stream-gauging stations by the U.S. Geological Survey. Company representatives also are working closely with the fish and wildlife agencies of the State.

Mercury. Three new furnaces to handle mercury ore went into operation in Oregon during the year. At the Bretz mine in southern Malheur County, Arentz-Comstock Mining Venture completed an operating agreement with Shawano Development Corporation to construct a treatment plant. Shawano had previously completed some exploratory drilling on the property. Stripping of overburden began in April and plant construction was started in August. On December 1, a 150-ton flotation plant and retort went into operation. At the Black Butte mine in Lane County, Mercury & Chemicals Corporation fired up a 100-ton retort early in November and at year's end was operating around the clock. Two shifts a day are working in the mine. A new raise from the 900 to the 1100 levels was completed and ore was coming from both levels. In Douglas County, the Buena Vista mine was reported to be in production late in the year. Considerable exploration work had been done at the mine in the previous 12 months. A 50-ton furnace ~~was reconditioned~~ and other improvements made to the surface plant.

At the Horse Heaven mine in Jefferson County, Cordero Mining Company operated a 25-ton rotary furnace for 10½ months during 1956. Ore was obtained from old pillars in the mine and from an open pit. Exploration work was also being carried on underground in an effort to extend the ore body. The Horse Heaven mine has been one of Oregon's large producers with a total of approximately 16,200 flasks produced to date. The other major mercury producer in the State during the year was the Bonanza mine operated by the Bonanza Oil & Mine Corporation in Douglas County. Aside from some lost time due to winter storms, the mine operated continuously. Shaft sinking to the 1230 level was carried on. Approximately half of the quicksilver produced came from a newly installed retort. Production at the Bonanza dates from about 1865, and by 1939 it was the second largest producer in the United States. Some exploration work was also carried on by Bonanza at the nearby Nonpareil property during the year.

Exploration work was carried on at eight other quicksilver properties in 1956. The Axehandle mine in Crook County, idle for a number of years, was leased by the International Engineering & Mining Company which started exploration work late in the year. The Digmores Claims in southern Lake County were being developed by John and Weyland Rousch, who reported discovery of a large low-grade deposit. Oregon Uranium Corporation moved a retort onto a prospect at Glass Mountain in northern Lake County, and the S. and S. Mining Company continued to explore and do a small amount of retorting at a property in the same general area. In April the Uranic & Strategic Minerals Company announced plans to drill on a prospect at Vale Butte in Malheur County. H. K. Riddle was exploring a prospect at Hope Butte in northern Malheur County. In Harney County, Oregon Drilling & Mining Co. leased several prospects near Fields and some drilling was reported under way late in the year. Chester and E. W. Kubli acquired the Steamboat Cinnabar No. 1 prospect (formerly the Curl prospect) in southern Jackson County in September and began exploration work.

The Defense Minerals Exploration Administration had two active contracts with mercury producers in the State during the year. Bonanza Oil & Mine Corporation extended its shaft to the 1230 level and did some development and exploration work on the 830 level with DMEA assistance, and H. K. Riddle explored the Jordan mine in Malheur County. Eight other DMEA contracts were being processed at the end of the year, six of them for mercury exploration, one for chromite, and one for mercury and uranium.

Mercury production in 1956 amounted to 1875 flasks having an average value of \$260 per flask for a total of \$487,500. The all-time record for the State was attained in 1940 when 9,043 flasks having a value of \$1,599,436 were produced by 20 mines. Average value per flask in 1940 was \$176.86. Ten years later, in 1950, when the price had slipped to \$81.26 per flask, Oregon production had dwindled to 5 flasks, all of which came from the Amity mine in Crook County.

Electro-process industries. One of the most encouraging developments in Oregon's mining and metallurgical field in recent years has been the rapid growth of the electro-metallurgical industry. Starting with the Reynolds' aluminum reduction plant at Troutdale during World War II, the industry now embraces such diverse products as calcium carbide, ferrosilicon, ferromanganese, silicon, aluminum silicon, ferronickel, titanium, and zirconium.

Titanium and zirconium production are newcomers to Oregon's metal industry. At Albany, Wah Chang Corporation was nearing completion of a zirconium reduction plant which, in conjunction with its facilities leased from the federal government, will produce 350,000 pounds of zirconium sponge per year. Also in Albany, Oregon Metallurgical Corporation began producing zirconium and titanium ingots from sponge in July and by year's end, castings were being made from both metals. Demand for zirconium and titanium by the aircraft and atomic energy fields is great and it would seem probable that plant expansions can be expected in the near future. A total of 270 men is currently employed by the two companies.

Sharp increases in tonnage of nickel ore mined and in the amount of ferronickel produced characterized the Hanna Company's operations at Riddle, Douglas County, during 1956. The mine, located on the top of Nickel Mountain, is owned and operated by Hanna Coal & Ore Corporation. A total of 437,316 dry tons of ore was mined and trammed down the mountain to the smelter which is owned by Hanna Nickel Smelting Company. The smelter produced 24,755,327 pounds of ferronickel which contained 11,382,984 pounds of nickel, an increase of 36 percent over 1955. Two additional electric furnaces were put in operation

early in the year. A total of 497 employees is engaged at the two Hanna operations. Exploration for nickeliferous laterite deposits in southwestern Oregon by the Department continued during the year. Similar activity was reported by the California Division of Mines for the area lying just south of the Oregon-California line in Del Norte County.

There was little change in the production pattern of ferroalloys in 1956. One of the current problems has been the shortage of metallurgical-grade silica. Oregon has only one silica producer and considerable tonnages are brought in from Washington. The following plants were in production in the State during the year: Electro Metallurgical Company, Portland, producing calcium carbide, ferrosilicon, and ferromanganese; Hanna Nickel Smelting Company, Riddle, producing ferrosilicon, and ferronickel; National Metallurgical Corporation, Springfield, producing aluminum silicon, and silicon; and Pacific Carbide & Alloys Company, Portland, producing calcium carbide.

The influence of the electrometallurgical industry on a community can be appreciable. Electro processes can generally be located with a freedom of action not possible for most other industries. With the exception of electric power, raw materials are imported and finished products are shipped considerable distances, so the choice of a plant site becomes relatively unimportant. To a small community the presence of such a plant means stabilization of income since it operates continuously and is not subject to seasonal variations.

Chromite. The extension of the General Services Administration chromite stockpile buying program from June 30, 1957, until June 30, 1959, gave a boost to the State's production of metallurgical-grade lump chromite and concentrates. With the expected deadline nearing, miners and mill men were reluctant to do additional development or improvement work. The extension removed this problem, at least temporarily, and deliveries to the Grants Pass stockpile during 1956 amounted to 8,330 long tons, the largest amount delivered under the current program. Since 1951, Oregon mines have produced a total of 33,897 tons of ore and concentrates having a total value of \$2,764,354. This is an average of \$81.60 per ton for the ore.

Twelve Grant County mines and three mills produced a total of approximately 1500 long dry tons of lump ore and concentrates for the Grants Pass stockpile in 1956. Tri-County Milling & Concentrating Corporation operated its plant at John Day on ore from the Lost Buck, Ward, and Zero mines; Al Dunn concentrated ore from the Gardner Ranch No. 1 and a property near the Potato Patch mine; and the Comstock Uranium & Tungsten Company, Inc., shipped concentrates obtained from low-grade ores mined at the Haggard & New mine. In addition to the mines delivering ore to mills for beneficiation, the following mines shipped directly to the stockpile: Dry Camp, operated by Allen and John Stinnett; Red Hill mine, with R. C. Beggs shipping; Stewart Ranch deposit, Burt Hayes, shipper; and the Mule Shoe mine in Mormon Basin, operated by Joe Anderson. Although most of the ore and concentrates were shipped to the Grants Pass stockpile by truck a small tonnage was sold under the car-lot program established during the year.

In southwestern Oregon, 25 mines and 9 mills were active during the year. Josephine County had 13 mines and 5 mills, Curry followed with 8 mines and 2 mills, Douglas County had 3 mines and 1 mill, and Coos County had 1 mine and 1 mill. Some mills operated entirely

on ore from one mine located nearby while others worked on a custom basis. A small amount of ore originating in northern California was upgraded in Oregon mills. Pacific Northwest Alloys dismantled their beneficiation plant just north of Coquille in August upon exhaustion of the stockpile of rough concentrates left by the Defense Plant Corporation mill during World War II. Minerals Sands Company continued work on their concentration plant north of Bandon, but no production was announced during the year.

The largest chromite mine in southwestern Oregon is Oregon Chrome located on the Illinois River in Josephine County and operated by William Robertson. The mine has a long history of intermittent production extending back to World War I. It has reportedly been "mined out" several times but reserves of ore at the end of the year were perhaps the largest since the mine was opened. Some of the ore is concentrated in the Gallaher Mill located a few miles away on U.S. Highway 199. More than 20 men are employed at the mine.

Oregon is one of the few states in the Union which produces metallurgical-grade lump chromite ore. Deposits are characteristically small, with a few exceptions, and mining costs are correspondingly high. The industry has been plagued over the years with periods of intense activity during national emergencies, and almost complete stagnation in peacetime. If a domestic chromite mining industry is to become firmly established, a long-term program must be set up in order that mine and mill operators can properly plan their mining venture and exploit the large disseminated ore bodies. A long-term program for chromite would also encourage other mining activities as chromite exploration could result in discovery of other mineral deposits.

Lime, limestone, and cement. Construction of a lime-burning plant near Baker by Chemical Lime Company began in August, with completion scheduled for early 1957. Raw limestone will be obtained from the company-owned quarry about 8 miles from the plant. Production from this plant will mark the first lime burned in the State since 1947 when the Horsehead plant in Josephine County suspended activity.

Production of limestone for the manufacture of cement increased considerably in 1956. Oregon Portland Cement Company completed plant expansions at Lime, Baker County, and at Oswego, Clackamas County. The plant capacity at Lime was doubled while that at Oswego was increased 60 percent. More than 3 million barrels of cement can be produced annually by the two plants as a result of the 6 million-dollar expansion program. Limestone for the Lime plant is obtained locally, while the Oswego plant obtains its supply from company-owned quarries near Dallas in Polk County and from Baker County. A total of 375 men is employed at the two plants. Ideal Cement Company was in full production at its plant at Gold Hill in Jackson County. High-grade limestone is trucked from the company's quarry near Wilderville, Josephine County. One-hundred fifty men were employed at the plant and quarry. Pacific Carbide & Alloys Company obtained marble from their quarry near Enterprise in Wallowa County and railed it to Portland for the production of calcium carbide. A wholly owned subsidiary, Greely Lime Company, distributed undersized material for agricultural purposes in the Willamette Valley area. The only producer of limestone operating solely for agricultural purposes was Dewitt's Polk County Lime Company near Dallas. Limestones in the Dallas area contain about 53 percent calcium carbonate, and the economic distance which such material can be hauled is limited. National Industrial Products Company continued to ship crushed limestone from a quarry located near Durkee in Baker County, to pulp mills, sugar factories, and the cement plant at Lime. Twenty-five men are employed at the quarry and crushing plant.

Uranium. The White King claim in Lake County, operated by the Lakeview Mining Company, was extensively diamond drilled during the year and sinking of a two-compartment shaft was begun in September. Two bulk shipments of crude ore were made to the Vitro Chemical uranium reduction plant in Salt Lake City, Utah. The latest shipment consisting of approximately 500 tons was obtained underground and was sent for mill-testing purposes.

A review of uranium prospecting activity in the State and notes on the geological relationships which have been observed at several prospects were published in the December 1956 issue of The Ore.-Bin.

Oregon's Mineral Industry at a Glance		
	1955	1956
Chromite	\$ 463,514	\$ 709,000+
Clays	275,916	290,000+
Copper	2,984	5,866+
Gold	59,780	86,800+
Lead	894	2,560+
Mercury	306,610	487,500+
Sand and gravel	11,832,344	11,900,000+
Silver	7,978	10,643+
Stone	9,417,834	9,500,000+
Undistributed	10,504,356	13,333,000+
	31,739,878	34,970,369+

(symbols indicate relation to 1955)

Minerals Summary

In addition to the major developments given above, other phases of Oregon's mineral industry have continued to grow. The following summarizes these activities. Attention is called to the accompanying table, "Oregon's Mineral Industry at a Glance."

The Department completed its investigation of the ferruginous bauxite deposits in the Salem Hills, Marion County, Oregon, and published a bulletin which showed the results of this work. On the basis of 27 widely scattered auger holes, there is indicated an aggregate area of approximately 1200 acres underlain by gibbsitic laterite which has an average thickness of 14.4 feet. Average analyses of drill hole samples give a weighted average of 35.0 percent alumina, 6.7 percent silica, 31.5 percent iron oxide, 6.5 percent titania, and 20.2 percent loss on ignition. Aluminium Laboratories, Limited, Canada, which carried on a drilling exploration program in this area during the summer and fall of 1955, concluded its study and has allowed its land options to expire. Throughout the year several geologists representing aluminum companies have visited the area of the deposits. Harvey Aluminum Company has recently announced its intention to begin an exploration program in the Salem Hills if a sufficient amount of land can be acquired. Harvey began construction of transmission facilities for its \$65,000,000 aluminum reduction plant at The Dalles in August. In a separate investigation the U.S. Bureau of Mines has begun metallurgical tests on the Salem Hills material.

The lightweight aggregate industry in Oregon falls into two classifications: pumice-cinder operations and expanded shale operations. In central Oregon three pumice producers were active during the year while two expanded shale plants operated in the Portland area. Detailed descriptions of the pumice and volcanic cinder operations in central Oregon were published in the November 1956 issue of The Ore.-Bin. Rigid controls over sizing and blending are maintained by the pumice-cinder plants, and production is tailored to individual consumer's needs. The two expanded shale producers, Empire Building Materials Company and Smithwick Concrete Products Company, continued to enlarge their line of pre-stressed and pre-cast structural members. Diverse applications of this relatively new building material is illustrated by the production of beams 72 feet long, structural members for bridges, and pre-cast expanded shale concrete for the bell shells used in constructing the piers of the Portland-Vancouver bridge. The saving of 20 tons of weight by using this type of concrete rather than regular sand-cement-gravel mix permitted emplacement of the shells in one piece below the water line with a consequent saving in expense. Empire announced that plans are well along for the reclaiming of crusher dust by pugging. The pellets thus produced would be added to the kiln feed.

The Buffalo mine near Granite in Grant County contributed the bulk of the State's gold during the year which totaled \$86,800. Minor production from small placer mines, mostly in southwestern Oregon, supplied the balance of the gold recovered. Sunshine Mining Company, Wallace, Idaho, examined five mines in the Bourne area of Baker County during the summer months. The mines included the Columbia, Tabor Fraction, E and E, North Pole, and Villard. They were important gold producers a number of years ago.

Exploration at the Fall Creek Copper mine on the Illinois River in Josephine County was carried out during the year with some shipments of chalcopyrite to the Tacoma Smelter. The Bohemia district, Lane County, had a minor amount of activity during the year. At the Helena mine, Kenneth Watkins drove a new level 100 feet below the lowest workings. The U.S. Bureau of Mines conducted sampling and analysis of areas overlying copper deposits in the Takilma-Waldo district in southern Josephine County.

Sand and gravel continued as the single largest mineral commodity produced in the State, with a preliminary value estimated at nearly 12 million dollars. A complete canvass of sand and gravel producers is not possible since considerable quantities of material are produced by companies not primarily engaged in the business. Valuation of sand and gravel and many other industrial minerals is difficult to determine. In the case of metals, national or international values of the finished product are readily obtainable. Industrial minerals enjoy no such standardization as the market value is usually determined between producer and consumer. Furthermore industrial minerals producers often report the value of their product as it comes out of the pit rather than when ready for market. If the latter figure was used, the value for sand and gravel would be at least double the figure reported.

Experimental work continued at Hatch Brothers Chemical Company plant near Tillamook on a process to extract magnesium from sea water. A small pilot plant was under construction at year's end. A. M. Matlock processed a small tonnage of soda from Alkali Lake in Lake County and sold it for a sweeping compound, sweetener, and neutralizer.

Bristol Silica Company continued to operate the only silica quarry in the State. Search for new deposits was unsuccessful despite a large and growing demand for metallurgical-grade rock.

Activities of two of the building stone quarries were reported in the November issue of The Ore.-Bin. A third quarry, operated by the Tuff Stone Company near Sublimity in Marion County was sold in November to Oregon Tuff Stone, Inc. Production was continuous during the year with an average of six men employed. The quarry supplies a specialty item which is used for construction of cold storage plants and cold rooms, in addition to the regular construction and veneer uses. Production of dimension and veneer stone was also reported from the Rocky Butte quarry in Portland and the Carver quarry in Clackamas County. Northwestern Granite quarry near Haines in Baker County produced monumental granite.

Oil and Gas Summary

During the year six new permits to drill for oil and gas in Oregon were approved by the Department. By the end of 1956, four drill rigs were active, three had suspended operations, and two tests had been plugged and abandoned. Leasing of land for drilling exploration in the State declined somewhat from the year before; however, much of the land taken up in previous years has been retained. Throughout the summer field season at least six major oil companies

maintained geological and geophysical crews for surface exploration in all parts of the State. Exploration activity of this type appears likely to continue in 1957.

The 13,000-foot well completed in January 1956 by the Sinclair Oil and Gas Company near Mapleton, western Lane County, is the deepest test recorded in the Northwest including Alaska. In Oregon, up to the present time, only eleven other wells have been drilled deeper than 5,000 feet. These range in depth from 5,141 feet to 9,263 feet. It is anticipated that further drillings by major companies will be made in 1957.

PLACER MINES ACTIVATED

The old China Diggings on Palmer Creek, a tributary of the Applegate River in Jackson County, sec. 7, T. 40 S., R. 3 W., has been purchased and put into operation by the Sierra Land Company of Grants Pass. The property consists of seven claims previously owned by the Haynes Brothers of Medford. Frank M. Kolkow and Ben R. Haynes, Murphy, are the operators. A 10-inch diesel-powered pump and a No. 2 Giant are being used. Howard Lewis, Grants Pass, one of the owners, said that the operation was started in November, 1956, and that a short supply of water has been their principal problem.

* * * * *

The Steam Beer placer, located at Leland in sec. 6, T. 34 S., R. 6 W., Josephine County, is being reactivated by McKee and Associates who have leased the property from Recoveries, Inc., an Oregon corporation. New equipment reportedly capable of handling about 80 yards of gravel per hour has been installed at the mine. Mr. Pete L. Gregersen, who is in charge of the operation, expected that installation of the plant would be complete by January 8th.

GROUND-WATER LEVELS IN OREGON ABOVE AVERAGE IN 1956

In the Willamette Valley the level in the key well at Portland was above average every month except October, January, and September and was about 1½ feet below average at the end of the water year. In the upper Willamette Valley the water level in an observation well at Junction City was near or above average during the first 4 months of the water year and below average during the rest. At year's end the level was about 1 foot below average.

East of the Cascades all year-end water levels reported were near or above average. In the Fort Rock Valley, an area of interior surface drainage, water levels in a well at The Poplars ranch continued the upward trend established in 1950-51; a new record-high level was measured every month except April and at year's end the level was about 4½ feet above average. The major factor controlling the fluctuations of levels in the wells at Milton-Freewater in the Walla Walla River basin, at Baker in the Powder River basin, and near Burns in the Harney Basin (an area of interior drainage) is the time of arrival of recharge from the snowmelt. The levels in all wells were average or below at the beginning of the year and rose to above-average stages as the melt from the above-average snowpack reached them. The water levels in these three wells remained at average or above-average stages throughout the rest of the year.

(From U.S. Geological Survey Water Resources Review, Annual Summary.)

GEOLOGIC MAP OF SIUSLAW RIVER AREA PUBLISHED

Geologic map of the lower Siuslaw River area, Oregon, by E. M. Baldwin, has been issued by the U.S. Geological Survey as Map OM 186 of the Oil and Gas Investigations series. The map was prepared in cooperation with the Oregon Department of Geology and Mineral Industries. The map covers six 15-minute quadrangles: Heceta Head, Mapleton, Blachly, Siltcoos Lake, Goodwin Peak, and Roman Nose Mountain, in western Lane and Douglas counties. Distribution of Tertiary sedimentary and volcanic rocks and intrusive igneous rocks are indicated in patterns of green and white. Major folds and faults are shown. The map is printed on a single sheet without text at a scale of 1 inch equals approximately 1 mile. It may be purchased for 50 cents from the Geological Survey, Denver Federal Center, Denver, Colorado.

SEVERANCE TAX BILL TO BE INTRODUCED

According to the Oregon Voter of January 26, 1957, a severance tax bill is to be introduced shortly in the House of Representatives by the State Tax Commission. The Oregon Voter states: "Bill provides for state severance tax on oil, gas, coal and minerals. Tax to be imposed on producer on probably a net basis in order to distinguish between high and low cost production. Rate would be 3% on oil and gas - 2% on all other. Net revenues to go 80% to general fund, and 20% back to counties." It is understood that the bill is to be very similar to the severance bill introduced in the last session of the Legislature which never got out of committee.

STATE LEGISLATURE COMMITTEES ANNOUNCED

Members of the Senate Committee on Natural Resources for the Forty-ninth Legislative Assembly of Oregon are as follows:

Philip B. Lowry, Chairman, Medford
Warren Gill, Vice-Chairman, Lebanon
Howard C. Belton, Canby
Phil Brady, Portland

Andrew J. Naterlin, Newport
Daniel A. Thiel, Astoria
Francis W. Ziegler, Corvallis

Members of the House Committee on Forestry and Mining are as follows:

George J. Annala, Chairman, Hood River
V. Edwin Johnson, Vice-Chairman, Eugene
Eddie Ahrens, Turner
Carl Back, Sixes
Fay I. Bristol, Grants Pass

W. O. Kelsay, Roseburg
E. A. Littrell, Medford
Emil A. Stunz, Nyssa
Carl Yancey, Klamath Falls

CORRECTION

The location of Drilling Permit No. 23 issued to Standard Oil Company of California should read 4319 feet west and 2909 feet south of the N.E. corner of sec. 6, T. 4 S., R. 21 E., Gilliam County. The location appearing in the December Ore.-Bin was incorrectly given.

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STRATIGRAPHIC IMPLICATIONS OF SOME CENOZOIC FORAMINIFERA
FROM WESTERN OREGON*

By
R. E. Stewart**

EOCENE*

Upper and/or Middle Eocene

Yamhill formation and Sacchi Beach beds (upper and/or middle Eocene): The Yamhill formation of the Mill Creek area in Polk County (22g)*** and the beds exposed at Sacchi Beach in Coos County are essentially equivalent insofar as their foraminiferal content is concerned. They are similarly equivalent to the lower part of the McIntosh formation of Washington. The Yamhill-Sacchi Beach-lower McIntosh fauna is distinguished by the common and restricted occurrence of Amphimorphina californica Cushman and McMasters, which is Laiming's marker for his upper Domengine B-1A zone in California.

The Yamhill-Sacchi Beach Amphimorphina californica fauna contains in excess of 150 species of foraminifera. It appears to mark the upper range limits of a few middle Eocene species, including Nodosaria latejugata Gumbel and probably Amphistegina californica Cushman and M. A. Hanna, A. Simiensis (Cushman and McMasters), and Pseudophragmina psila (Woodring). It appears also to mark the lower range limits of a number of upper Eocene species, including Gyroidina cf. G. soldanii d'Orbigny (9, pl. 50, figs. 13 a-c) (10, pt. 4, pl. 10, figs. 6 a-c); Robulus welchi Church, and Valvulineria chirana Cushman and Stone.

Gyroidina cf. G. soldanii occurs commonly in the Yamhill-Sacchi Beach fauna and in considerable abundance in the fauna of the lower member and the lower 375± feet of the middle member of the Coaledo formation. Bulimina corrugata Cushman and Siegfus is common in the Yamhill-Sacchi Beach strata, very rare in the Umpqua formation, and common in the lower 375± feet of the middle member of the Coaledo formation. A very few poorly preserved specimens closely resembling this species have been observed in an assemblage from the uppermost part of the middle member of the Coaledo formation. Gaudryina cf. G. atlantica (Bailey) var. asperita Cushman and Barbat has common to abundant occurrence in the Yamhill-Sacchi Beach fauna and in that of the lower member of the Coaledo formation.

A chart compiled by the writer in 1953 and published in 1955 (22g) recorded 86 forms from the Amphimorphina californica fauna. Forty-four were given generic names only. Specific identifications given for the other 42 were tentative and needed revision. Subsequent study

* Concluded from The Ore.-Bin, vol. 18, no. 7, July 1956.

** Geologist, State of Oregon Department of Geology and Mineral Industries.

*** See note concerning bibliography on page 15.

indicates, for instance, that Gyroidina simiensis does not occur in the Yamhill-Sacchi Beach fauna, but that G. cf. G. soldanii (9, pl. 50, figs. 13 a-c) (10, pt. 4, pl. 10, figs. 6 a-c) appears to conform with the description of G. simiensis in all respects except in the development of thickened knobs at the umbilical ends of the chambers. G. cf. G. soldanii has no umbilical knobs.

Bandy (7) has recorded the following foraminiferal assemblage from gray shale at Cape Blanco, giving its indicated age as middle Eocene: *Amphistegina simiensis (Cushman and McMasters), Anomalina packardii Bandy, Astacolas subtumidus Bandy, *Bulimina ampla Cushman and Parker, *B. pupoides d'Orbigny, Cibicides celebrus Bandy, *C. howelli Toulmin, *C. lobatus (d'Orbigny), C. mexicanus Nuttall, C. perlucidus Nuttall, *Glandulina elliptica Reuss, Globigerina eocaenica Terquem, G. quadripartita Koch, *G. trilocularis d'Orbigny, *Globorotalia lotus (Schwager), Guttulina oregonensis Bandy, *Lagena williamsoni (Alcock), Lamarckina rugatina Bandy, Marginulinopsis cingulosa Bandy, M. prolata Bandy, Nodosaria consobrina (d'Orbigny), Nonion planatum Cushman and Thomas, *Quinqueloculina laevigata d'Orbigny, Robulus americanus (Cushman), R. degolyeri (Plummer), R. texanus (Cushman and Applin), *Rotorbinella colliculus Bandy, *Saracenaria blancoensis Bandy, Spiroplectammina adamsi Lalicker, *Triloculina laevigata d'Orbigny, Valvulineria cooperensis (Cushman), V. lottensis (Garrett), V. patelliformis Bandy.

This assemblage appears to be more closely related to the Yamhill-Sacchi Beach fauna than to those of the Tyee and Umpqua formations. Forms which closely resemble Bandy's figures for the species indicated by asterisks in the preceding list occur in the Yamhill-Sacchi Beach fauna.

Middle and Lower Eocene

The Tyee and Umpqua formations are here considered to be middle and lower Eocene in age and essentially equivalent to Laiming's Domengine and Capay zones B-1 through C. It may be that Laiming's Meganos D zone fauna is also represented, but this has not been conclusively demonstrated by material examined by the writer. Neither does it appear certain that all of Laiming's B zones are separately distinguishable in the Oregon section. The B-1 zone assemblage with Cibicides coaligensis (Cushman and G. D. Hanna), for instance, has not been observed by the writer.

Presently available material indicates clearly, however, that zoning of the Tyee-Umpqua section will be possible when suitable control section material becomes available for detailed study. This will probably depend upon drilling in fossiliferous sections of the middle and lower Eocene. In the meantime a fair degree of bio-stratigraphic control is possible, based upon study of stratigraphic series of samples collected along roads and rivers and scattered samples from other suitable surface exposures.

It does not yet appear certain that consistently dependable separation of Tyee foraminiferal assemblages from those of some strata which have rather generally been considered upper Umpqua in age can be made on the basis of material presently at hand, although in all probability data for distinguishing the Tyee formation from the Umpqua formation will eventually be developed.

Tyee formation (upper middle Eocene): Foraminifera from sediments believed to be of Tyee age are listed from the following four localities. None of the lists is complete for the assemblage represented, but each is nearly complete except the one for the Glide section Tyee2. Identifications are based primarily upon comparison with published figures.

1. Glide section Tye?. Along North Umpqua River approximately 17 miles north-east of Roseburg in sec. 17, T. 26 S., R. 3 W., between the west section line and Lone Rock Bridge. Low Tye? (4b, p. 11, fig. 3, table 3). Ammodiscus cf. A. incertus (d'Orbigny), Anomalina cf. A. coalingsensis Cushman and G. D. Hanna (compressed form), Bulimina cf. B. schencki Beck, Ceratobulimina sp., Cibicides cf. C. sp. D of Cushman and McMasters, Cornuspira sp., Cyclammina cf. C. cancellata Brady var. obesa Cushman and Laiming, Dentalina cf. D. approximata Reuss, D. cf. D. consobrina d'Orbigny, Eponides cf. E. ellisorae Garrett, E. minimus Cushman, Globulina sp., Gyroidina cf. G. soldanii d'Orbigny, G. soldanii d'Orbigny var. octocamerata Cushman and M. A. Hanna, Lenticulina cf. L. convergens (Bornemann), Marginulina mexicana Cushman var. (Resembles Hemicristellaria vacavillensis [G. D. Hanna] of Israelsky [5a, pl. 3, figs. 4, 5] in its somewhat inflated final chamber.), M. cf. M. truncana (Gümbel), Nodosaria cf. N. adolphina (d'Orbigny), N. cf. N. arundinea Schwager, N. latejugata Gümbel, Pseudoglandulina laevigata (d'Orbigny) var. ovata (Cushman and Applin), Quinqueloculina cf. Q. yeguaensis Weinzierl and Applin, Rhabdammina eocenica Cushman and G. D. Hanna, Robulus cf. R. midwayensis (Plummer) (8-9 instead of 10-12 chambers in adult form), Sigmoilina sp., Textularia cf. T. distortio Cushman and Applin, Triloculina (?) cf. T. inornata d'Orbigny.

2. Basket Point type Tye. At Basket Point on north bank of Umpqua River near section line between secs. 29 and 30, T. 24 S., R. 7 W. High Tye. (4b, pp. 16-20, 38. Doubtless due to typographical error, the range was given as 4 W. in Turner's paper.) Bathysiphon (?) sp., Cibicides cf. C. jeffersonensis Garrett, C. cf. C. sp. D of Cushman and McMasters, Cyclammina cf. C. clarki G. D. Hanna, Dentalina communis d'Orbigny, Eponides cf. E. ellisorae Garrett (10, pt. 4, pl. 10, figs. 7 a-c) (Some partially crushed specimens may be E. guayabalensis Cole var. yeguaensis Weinzierl and Applin), E. cf. E. minimus Cushman, Gaudryina (?) sp., Gyroidina soldanii d'Orbigny var. octocamerata Cushman and G. D. Hanna, Marginulina mexicana Cushman var. A of Laiming, Nodosaria latejugata Gümbel, Nonionella cf. N. frankei Cushman, Robulus inornatus (d'Orbigny).

3. Elkton Tye. Roadcut on south side of Umpqua River about $1\frac{1}{4}$ or $1\frac{1}{2}$ miles west of Elkton in sec. 24, T. 22 S., R. 8 W. High Tye. Anomalina cf. A. coalingsensis Cushman and G. D. Hanna (compressed form), Cibicides cf. C. sp. D of Cushman and McMasters, Dentalina cf. D. approximata Reuss, D. communis d'Orbigny, D. consobrina d'Orbigny, Eponides ellisorae Garrett (10, pt. 4, pl. 10, figs. 7 a-c), Gyroidina soldanii d'Orbigny var. octocamerata Cushman and G. D. Hanna, Marginulina mexicana (Cushman) var. A of Laiming (5b, p. 198, figs. 4 a-b), M. mexicana (Cushman) var. B of Laiming (5b, p. 198, figs. 5 a-b), M. mexicana (Cushman) var. (Resembles 5a, pl. 3, figs. 4, 5 in the somewhat inflated final chamber), Nodosaria latejugata Gümbel, Quinqueloculina cf. Q. yeguaensis Weinzierl and Applin, Robulus inornatus (d'Orbigny), R. cf. R. midwayensis (Plummer) (8-9 instead of 10-12 chambers in adult form), R. pseudovortex Cole, Textularia labiata Reuss.

4. Comstock overpass Tye. Roadcut at east end of (former) highway overpass $\frac{1}{2}$ mile south of Comstock on Pacific Highway, sec. 20, T. 21 S., R. 4 W. High Tye. (4b, pp. 21, 38). Bathysiphon eocenica Cushman and G. D. Hanna, Cibicides cf. C. sandiegensis Cushman and M. A. Hanna, C. cf. C. sp. C of Cushman and McMasters, C. sp. D of Cushman and McMasters, Eponides cf. E. guayabalensis Cole var. yeguaensis Weinzierl and Applin, Gaudryina cf. G. convexa Cushman var. sandiegensis Cushman and M. A. Hanna, Globigerina cf. G. bulloides d'Orbigny, Haplophragmoides coalingsensis Cushman and G. D. Hanna, Marginulina mexicana Cushman var. A of Laiming, M. cf. M. mexicana Cushman var. A

of Laiming (thinner than Laiming's figure), M. mexicana Cushman var B of Laiming, Nonionella (?) cf. N. frankei Cushman, Robulus inornatus (d'Orbigny), Textularia cf. T. labiata Reuss var. of Cushman and M. A. Hanna.

Umpqua formation (middle and lower Eocene): Next older than the upper middle Eocene Tyee formation is the Umpqua formation of middle and lower Eocene age. In the Glide section (4b, pp. 10-15) it contains a large foraminiferal fauna which includes the following species: Allomorphina trigona Reuss, *Anomalina dorri Cole var. aragonensis Nuttall, Bathysiphon eocenica Cushman and G. D. Hanna, *Bolivina (Loxostoma) applini Plummer, Bulimina cf. B. corrugata Cushman and Siegfus, B. cf. B. inflata Seguenza, Cassidulina globosa Hantken, *Clavulina cf. C. parisiensis d'Orbigny, Cyclammina sp., Dentalina communis d'Orbigny, D. consobrina d'Orbigny, Discocyclina sp., *Eponides umbonatus (Reuss), *Gaudryina indentata Cushman and Jarvis, G. cf. G. jacksonensis Cushman var. coalingensis Cushman and G. D. Hanna, *Globorotalia cf. G. crassata (Cushman), G. crassata (Cushman) var. densa (Cushman), *Gumbelitra cf. G. columbiana Howe, *Gyroidina cf. G. florealis White, Marginulina mexicana (Cushman) var. C of Laiming, M. cf. M. mexicana (Cushman) var. D of Laiming, M. saundersi (Hanna and Hanna), M. subbullata Hantken, Nodosaria latejugata Gumbel, N. cf. N. parexilis Cushman and K. C. Stewart var. sentifera Cushman and Parker, N. cf. N. vertebralis (Batsch), Nonion cf. N. danvillense Howe and Wallace, *Pleurostomella alternans Schwager, Pseudoglandulina conica (Neugeboren), Rhabdammina eocenica Cushman and G. D. Hanna, Robulus cf. R. inornatus (d'Orbigny), R. cf. R. midwayensis (Plummer) (8-9 instead of 10-12 chambers in adult form), *Silicosigmoilina cf. S. californica Cushman and Church, Siphonina claibornensis Cushman, Textularia cf. T. mississippiensis Cushman.

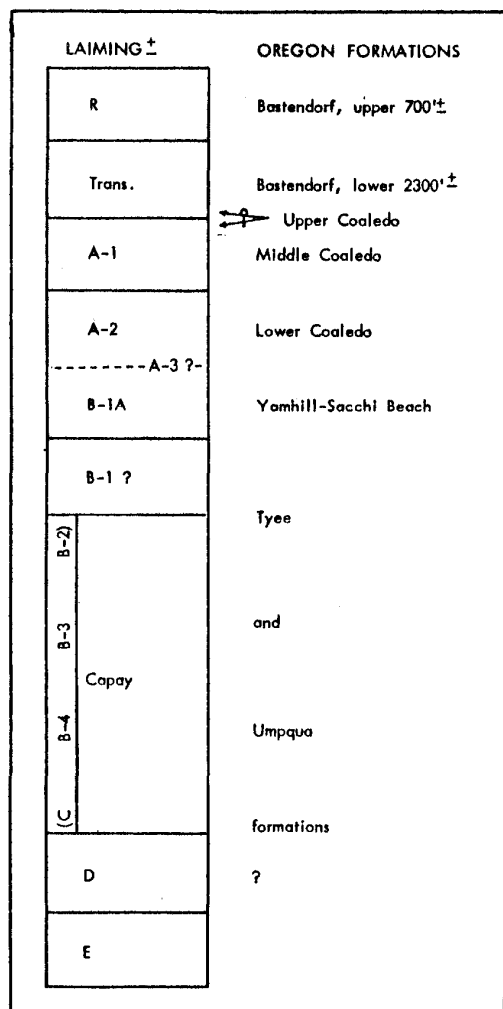


Figure 2. Chart showing apparent correlation between Laiming's California Eocene zones and some Oregon formations.

The species marked with asterisks in the preceding list indicate close affinity between the fauna of the lower sediments of the Glide section and that of Laiming's lower Capay C zone of California.

Concluding Statement

Figure 2 shows apparent foraminiferal relationships between the Oregon Eocene formations discussed in this paper and the California Eocene zones of Laiming.

The lower 2300 $\pm$ feet of the Bastendorf formation appears to be uppermost Eocene in age and faunally transitional between the lower Oligocene upper Bastendorf beds and the middle member of the upper Eocene Coaledo formation.

In the coastal section, which is discussed in this paper, shale predominates in the lithology of both the Bastendorf formation and the middle member of the Coaledo formation. The intervening upper member of the Coaledo formation, however, is composed almost entirely of thick-bedded sandstone with very minor amounts of shale and coal. There is some question, therefore, as to whether an upper Coaledo shale facies which was doubtless deposited farther off-shore during upper Coaledo time is more closely related faunally to the Bastendorf formation or to the middle member of the Coaledo formation.

Existence of some doubt as to the upper or middle Eocene relationships of the Yamhill-Sacchi Beach fauna has been pointed out in this paper (The Ore.-Bin, vol. 18, no. 7, July 1956, p. 57, fig. 1, and vol. 19, no. 2, February 1957, p. 11).

Reference has also been made to the present tentative status of foraminiferal zoning in the Tyee-Umpqua portion of the Oregon Eocene section.

Present ideas regarding the Tertiary of Oregon are wide open for all manner of revision, and changes involving many parts of the section are to be expected. Weaver (8, pp. 1399, 1401, 1403) has given an admirable outline of this situation in the following statement:

"The entire area of the Coast Range between the Olympic Mountains on the north and the Klamath Mountains on the south together with most of the Puget Sound-Willamette trough is composed exclusively of Tertiary volcanic and sedimentary rocks. These materials have a total maximum thickness of 30,000 feet although a complete stratigraphic section of all the formations is not present in any one locality. These rocks accumulated in continuously changing embayments and under different physical environments. Accordingly, a single formation may vary in thickness, lithologic character, and geologic age from one locality to another. The base of a formation at one place may correspond with the middle of the same formation at another locality where its deposition began somewhat later. For similar reasons the top beds of the same formation may not everywhere be contemporaneous. The basins in which a single formation accumulated may have been intricately connected with one another or entirely separate, thus permitting contemporaneous but entirely different conditions of accumulation of sediments. The contained faunas were responsive to these varying physical environments. Consequently, the exact correlation of the different sections of the Tertiary formations in western Oregon and Washington is always open to revision."

This is the last of three parts of a paper entitled "Stratigraphic Implications of Some Cenozoic Foraminifera from Western Oregon" published in The Ore.-Bin (vol. 18, no. 1, January 1956, pp. 1-6; vol. 18, no. 7, July 1956, pp. 57-63; vol. 19, no. 2, February 1957, pp. 11-15). The paper is to be revised and, under the same title, reissued as State of Oregon Department of Geology and Mineral Industries Bulletin 36, Part 9.

Anyone interested in obtaining a copy of the bibliography prior to final publication may do so by addressing a request to the Department.

EASTERN OREGON CHROME PRODUCTION

August 3, 1951, through December 31, 1956

The General Services Administration's chrome-purchasing depot at Grants Pass, Oregon, opened for business August 3, 1951, for the purpose of purchasing domestic-mined chromite ores in accordance with the government's defense materials procurement program. Depot operation was predicted on a support price designed to make possible the operation of domestic chrome occurrences.

Although the first ore purchased at the depot originated from the nearby Oregon Chrome mine, Josephine County, subsequent depot purchases have included a considerable tonnage of ores and concentrates from many distantly located properties in California and eastern Oregon. This shows that the opening of the depot stimulated the development and operation of domestic chrome properties in the intended manner. However, due to the fact that the ore-purchasing schedule contains no provisions for equalizing mine-to-depot transportation costs, except to the extent of provisions made August 10, 1956, for purchases of carload lots (see The Ore.-Bin, December 1956), the operators of properties located far from the depot have been faced with high mine-to-depot delivery costs. As a consequence, prospect development in the outlying chrome areas has lagged.

The operators in the John Day chrome area of east-central Oregon represent a group which has had to absorb mine-to-depot delivery costs ranging from \$16 to \$18 a ton, on top of their base operational costs. This has constituted a serious deterrent to the development of the John Day area for the reason that most investors have been prone to spend their speculative capital on prospects located closer to the depot in order to gain the advantage of the more favorable delivery costs.

The first eastern Oregon shipment was made in mid-summer of 1952, practically a year after the Grants Pass depot had opened. Once started, eastern Oregon deliveries continued steadily. Approximately 4,616 dry long tons were delivered to the depot by December 31, 1956, representing approximately one-eighth of the recorded Oregon production. Value received by eastern Oregon chrome producers for the recorded 4,616 tons shipped was \$481,064. The average value of eastern Oregon's chrome was \$104.20 per ton, as compared with a reported average of \$81.60 per ton for all chrome purchased from the State as a whole since the depot opened. The difference undoubtedly reflects the purchase of greater amounts of crude lump ore from western Oregon shippers. Eastern Oregon shipments have been largely concentrates, due to the prevalence of concentrating-type ores in eastern Oregon, and to the greater delivery costs faced by the eastern Oregon operator.

Most of the eastern Oregon chrome shipments originated from the Haggard and New and Dry Camp mines, both of which have a previous production record. The old Ward mine, which has a World War I production record of between 2000 and 2500 tons, and which has been idle ever since, is the third largest producer. It was reactivated during the summer of 1956. In all, the production originated from thirteen different deposits and was made by fifteen different operators. Several of the smaller properties represent deposits having no previous record of operation. Five concentrating mills were erected in the John Day area during this period, the first being a small pilot plant constructed by Burt Hayes in the summer of 1952. Three of the five mills were intact at the close of 1956; all were in operation at various times during the 1956 season. These are (1) the Tri-County mill operated on a custom basis, (2) the Al Dunn mill, operated part time on ore from the Dunn lease and part time on a custom basis, and (3) the Haggard and New mill operated exclusively on ore from the Haggard and New mine.

In addition to the shipments cited in the previous paragraphs, there was on hand in the John Day area at the end of 1956 an estimated 260 tons of ore ready to be milled and 50 tons of concentrates ready to be shipped as soon as weather conditions moderated. There were also nine operators who announced plans for continued and expanded operation in 1957.

Such is the picture of eastern Oregon chrome mining at the close of 1956. Whether the 1956 production record of 1533 dry short tons and \$167,390 settlement value will be maintained during 1957, remains to be seen, but the year is in any event starting out strong, and the new carlot shipment plan should be a help to those operators who can afford to hold back their concentrates long enough to amass a carload.

N. S. W.

BLACK SAND POTENTIAL INVESTIGATED

Black sand deposits in Idaho, Montana, Oregon, and Washington are appraised in a recent report by the U.S. Bureau of Mines entitled "Potential of heavy-mineral-bearing alluvial deposits in the Pacific Northwest." Technology and uses of the heavy minerals are reviewed also.

Heavy minerals present in recoverable quantities in black sands are chromite, ilmenite, magnetite, zircon, monazite, columbite-tantalite, and radioactive blacks. The term "radioactive blacks" refers to columbium, tantalum, uranium, thorium, and certain rare earths. Mineral constituents in the black sands of the Pacific Northwest vary considerably from place to place depending upon the source rock. For example, Idaho has placer deposits that contain large concentrations of monazite and radioactive blacks. Oregon and Washington have extensive deposits of beach sands, but, so far as has been determined, these sands contain only small quantities of monazite with larger proportions of chromite, zircon, ilmenite, and garnet.

Interest has been focused since 1950 on monazite because of the short supply of this critical mineral. But interest in the other heavy-mineral constituents of black sands is growing, and research and development programs directed toward their utilization are steadily increasing. According to the Bureau's report, development of heavy minerals from the Pacific Northwest alluvial deposits will depend largely on availability of markets within a reasonable distance.

The report, designated as Information Circular 7767, may be obtained free of charge from the U.S. Bureau of Mines, Publications Distribution Section, 4800 Forbes Street, Pittsburgh 13, Pennsylvania. It should be identified by number and title.

GEOLOGY OF IZEE AND LOGDELL QUADRANGLES MAPPED

Reconnaissance geologic map of the Izee and Logdell quadrangles, Oregon, by Robert E. Wallace and James A. Calkins, has just been published by the U. S. Geological Survey. It is designated as MF 82 and is one of the Mineral Investigations Field Studies map series.

Formations exposed in the area are metamorphosed rocks of probable Paleozoic age, marine sedimentary rocks of Triassic and Jurassic age, numerous basic and silicic extrusive rocks of Tertiary age, and intrusive rocks including basaltic dikes and sills, dioritic dikes, peridotite, and serpentine. Major folds and faults are shown on the map as are attitudes of beds, fossil localities, and mines and prospects.

The map and a text describing the geology are printed on a single sheet. The map is in black and white with patterns and symbols to differentiate rock units; it requires coloring for

easy readability. Base for the map is the 1951 edition of the Forest Service map, which shows roads, streams, and the more prominent topographic features. Scale is 1:62,500 (1 inch = 1 mile).

MF 82 may be obtained from the U.S. Geological Survey, Denver Federal Center, Denver, Colorado. Price has not been announced. 50¢.

LONG-RANGE MINERALS PROGRAM

The long-awaited, long-range minerals program of the Department of the Interior is still not completed and there is no definite indication as to when it will be announced. This was the implication to be drawn from a statement made recently by Interior Assistant Secretary Felix E. Wormser. Wormser said, "nothing is firm yet in spite of much hard work by all available staff." He told the Colorado Mining Association that some of the long-range mining aids under consideration are possible changes in tax laws affecting mining, stepped-up technological research and possible revision of the mining and leasing laws.

Of extreme import to the mining industry was Wormser's statement, "We have also examined the extremely controversial area of international trade in mineral commodities to determine if Federal action is needed to equalize competition between foreign and domestic producers, and to find out if appropriate action might be taken without jeopardizing other national objectives." (From The American Mining Congress Bulletin Service, February 15, 1957.)

FEDERAL LEGISLATION

United States Senators Magnuson and Jackson, Washington, have recently introduced Senate Joint Resolution 49 to establish a public lands' study group. The resolution would establish a temporary commission of fifty members appointed by the President to investigate the division of authority and control over public lands among Federal agencies to determine the feasibility of a uniform program by such agencies, determine the most effective long-range conservation adaptable to the lands, and determine the most effective multiple uses of such lands. The commission would submit its recommendations to the President and Congress.

S. 1004-PERMIT MINING ON RECLAMATION SITES - Dworshak (Idaho) and Barrett (Wyoming). Committee on Interior and Insular Affairs. Would open all public lands belonging to the United States heretofore or hereafter withdrawn or reserved for reservoir sites under the reclamation laws to entry for location and patent of mining claims and for mining, development, beneficiation, removal, and utilization of the mineral resources. The United States, its permittees and licensees could not be held liable for damage, destruction or loss resulting from the use of such lands. (From The American Mining Congress Bulletin Service, February 20, 1957.)

FEDERAL MINERAL PURCHASES

Mineral purchasing by the U.S. Government is expected to begin in March. The Senate passed the appropriations bill containing the \$30-million for buying tungsten, acid grade fluor-spar, asbestos, and columbium - tantalum. The bill will go into joint Senate-House conference soon. Most observers believe it will go through. (From E&MJ Metal and Mineral Markets, February 21, 1957.)

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THIRTY YEARS OF MERCURY IN OREGON

By
Howard C. Brooks*

Oregon's quicksilver industry remained largely undeveloped until 1927, despite the fact that two of its largest producing mines were discovered prior to 1900. Although records of pre-1927 production are meager, Schuette** estimated the total to be about 3,000 flasks. During the past thirty years, Oregon mines have produced slightly more than 92,000 flasks or approximately 15 percent of the domestic quicksilver supply.

Cinnabar was recognized, possibly for the first time in Oregon, by placer miners working the alluvial-gold deposits of Jackson County in the early 1860's. In the following years, some quicksilver was recovered with crude retorts and sold locally to the miners. The Bonanza, Nonpareil, and Elkhead deposits of Douglas County were discovered before 1870, and by 1879 reduction plants were established on both the Bonanza and Nonpareil properties. However, the mines were abandoned after slight production, and the Bonanza, which was to become Oregon's greatest contributor, produced little until 1937.

Development of the Black Butte mine in Lane County, another of Oregon's larger producers, began in the early 1890's. In 1898, the late W. B. Dennis, a prominent Oregon engineer, acquired the property, and, under his management, some 15,000 feet of development work was done. To treat the ore, Dennis designed a furnace plant that is said to have been far in advance of its time. Because of low mercury prices and the bank panic, the mine was closed in 1908 and remained idle until 1916.

The demands of World War I so stimulated production that the Black Butte was reopened, and the War Eagle mine in the Meadows district of Jackson County came into production. From 1916 through 1919, these and several smaller mines and prospects contributed to a total of 1,860 flasks (1,271 of which came from the Black Butte) at an average price of \$113.36 per flask.

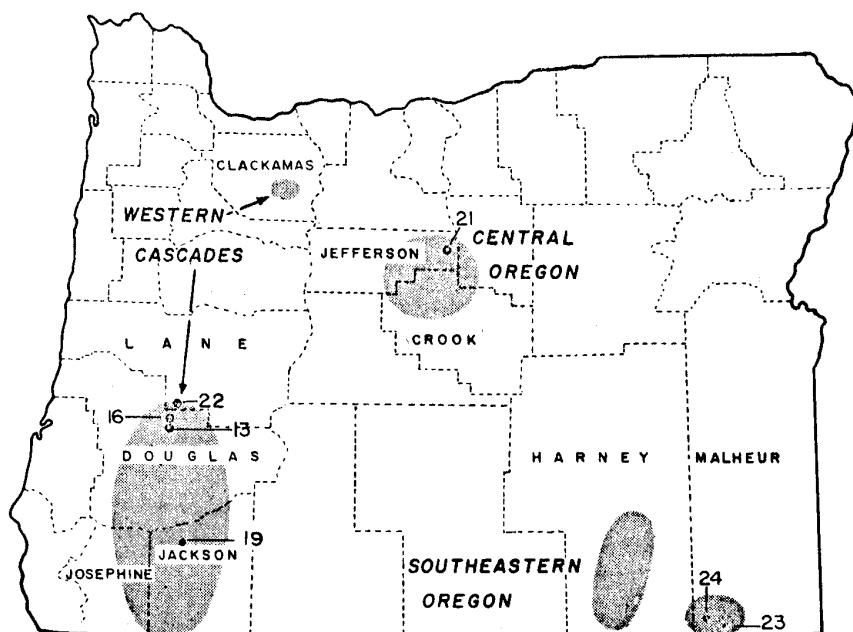
By 1921, mercury prices had declined to an average of only \$46.07, and Oregon's production again became almost nil, remaining so until 1927. The total United States production dropped to 6,339 flasks in 1921 from a 1917 wartime high of 36,159 flasks. In 1926, the total output was only 7,642 flasks, although the average price doubled that of 1921. Thus is reflected the industry's fear of the mercury market, the instability of which

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**See references following report.

was so drastically emphasized in the 1921 collapse. However, mercury values rose to an average of \$118.16 in 1927 and, largely because of the influence of the European cartel (Mercurio Europeo, established in 1928), prices remained in excess of \$100 per flask until 1931. The cartel was formed by Spanish and Italian producers who controlled 80 percent of the world production at the time. Aims of the organization were distribution of sales, control of production, and stabilization of prices. As a result of continuing high prices, plus the general feeling of prosperity prevalent in the late 1920's, mines began reopening and new prospects were developed. In 1931, the United States produced enough quicksilver for its own needs for the first time since 1918.

The real development of Oregon's quicksilver industry began with the production of 2,080 flasks in 1927 - nearly as much as the estimated total previous production. Several mines became so well established during the boom period, 1927-1931, that they were able to weather the depression, although production decreased from 5,011 flasks in 1931 to 1,342 in 1933. By the end of 1937, all of Oregon's major producers of the past 30 years were in operation.



PRINCIPAL QUICKSILVER DISTRICTS

Principal Quicksilver Producers

Mine	County	Mine	County
1. Kiggins	Clackamas	13. Bonanza	Douglas
2. Nisbet	"	14. Elkhead	"
3. Blue Ridge	Crook	15. Mother Lode	"
4. Byram and Oscar	"	16. Nonpareil	"
5. Champion	"	17. Cinnabar Mountain, Jackson	"
6. Johnson Creek	"	18. Mountain King	"
7. Maury Mountain	"	19. War Eagle	"
8. Mother Lode	"	20. Axe Handle	Jefferson
9. Number One	"	21. Horse Heaven	"
10. Staley	"	22. Black Butte	Lane
11. Taylor Ranch	"	23. Bretz	Malheur
12. Towner	"	24. Opalite	"

The major contributors in the early period from 1927 to 1933 were the Black Butte mine, reopened in 1927 by the Quicksilver Syndicate, and the Opalite and Bretz mines in Malheur County, put in operation by the Bradley Mining Company in 1927 and 1931, respectively. The Horse Heaven mine in Jefferson County came into production in 1934, and was acquired by the Horse Heaven mine, Inc., division of the Sun Oil Company in 1936. The Bonanza, discovered several decades before, began active and continuous production in 1937, operated by Bonanza Mines, Inc. Although there are a large number of small producers and undeveloped prospects in Oregon, more than 80 percent of Oregon's past mercury production is accounted for by these five mines. By 1944, each had produced more than 10,000 flasks, and the Bonanza in eight years had contributed 24,471 flasks to account for more than a quarter of Oregon's total output.

The yearly average of Oregon production from 1927 through 1945 is about 4,265 flasks. The greatest production was made in 1940-1941 when more than 20 mines contributed over 9,000 flasks each year for an average of \$180.95 per flask. In 1940, the Bonanza led all mercury mines in the United States in annual production with a contribution of 5,733 flasks. However, during each succeeding war year after 1941, a sharp decrease in production was realized until in 1945, Oregon's total output was only 2,500 flasks. In 1943 and 1944, large amounts of foreign mercury were purchased by the government despite the fact that domestic mines were adequately supplying the wartime needs of the United States and some of the Allied Nations. A surplus was quickly obtained. As a result, the government price support was removed and prices declined rapidly. The United States production decreased from an all-time record of 51,929 flasks from 146 mines in 1943 to 30,763 flasks from 68 mines in 1945.

By 1944, the Bretz, Opalite, and Black Butte mines were closed as reserves minable under existing conditions were depleted. In 1944, the surface plant at the Horse Heaven mine was destroyed by fire, and known reserves did not warrant the expenditure required to rebuild even of war-directed labor and materials had been available. Consequently it too closed, leaving the Bonanza as Oregon's only major producer still in operation.

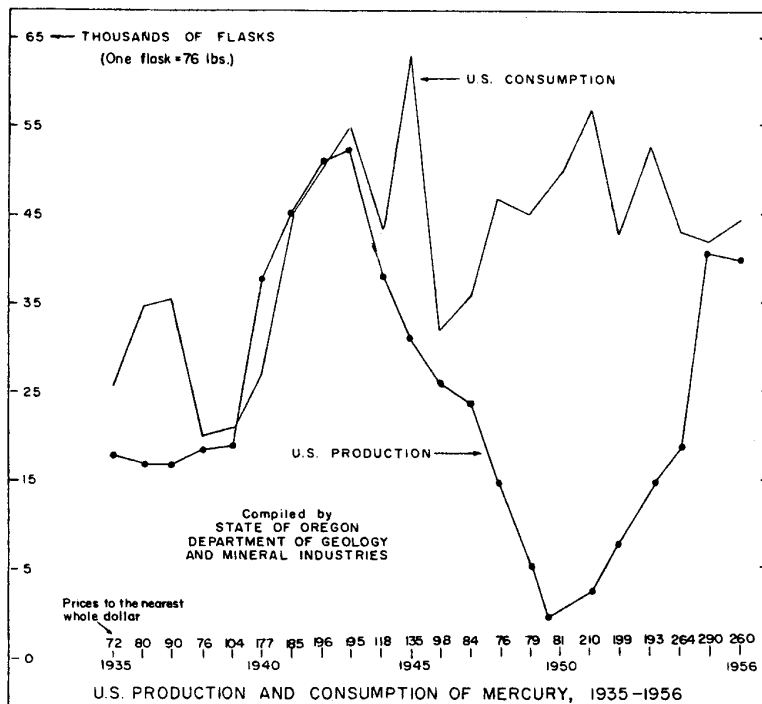
When World War II ended in 1945, mercury played its familiar role of reacting rapidly to changed economic conditions and became a drug on the market even before the consumption of other metals diminished. New supplies, foreign and domestic, exceeded consumption by 55 percent in 1946, and some United States producers are believed to have operated at a loss. Oregon's contribution was 1,326 flasks, the lowest output since 1926. Due to the excessive purchases of foreign mercury by the United States government, the domestic market became saturated and prices were forced ever lower while production costs rose. In 1950, all but 16 mercury mines in the United States were closed, including Oregon's all-time great, the Bonanza. Oregon produced 5 flasks of mercury in 1950. The total United States production that year was 4,535 flasks for an average price of \$81.26 per flask. These 4,535 flasks, the smallest annual output in at least 100 years, constituted only 7 percent of the total United States supply. The other 93 percent was imported.

The United States normally produces only a fraction of its consumption requirements because the lower grade of domestic ores and the higher production costs place domestic producers at a disadvantage in competing with major sources. The 1952 Minerals Yearbook reports that the annual averages of mercury ore produced from 1927 through 1952 varied between 6.0 and 12.5 pounds per ton, and the 1943 record production was extracted from ore averaging 6.3 pounds of recoverable mercury per ton. Italian ores about double this

latter figure, and the grade of ore at the Almaden mine in Spain, the world's largest producer, is 3 to 5 times that in Italy. In spite of this fact, United States producers did supply the war-time needs of the Allied Nations when foreign sources were cut off and mercury prices were

forced to abnormal heights. The accompanying graph illustrates the reaction of domestic production to economic conditions of the mercury market.

With the phenomenal rise in average price to \$210.13 per flask in 1951, domestic production increased to only 7,283 flasks. Oregon's contribution of 1,177 flasks came almost entirely from the reactivated Bonanza mine. During the war years, production had been at tremendous rates and, due to the shortage of men and materials, the upkeep of many of the mines and the development of future reserves were neglected. Consequently, the reopening of inactive mines required outlays of considerable capital, and producers were slow in expanding



production without some assurance of market stability. Also, when compared with pre-inflation mercury values and production costs, the 1951 average price is considerably reduced. The following table is taken from Minerals Yearbook 1951. Prices were adjusted by the Bureau of Labor Statistics wholesale price indexes (1947-1949 = 100).

Average Annual Prices (range)		
	Actual	Adjusted
1935-1939	\$ 71.99 to \$103.94	\$ 90 to \$135
1940-1943	176.87 to 196.35	225 to 199
1950	81.26	50
1951	210.13	116

In 1951, the Defense Minerals Procurement Agency considered it unnecessary to allow government aid in the expansion of domestic mercury production. World supply was then adequate for world demand. However, since the United States was then producing only a small part of its consumption requirements, dependence on foreign sources led to the establishment of a strategic stockpile of mercury. Mercury was also included with minerals eligible for exploration aid through the Defense Minerals Exploration Administration. The loans are granted to those eligible on a matching-fund principle, the DMEA meeting 75 percent and the operator 25 percent of exploration costs. Substantial reserves have been developed in Oregon and other states as a result of this assistance.

In July 1954, without consulting the mercury industry, the General Services Administration announced a mercury procurement program calling for the purchase of 125,000 flasks of

domestic and 75,000 flasks of Mexican mercury at a price of \$225 per flask. The program is to remain in effect until such procurement is completed or until December 31, 1957, whichever occurs first. Because the market prices for mercury have greatly exceeded \$225 per flask since the establishment of the program, no Government stockpile purchases of domestic metal have been made. Nevertheless, the purchase program has been of value in that it established a "floor" price for quicksilver and assured domestic producers a minimum price. This has deterred price manipulations by the cartel.

The 1956 total of 1,875 flasks for an average of \$260 per flask became Oregon's highest contribution since 1945. The major contributions were made by the Bonanza mine and the Horse Heaven mine, the latter of which began producing again in May 1955 from broken ore and pillars left in the mine since the fire in 1944.

Two other large past producers, the Bretz and the Black Butte, closed since 1944, came into production again late in 1956. Substantial reserves of high-grade ore are reported to have been developed at the Bretz in 1955. To treat the ore, a 150-ton flotation plant was completed in December 1956 and is now operating 24 hours a day. The process of concentrating cinnabar by flotation on such large scale is almost, if not wholly, unique. The management reports that results have been very favorable. Development work at the Black Butte mine has succeeded in blocking out new ore, and by the end of 1956, the mine was turning out about 100 flasks of quicksilver per month.

Several of Oregon's smaller past producers have also been reactivated, and expensive exploration work has been done in attempting to develop new mines.

The comparative stability and high level of prices in recent years have encouraged the revitalization of Oregon's quicksilver industry. If present conditions continue, the industry will undoubtedly expand. However, what the future holds is difficult to determine for, as demonstrated by past events, the domestic market is most erratic, and mercury values depend largely upon international conditions and price manipulations. With the ending of the purchase program at the end of 1957 the domestic quicksilver industry will once more be at the mercy of the cartel controlling the European mines.

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Williams, Howell, and Compton, R. R., (1953), Quicksilver deposits of Steens Mountain and Pueblo Mountains, southeast Oregon: U.S. Geol. Survey Bull. 995-B.

Yates, R. G., (1942), Quicksilver deposits of the Opalite district, Malheur County, Oregon, and Humboldt County, Nevada: U.S. Geol. Survey Bull. 931-N.

MERCURY FLOOR PLAN EXTENDED

The Department was notified March 21 by Congresswoman Edith Green that the \$225-per-flask purchase program for quicksilver had been extended for one year. Mrs. Green's telegram follows:

HOLLIS M. DOLE, DIRECTOR

ODM TODAY AUTHORIZED GSA TO EXTEND MERCURY PURCHASE PROGRAM THROUGH 1958. THIRTY THOUSAND FLASKS DOMESTIC TWENTY THOUSAND MEXICAN AUTHORIZED TO BE PURCHASED SAME PRICE

EDITH GREEN MC

WHITE KING URANIUM CONTINUES PRODUCTIVE

The Lake County Examiner reports that 10 carloads of uranium ore were shipped from the White King property, near Lakeview, in late January and early February. Four carloads were surface ore and six carloads were underground ore taken from the shaft. The exploratory shaft is down to 90 feet and drilling continues. A level has been established at 70 feet and the next level will be at 155 feet. The company has several geologists exploring and studying the area.

U.S. GEOLOGICAL SURVEY ANNOUNCES NEW MAP PRICES

The U.S. Geological Survey announces the following changes in the prices of its topographic maps effective May 1, 1957:

List Price: The list price of topographic quadrangle maps at scales 1:24,000; 1:31,680; 1:62,500; 1:125,000; and 1:250,000 (1° x 1° reconnaissance series) is 30 cents each. The list price of topographic maps at scale 1:250,000 (new 1° x 2° series) is 50 cents each.

National Park and other special topographic maps are individually priced. A price list is available upon request.

Discounts: A discount of 20 percent is allowed on all orders which amount to \$10 or more at the list price. A discount of 40 percent is allowed on all orders which amount to \$60 or more at the list price. The discounts apply to all topographic, geologic, and special maps distributed by the Geological Survey.

SHELDON GLOVER RETIRES

Sheldon L. Glover retired as Supervisor of the Washington Division of Mines and Geology on March 1, 1957, after serving on the staff of the Division for 23 years, the last 16 of which as Supervisor.

Mr. Glover graduated from the University of Washington with a Bachelor of Science degree and received his Master of Science degree from the University in 1921. After 7 years of consulting work with the firm of Landes and Glover, consulting geologists of Seattle, he went into private professional work in British Columbia in charge of exploration and development for the Shenandoah Mining Company. In 1934 he joined the staff of the Washington Division of Geology as Assistant Supervisor, with headquarters at Pullman. He was transferred to Olympia in 1941 as Supervisor of the Division of Mines and Mining, and in 1945, when the two divisions were consolidated to form the Division of Mines and Geology, he became supervisor with headquarters in Olympia.

Sheldon Glover served in the U.S. Army Coast Artillery as First Lieutenant from 1917 to 1919. He is the author of numerous technical articles and bulletins on Washington geology.

The names of Glover and the Washington Division of Mines and Geology became synonymous over the years and no geologist in the Northwest was better known, more greatly respected and liked than Shelly Glover. The State of Washington owes him a debt of gratitude for long and faithful service.

Marshall Huntting, formerly Assistant Supervisor, has succeeded Mr. Glover as Supervisor.

DREDGING LEGISLATION INTRODUCED

A bill, H. B. No. 655, was introduced in the Oregon House of Representatives March 5 that, if passed, would require any placer or dredge mining operation conducted in Oregon to:

- (1) Secure a license from the State Land Board, the application fee for which would be \$50 for each 50 acres of land or fraction thereof.
- (2) Post a bond with the State Land Board of \$300 for each acre of land to be mined.
- (3) Replace topsoil and restore area to its natural condition.
- (4) Replace water course on original meander line.
- (5) Construct settling ponds to clarify water.

The Land Board may revoke a license if violations of the conditions are found and the Board may make rules and regulations to carry out provisions of the act if necessary. The bill also states that violation of the provisions would be a misdemeanor.

H. B. 655 has been referred to the House Committee on State and Federal Affairs, Representative Norman Howard, Chairman. As yet no time has been set for a hearing.

AIME REGIONAL CONFERENCE TO MEET

The tenth annual AIME Pacific Northwest Regional Conference will be held in Portland at the Multnomah Hotel on April 11, 12, and 13. The Conference which originated in Portland in 1948 has grown from a strictly Industrial Minerals meeting to a full-fledged conference which embraces nearly all of the various fields of mining and geology. Included in the three-day program will be two field trips, one to the Owens-Illinois glass plant in Portland, another to Albany where titanium and zirconium plants operated by Oregon Metallurgical and Wah Chang will be visited. The U.S. Bureau of Mines station at Albany will hold open house also. Luncheon and banquet speakers will include Dr. A. B. Kinzel, president, Union Carbide & Carbon Research Laboratories; George Beard, assistant vice president and project development engineer, Pacific Power and Light; Dr. William J. Kroll, metallurgist; and R. R. McNaughton, Manager, Metallurgical Division, Consolidated Mining & Smelting Company of Canada.

The Industrial Minerals Section will hold two sessions. On Friday afternoon the following papers will be given: "Euxenite Dredging, Concentration and Chemical Processing" by Warren Wagner, "Increasing Military Demands on Alaska Coals" by H. F. Yancey and M. R. Geer, "Development of the Lone Clay Property" by Richard P. Brooks, "New Applications of Carbon in Mining and Metallurgy" by S. W. Martin and L. Kiefer, and "The Conversion of Gilsonite to Coke, a Process Seventy-two Miles Long" by Park L. Morse. On Saturday morning there will be a lightweight aggregate symposium with Frank Spangler, S. Carl Smithwick, Lloyd A. Williamson, and William E. Miller participating.

The Geology Section has scheduled the following papers for Friday morning: "Uranium Deposits of Northwestern Washington" by Hubert W. Norman, "Nature and Origin of Southwestern Oregon Chromite Deposits" by Len Ramp, "The Challenge of Moran" by Harry V. Warren, and "Riddle Nickel Deposit" by Walter A. Foster.

The Metals Branch will have a full session of papers and there will also be a Minerals Beneficiation session. Since many wives attend the Regional Conferences a full program of activities has been provided for them.

LAND DETERMINATIONS PUBLISHED

The U.S. Forest Service has notified the Department of the publication in local newspapers of several notices to mining claimants (see opposite page). The notice is part of the procedure established by Public Law 167, the Multiple-Use Mining Law, that would allow the U.S. Forest Service and U.S. Bureau of Land Management to take over management of the surface resources of mining claims. Holders of valid mining claims which are included in the notice must file a "Verified Statement" (a statement under oath) in response to the publication if they wish to keep the status of their claims the same as before passage of Public Law 167. Failure to file a "Verified Statement" within 150 days from the time of first publication in the newspapers will be considered as conclusive evidence that the mining claim owner:

- (1) Waives and relinquishes any right, title, or interest under such mining claim as regards the surface rights.
- (2) Constitutes a consent by the mining claimant that the mining claim shall be subject to the limitations and restrictions of Public Law 167.

- (3) Precludes thereafter any assertion of such mining claimant of any right or title or interest in the mining claim contrary to or in conflict with Public Law 167.

The "Verified Statement" should be filed with the Land Office of the Bureau of Land Management, P.O. Box 3861, Portland 8, Oregon. Attention is called to the necessity of having the statement sworn to before a notary public or other officer authorized by law to administer oaths. Persons desiring a "Verified Statement" form can obtain it at no charge by writing to offices of the Department.

FOREST SERVICE PUBLICATION NOTICES					
National Forest	Name of area	Acres Nat'l. Forest Land	Date of First Publication	Name of Newspaper	City of Publication
Siskiyou	Fuller	8,200	Feb. 21, 1957 Feb. 27, 1957	Curry County Reporter Coos Bay Times	Gold Beach Coos Bay
Siskiyou	Wildhorse	53,000	Feb. 21, 1957	Curry County Reporter	Gold Beach
Willamette	Little N. Fork	22,600	Feb. 27, 1957	Oregon Statesman	Salem
Deschutes	Chemult	45,500	Feb. 27, 1957	Herald and News	Klamath Falls
Fremont	Chemult	8,500	Feb. 27, 1957	Herald and News	Klamath Falls
Whitman	Woodley	35,250	Feb. 27, 1957	Observer	La Grande
Whitman	Dooley Mt. Buffalo	44,000	Feb. 21, 1957 Feb. 27, 1957	Blue Mt. Eagle Democrat Herald	John Day Baker

An explanation of Public Law 167 was given in the August 1955 issue of The Ore.-Bin. The procedures under which the U. S. Forest Service is conducting land determinations and the rights of claim holders were discussed in the April 1956 Ore.-Bin. Maps showing location of the land determination areas listed on this page were printed in the October 1956 Ore.-Bin. Persons desiring

copies of these Ore.-Bins may obtain them at no charge by writing to the Department of Geology and Mineral Industries, 1069 State Office Building, Portland 1, Oregon.

FRESH WATER AVAILABLE IN COOS BAY SAND DUNES

Studies made by U.S. Geological Survey

An investigation made in 1954-56 by the U.S. Geological Survey in cooperation with the State Engineer has shown that a considerable amount of fresh ground water of generally good quality is present in the sand-dune area north of Coos Bay. The results of the investigation are incorporated in a 32-page open-file report entitled, "Ground-water resources of the sand-dune area north of Coos Bay, Oregon." Authors are S. G. Brown and R. C. Newcomb, geologists with the U.S. Geological Survey. The report is not for sale, but copies are on file at offices of the State Engineer and at the principal libraries in the Coos Bay area. The report may be consulted at the offices of the U.S. Geological Survey and the Oregon Department of Geology and Mineral Industries in Portland.

The report describes the ground-water body as a thin lens lying in an area of about 8 square miles of dune sand. The base of the lens is near sea level while the upper surface rises to 25 or 30 feet at the crest of the dune ridge. The lens is believed to be perched on a layer of clay that isolates it from the possible saline water below.

Annual rainfall in the area is about 61 inches. With 75 percent of it percolating into the ground-water body, an estimated 780 million gallons of water per year, or an average of about 2 million gallons per day, may be available for withdrawal from each square mile of sand-dune area.

Analyses of the water show that it is soft, has low salinity, is odorless, has a satisfactory taste, and normal temperature. The known features that are detrimental to its quality are a slight acidity, presence of iron in some places, and a light-brown organic color near marshy areas.

Studies continued by Pacific Power and Light Company

With completion of the preliminary investigations by the U.S. Geological Survey, as described above, the work was taken up and continued by the Pacific Power and Light Company to determine whether the fresh water in the dune area would be suitable in quantity and quality for pulp and paper manufacture. The Company reports that during the past 14 months it has made extensive field investigations in a 20 square-mile area. Pilot-plant pumping was done at Jordan Lake on the southern edge of the dune area and at Hauser on the eastern edge, and 170 piezometers and a number of rain gauges were installed throughout the dunes. A larger quantity of fresh water than could be accounted for by rainfall was indicated, and it was determined that there is an underground replenishment from older formations lying to the east where the annual rainfall averages higher than in the dune area. Drilling indicated that sand containing fresh water extends well below sea level. The Company's investigations reveal that the water supply potential is even more favorable than indicated by the U.S. Geological Survey's report.

NOTICES PUBLISHED BY BUREAU OF LAND MANAGEMENT

The U.S. Bureau of Land Management has published notices of land determinations on mining claims in Josephine and Douglas counties according to a release from the regional office. Date of first publication is given as March 20, 1957. Owners of valid mining claims who wish to maintain their claims the same as before passage of Public Law 167 must file a "Verified Statement" with the Land Office of the Bureau of Land Management, P.O. Box 3861, Portland 8, Oregon, within 150 days from March 20 (see p. 26, this issue of The Ore.-Bin). Mining claims involved in these are located as follows:

Josephine County - Sections 1, 3, 5, 7, 9, 11 to 13 incl., 15, 17 to 19 incl., 21, 23, 25, 27, 29, 31, 33, and 35, T. 38 S., R. 6 W., W.M.; Sections 1, 2, 6, 7, 9, 11 to 15 incl., 17, 19, 21, 22, 23, 25, 27 to 35 incl., T. 39 S., R. 5 W., W.M.; and Sections 1, 3, 11 to 15 incl., 23 to 26 incl., T. 39 S., R. 6 W., W.M.

Douglas County - Sections 1, 3, 5, 6, 7, 9, 11, 12, 14, 15, 17, 19, 21, 23, 28, 29, 31, 32, and 34, T. 30 S., R. 2 W., W.M.

BILL INTRODUCED IN U.S. SENATE

S. 1176 - National Wilderness Preservation System - Humphrey (Minn.), Neuberger (Ore.), Smith (Maine), Morse (Ore.), Douglas (Ill.), Mundt (S.D.), Murray (Mont.), Wiley (Wis.), Clark (Pa.), Lausche (Ohio), Jackson (Wash.), and Magnuson (Wash.). Committee on Interior and Insular Affairs. Similar to H.R. 361 by O'Hara (Ill.). Would establish a vast National Wilderness Preservation System which would include large areas within national forests; "mining or the removal of mineral deposits" would be prohibited in any part of the System.

(From Am. Mining Congress Bulletin Service, March 18, 1957.)

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

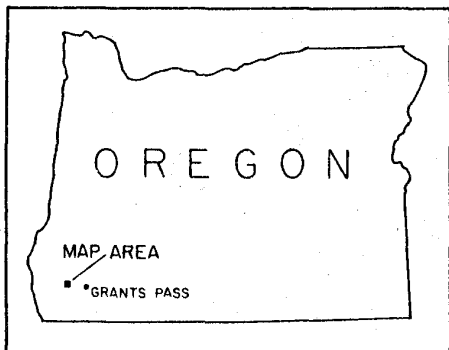
GEOLOGY OF THE LOWER ILLINOIS RIVER CHROMITE DISTRICT

By
Len Ramp*

Introduction

General. This is the second preliminary report on the work being done in connection with a study of chromite deposits in southwestern Oregon. Most of the State's chromite production has come from this area and predominantly from the Oregon Chrome mine (No. 31, see map on following page).

Geography. The area mapped lies mostly in the west $\frac{1}{2}$ of T. 37 S., R. 9 W., along the Illinois River in the western part of Josephine County. A portion of the area overlaps into R. 10 W. and T. 38 S. It is reached by 12 miles of Forest Service road from Selma, on the Redwood Highway (US 199) about 22 miles southwest of Grants Pass.



Topography of the area is rugged. Relief from the highest point, Pearsoll Peak, a short distance southwest of the mapped area, to the narrow, often steep-walled canyon of the Illinois River is about 4100 feet. Land-sliding is a common feature. There are more than ten fairly large active landslides in the area. The cirque-

like landslide area just north of the Chrome King mine (No. 44) and the one west of the Crown mine (No. 5) are prominent topographic features. The hillside west of the Illinois River and north of Dailey Creek to the drainage area of Lightning Creek contains numerous slump blocks and sag ponds and in general displays the typical hummocky topography of a landslide area.

Field work. Basic geologic information is from the Kerby quadrangle geologic map (Wells and others, 1949). The large-scale mapping of the present studies by the Department was begun during the fall and winter of 1953 and has been carried on intermittently until the present. Several of the larger chromite deposits have been mapped in detail.

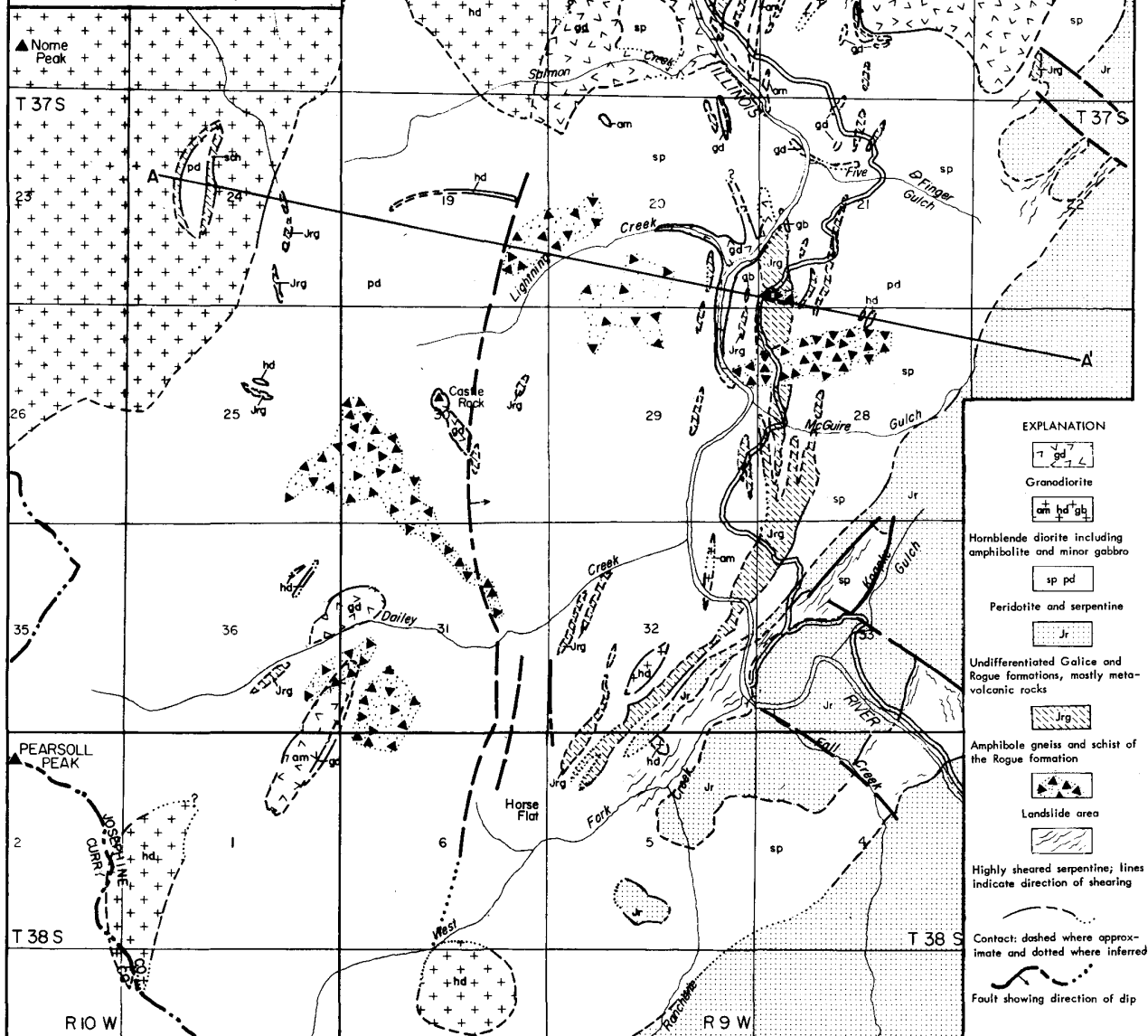
Geologic setting

Geology of the area is complex. The area is underlain predominantly by peridotite which is either partly or completely altered to serpentine. The most common variety of peridotite is saxonite which is composed primarily of olivine and enstatite in varying pro-

*Geoloaist. State of Oreaon Department of Geoloav and Mineral Industries.

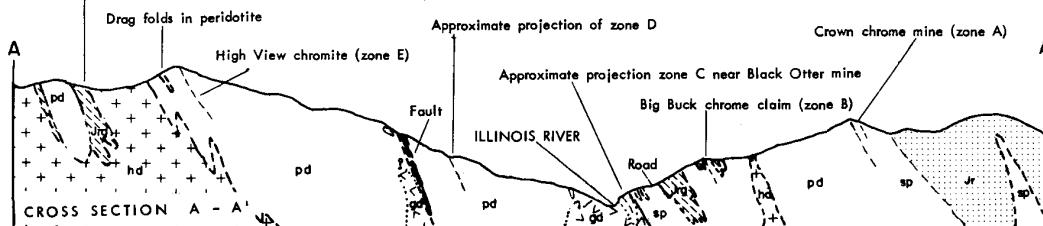
GEOLOGIC MAP of the LOWER ILLINOIS RIVER AREA

JOSEPHINE COUNTY, OREGON

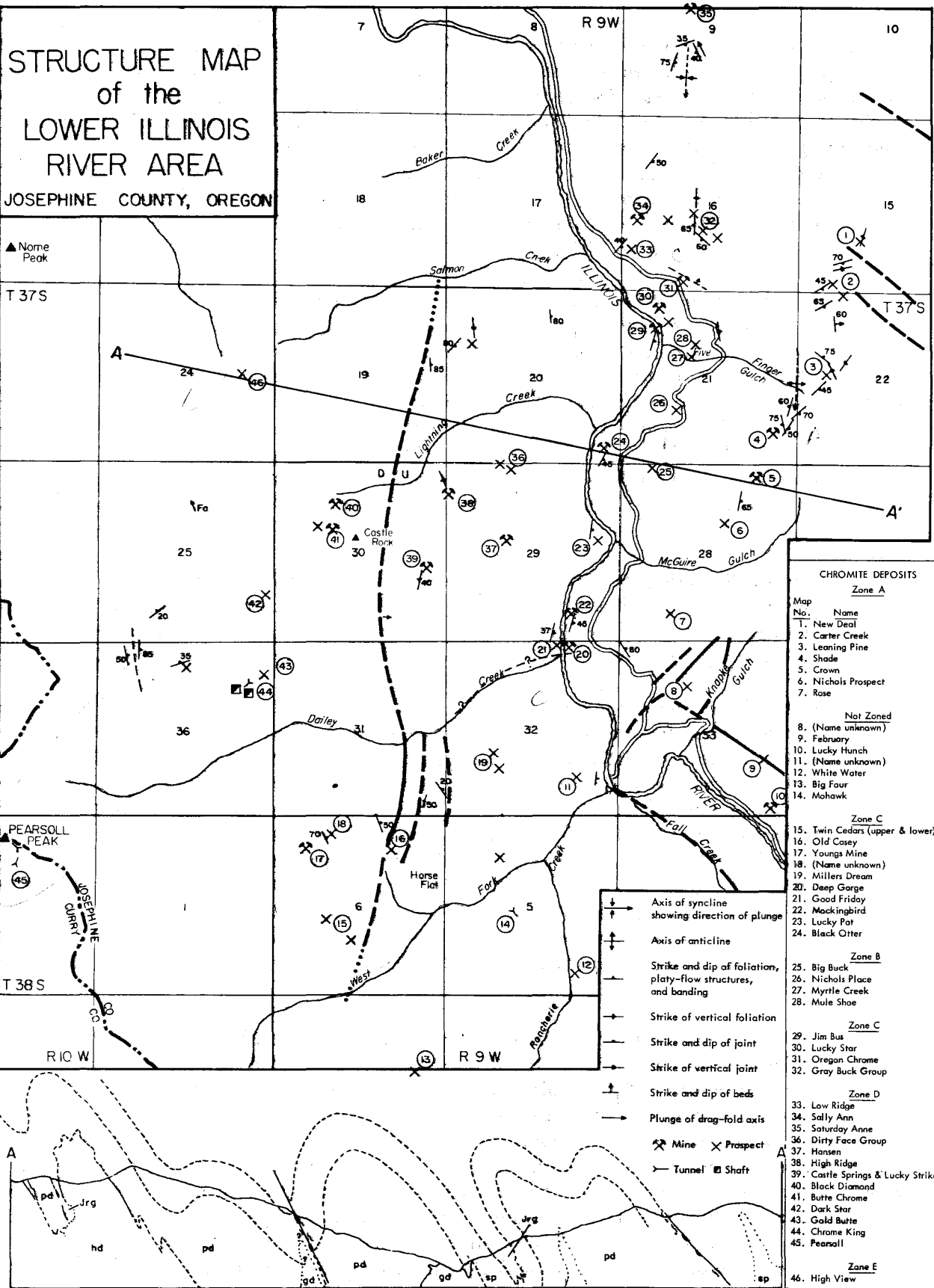


Drag-folded schist and gneiss

0 1/4 1/2 1 2 MILES



Geologic Map by
Len Ramp, Geologist
State of Oregon
DEPARTMENT OF GEOLOGY
and
MINERAL INDUSTRIES
April 1957



portions together with minor amounts of magnetite and chromite. Serpentinization is more complete in shear zones, near contacts with the intruded rocks or inclusions, and in areas surrounding later intrusives. The ultramafic rocks (peridotite and serpentine) have intruded sedimentary and volcanic rocks belonging to the Galice and Rogue formations of Upper Jurassic age. These formations (undifferentiated on the accompanying geologic map) are composed mainly of volcanic rocks which have suffered low-grade regional metamorphism. Hornblende gneiss occurs near the serpentine contacts and as inclusions and roof pendants in the serpentine and peridotite. Similar gneiss has been mapped as Rogue formation in other areas (Wells and Walker, 1953).

Dikes and irregularly shaped intrusives of hornblende diorite and granodiorite and occasionally amphibolite and gabbro have intruded the ultramafic rocks. A stock of granodiorite underlies the northern part of the map area and extends north to the drainage of Red Dog Creek. The granodiorite exposed in the bed of the Illinois River at the mouth of Lightning Creek is apparently part of the same intrusive. A belt of hornblende diorite approximately 5 miles wide borders the map area to the northwest.

All of the intrusive rocks in the area are dated as late Jurassic to early Cretaceous and the more basic rocks are considered as having been intruded the earliest.

Structure

In general the formations strike north to northeast and dip steeply to the east. The granodiorite and its related dikes show the least amount of conformity in this respect. Inclusions, schlieren, and foliations in the ultramafic rocks, as well as in the chromite deposits, all seem to conform to this major structural trend.

Folding. The peridotite and older rocks have been subjected to considerable deformation. Jointing is a prominent feature wherever fresh outcrops of peridotite are seen. Further evidence of deformation is displayed in the drag folds and the present attitudes of the chromite and pyroxene-rich schlieren which represent primary platy-flow structures in the peridotite. Most of the evidence of folding in the peridotite was obtained in the northern portion of the mapped area. The present outcrop pattern of the granodiorite-serpentine contact appears to be controlled by folding. The series of folds in this area are plunging to the south. Their axes appear to plunge more steeply near the granodiorite contact and it is possible that intrusion of the granodiorite accentuated the plunge. Interpretation of the folding, as illustrated in cross-section A - A', is somewhat idealized and simplified; however, it seems to fit well the available structural data. The folds are inclined, apparently asymmetrical, and approach isoclinal development.

Faulting. As in other areas in southwestern Oregon (Ramp, 1956, and Wells and others, 1940, p. 470) there are apparently two major sets of faulting. One set is essentially parallel to the regional structure (longitudinal) and the other is almost normal to this direction (transverse). Most of the exposed contacts of serpentine with older rocks are highly sheared and undoubtedly represent zones of considerable movement. "Slickentite" along the road west of Rancherie Creek is the result of such shearing. Faults trending N. 40° to 80° W. are far more numerous than shown on the map, but the magnitude of their displacements is probably less than that of the longitudinal faults. Where direction of movement on the transverse faults could be determined, it was found to be oblique. With exception of the large north-trending fault cutting through the mapped area, the transverse faults are of later origin than the longitudinal faults.

Nature of the chromite deposits

General. Spotty outcroppings ranging from lens-shaped pods to almost tabular-shaped wisps of massive chromite and schlieren-banded disseminated chromite are found along definite zones in the serpentinized peridotite. These zones strike from N. to N. 40° E., and in most cases dip at high angles to the southeast.

Shape and size of orebodies. Most of the deposits of the area consist of narrow lenses or planar streaks of disseminated to massive chromite, seldom more than 2 or 3 feet in thickness, extending 20 to 50 feet along the strike, and measuring similar distances down dip. The chromite bodies have been subjected to considerable offset by faulting, which often occurs at small angles to the plane of the ore zone. The result is separation of the lens-shaped pods to a greater degree than that caused by magmatic flowage.

The largest bodies of chromite ore have been found in the Oregon Chrome mine (No. 31). The bodies are lens-shaped and somewhat ellipsoidal in plan; they are approximately 20 feet in maximum thickness, about 150 feet in length, and 50 feet in width; some have been mined that contained as much as 5,000 tons of ore.

In areas of intense shearing and alteration of the ultramafic rocks to "slickentite," small lens-shaped pods of massive, relatively unsheared chromite are occasionally found. "Tails" of crushed chromite leading off the pods in the direction of shearing often lead to other chromite pods. Chromite bodies of this type containing as much as 75 tons of ore have been found in the area.

Composition. The chromite deposits vary considerably in size, shape, and degree of concentration, that is, degree of segregation from the rock. Variation is seen also in the chromic oxide content of chromite crystals from the various deposits. Analyses of chromite samples from the area, with very few exceptions, indicate quite similar compositions. The amount of Cr_2O_3 generally varies between 40 and 50 percent. The average Cr to Fe ratio is 2.45 to 1, and the average Cr_2O_3 content is about 45 percent. A few of the deposits, however, have considerably lower chromic oxide content. The High Ridge claim (No. 38) for example, contains about 37 percent Cr_2O_3 and about 13 percent Fe in milled concentrates. The Twin Cedars prospect (No. 15), the Black Otter (No. 24), and the Rose claim (No. 7) also show off-grade ores which when concentrated fall below the minimum grade requirements* at the Government Stockpile.

The reasons for the variation in composition are not known with certainty, but are believed to be controlled partly by the high alumina content in some, and in other instances to hydrothermal alteration which may have resulted in a replacement of chromic oxide by iron oxide released during serpentinization of olivine. Secondary chrome-bearing minerals, such as kammererite and uvarovite which formed as a result of hydrothermal action, are believed to be evidence of chromite alteration. The presence of abundant talc, occasional aragonite, and minor sulphides in and around the chromite is further evidence of the hydrothermal action.

The chromite-bearing horizon. Five chromite-bearing zones have been distinguished in the broader portion of the ultramafic intrusion. They are designated from east to west as: Zones A, B, C, D, and E. Three of them, zones A, C, and D, are more easily observed than the other two. In the early stages of mapping these three zones were the only ones recognized. They were thought to be entirely separate from one another. After further

* 42 percent Cr_2O_3 and 2 to 1 Cr to Fe.

structural data were gathered, the possibility of the zones belonging to a single chromite-bearing horizon, which was exposed repeatedly in a tightly folded section, became apparent. Drawing of cross section A - A' helped explain why deposits such as those on the Mule Shoe, Myrtle Creek, and High View claims (Nos. 28, 27, and 46) did not seem to fit into the three zones first recognized. Later, with the discovery of the chromite at C. E. Nichols' place (No. 26) and knowledge of the location of the Big Buck claim (No. 25) farther south on Zone B, it was found that these two deposits fitted very nicely on the cross section.

In places the chromite-bearing horizon consists of two parallel chromite zones about 200 feet apart. Two separate chromite zones have been recognized at the Crown mine (No. 5), Deep Gorge (No. 20), and the Mockingbird (No. 22). The two zones could possibly be found in other parts of the area if additional detailed mapping were done.

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URANIUM MILL PROJECTED FOR LAKEVIEW

The Lakeview Mining Company submitted a formal proposal April 12 to the Atomic Energy Commission at Grand Junction, Colorado, for construction of a uranium mill at Lakeview, according to an announcement made by Dr. Garth Thornburg, president of the Company. It is estimated that it will take about 90 days for the AEC to process the proposal. If the proposal is accepted and permission to build received, it will take about 10 months to construct the mill. Cost of the proposed mill is estimated at \$2,750,000. The mill will be rated at 210 tons of ore per day capacity, dry weight, and will employ about 62 persons. It will operate 24 hours per day seven days a week and will accommodate custom ore from other uranium mines provided that the ore is amenable to the process used at the Lakeview mill.

During the coming summer the Lakeview Mining Company expects to employ 54 men in exploration and development at the White King mine and to accelerate underground development. Negotiations are underway with the California-Oregon Power Company for installation of a power line to the mine site.

(Information from Lake County Examiner, April 18, 1957.)

BINGHAM REAPPOINTED TO BOARD

Reappointment of Mason L. Bingham of Portland to the governing board of the State Department of Geology and Mineral Industries was announced Tuesday by Governor Robert D. Holmes.

Bingham, official of the Lewis Investment Company of Portland for more than 20 years, has been chairman of the three-man board which directs the State's activities for geological and mineral resources.

A native of Walla Walla, Washington, Bingham is a graduate of Harvard College and is an associate in the American Institute of Mining and Metallurgical Engineers.

Bingham's new term will run until 1961. Other members of the board are Austin Dunn, Baker, and Niel R. Allen, Grants Pass.

TUNGSTEN PROSPECT LEASED

Mr. Guy O. Woolf, Gold Hill, recently leased his tungsten prospect located on Footh Creek, sec. 14, T. 37 S., R. 4 W., Jackson County, to the Calnevore Developing Corporation from Los Angeles represented by Messrs. Frank D. Robins, M. Goldman, and L. F. Darrell. Calnevore reportedly has tungsten and uranium holdings in California and Nevada. Mr. Woolf said that exploration work will start within three months.

The scheelite occurs in a quartz vein rather than the usual tactite formation. Portions of the vein contain pyrite and minor galena. A sample of the better-grade ore (quartz containing large crystals of scheelite) assayed 15.49 percent WO_3 . Values in silver and gold are present in the sulphide-bearing portion of the vein.

GEOLOGIC MAP OF THE LEBANON QUADRANGLE PUBLISHED

"Reconnaissance geologic map of the Lebanon quadrangle, Oregon," has just been published by the State of Oregon Department of Geology and Mineral Industries as one of its geologic map series. Authors are Ira S. Allison, Chairman of the Department of Geology, Oregon State College, and Wayne M. Felts, Senior Geologist with The Texas Company.

The Lebanon quadrangle lies chiefly in Linn County at the eastern edge of the Willamette Valley near the confluence of the North and South Santiam rivers just a few miles east of Albany. The oldest geologic formation, the Mehama volcanics, occurs in the eastern half of the quadrangle and interfingers westward with the Oligocene marine sediments of the Eugene formation. Both formations are intruded locally by basic volcanic dikes and pipes. Stayton lava flows of Miocene age overlie large areas of the Oligocene formations. Pleistocene gravels and silts representing several stages of alluviation are widespread on terraces and valley floors. In general the rocks in the Lebanon quadrangle have undergone only minor deformation. No metallic ores are known in the area, but there is an abundant supply of basalt rock of excellent quality, sand and gravel, and clays.

The various geologic formations are designated on the map by color and pattern and are superimposed on the Lebanon quadrangle topographic map. Fossil localities are shown and the dip and strike of rocks at outcrops are indicated. A text describing the geology of the quadrangle is printed on the back of the map. The map may be obtained from the office of the State Department of Geology and Mineral Industries, 1069 State Office Building, Portland 1, Oregon, and the field offices at Grants Pass and Baker. Price is 75 cents.

PROPOSED LAND WITHDRAWALS

<u>Date of Notice</u>	<u>County</u>	<u>Location</u>	<u>Area</u>	<u>Acres</u>	<u>Purpose</u>
March 21, 1957	Curry	T. 32 S., R. 14 W.		90	Development and management of fishing resources of the Sixes River
March 21, 1957	Lane	Tps. 21, 22, 23, S., R. 3 E.		3,780	For use in connection with Hills Creek reservoir project
April 3, 1957	Morrow	T. 4 N., R. 26 E.		1,672	Expansion of Umatilla Ordnance Depot
April 3, 1957	Marion, Linn	T. 10 S., Rs. 5, 6 E.		36	Construction and operation of the Detroit reservoir project
April 24, 1957	Wasco	T. 5 S., R. 11 E.		880	For wildlife purposes in connection with the White River Big Game Range
April 24, 1957	Wallowa	Tps. 5, 6 N., R. 42 E. Tps. 5, 6 N., R. 43 E.		1,200	For wildlife purposes in connection with the Wenaha Game Management Area

During the past month the Department has received from the U.S. Bureau of Land Management notices of six applications to withdraw public land for special purpose use (see chart). The merits and needs for these withdrawals are not known nor are they questioned, as the small acreage listed on the chart is not likely to work much of a hardship on the many other users of public land. Nevertheless it should be noted that withdrawal of land for special purpose use is continuing year after year and that the amount of public land in the State is not unlimited.

Withdrawal of land in the western states, especially in Nevada, has reached proportions sufficient to cause alarm to many people and certain industries. Among the concerned industries are forestry and mining.

Existence of a mining industry depends, among other things, on continual discovery of new deposits. This means that prospecting can never cease. New ore search techniques are being perfected to explore areas for hidden or covered deposits and, encouragingly, important new discoveries have been made. The more land open to prospecting the greater the chance of finding new ore deposits. In this day of accelerating demands for metals and industrial minerals it is important that as much land as possible be left open to prospecting.

Persons desiring to obtain information on withdrawals in Oregon can do so by writing the U.S. Bureau of Land Management, Department of Interior, 1001 N.E. Lloyd Blvd., P.O. Box 3861, Portland 8, Oregon.

H.M.D.

DREDGING BILL

House Bill 655, which is concerned with the control of dredging operations for materials other than industrial minerals and sand and gravel, was passed by the Oregon House of Representatives April 23. The bill is now in the Natural Resources Committee of the Oregon State Senate.

House Bill 655 has been amended twice since being presented at a hearing held on the evening of April 1 before the House Committee on State and Federal Affairs. Objections to the bill were presented by the mining industry. Some of these objections were resolved by revisions, but the general intent of the bill still remains.

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DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
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FOSSIL LOCALITIES OF THE SUNSET HIGHWAY AREA, OREGON

By
Margaret L. Steere*

Introduction

The Sunset Highway area in western Columbia and Washington counties, Oregon, is famous for its abundant marine fossils of Oligocene age. This fossiliferous area lies about 35 miles northwest of Portland and extends from Mist at the north end to Gaston at the south. Outcrops yielding fossils are numerous, and almost every exposure of sedimentary rock that is hard enough to have resisted weathering reveals at least a few fossils. The 12 localities described on the following pages, and shown with corresponding numbers on the accompanying map, are easily reached by road. Sunset Highway (US 26) bisects the area and surfaced roads lead north and south from it.

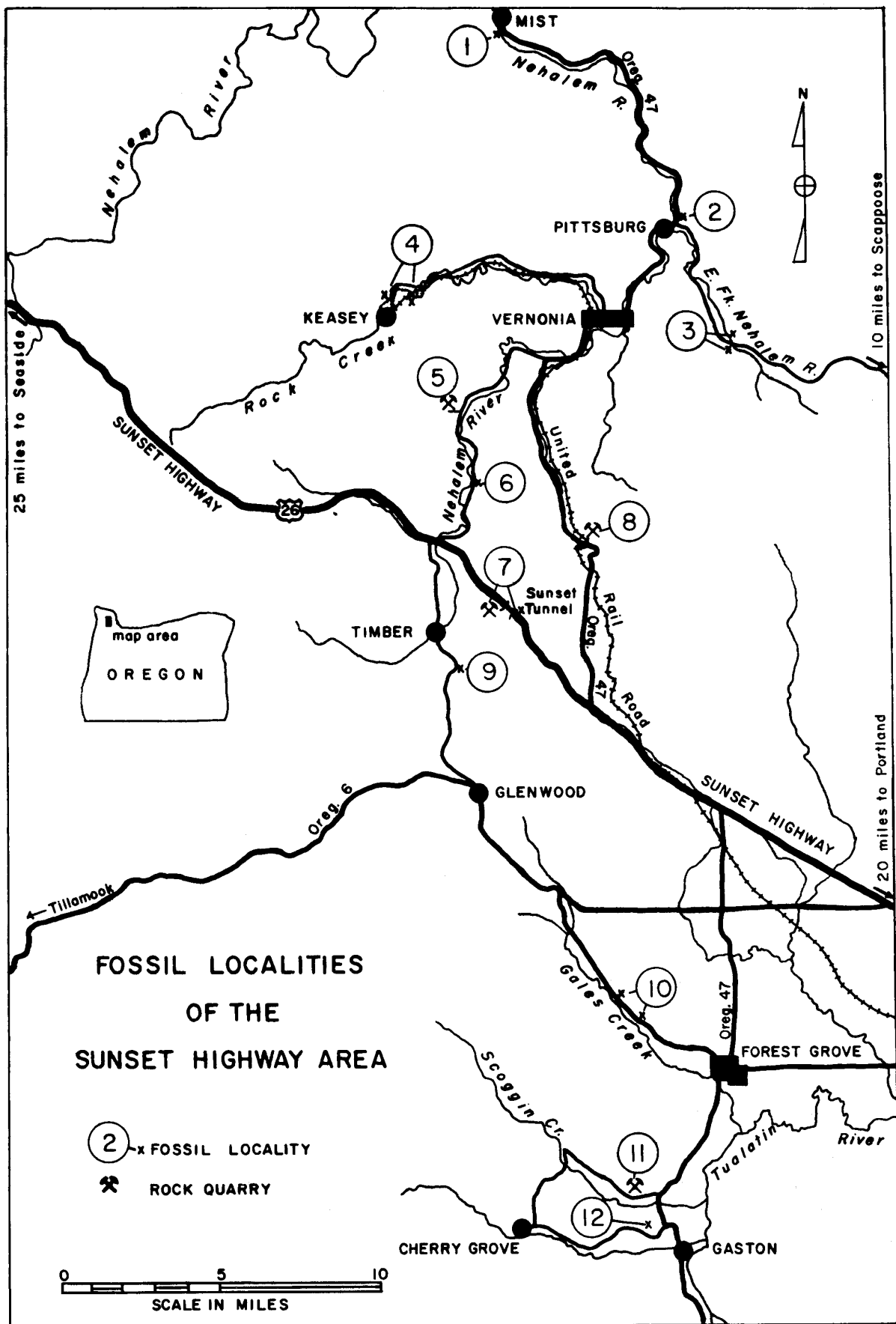
Geologic Setting

During most of the period from late Eocene until the end of Oligocene time, some 30 to 50 million years ago, northwest Oregon was covered by an arm of the sea in which molluscs and other marine invertebrates were exceedingly numerous. Streams eroding the adjacent lands brought in mud, sand, and volcanic ash which settled in layers on the floor of the sea, and as the floor gradually subsided, thousands of feet of sediments accumulated. Shells of the animals living on the sea bottom or washed up along the margins were thus buried and preserved as fossils in the sedimentary rocks.

Some time after the close of the Oligocene period, the land was uplifted permanently from the sea and the sedimentary rocks were warped into gentle folds and then deeply eroded. Today these tilted fossil-bearing strata are exposed in steep banks along streams and in road cuts and quarries.

The oldest fossiliferous sediments in the area belong to the Cowlitz formation (upper Eocene), which in the region of the Cowlitz River, Washington, reaches a thickness of nearly 8,000 feet. In Oregon, the Cowlitz formation is less extensive and consists largely of conglomerates and sandstones that were deposited near the shore of the Eocene sea. These rocks crop out irregularly along the western side of the Sunset Highway area, where they overlie older volcanic rocks of the Coast Range. Some outcrops of the Cowlitz formation contain marine shells (Locality 5) and others show fossil plant remains.

* Geologist, State of Oregon Department of Geology and Mineral Industries.



Overlying the Eocene sediments are the highly fossiliferous Oligocene marine formations. Most noteworthy of these, as far as abundance of fossils is concerned, are the Keasey and Pittsburg Bluff formations (named after Keasey and Pittsburg in Columbia County where the formations were first studied). The Keasey formation, which is the older of the two, is about 2,000 feet thick. It is, for the most part, a massive tuffaceous siltstone which is gray on fresh exposure but turns soft and yellowish when exposed to the weather. It crops out between Keasey and Vernonia, and continues in a wide band trending north and south through the center of the map area. Fossils are numerous in most unweathered outcrops (Localities 1, 4, 6, 7, 8, 9, 10) and include many new species that are yet to be described.

The Pittsburg Bluff formation is a massive sandstone about 800 feet thick containing beds that are richly fossiliferous. It is exposed in various places from the bluffs along the Nehalem River north of Pittsburg to outcrops along Sunset Highway east of the tunnel. It is most fossiliferous in the vicinity of Pittsburg (Localities 2 and 3) where the fossils are typical of a near-shore or shallow-water fauna. Layers of plant remains, carbonaceous material, and coal are characteristic of the Pittsburg Bluff formation. Farther south, near Gaston, a fossiliferous basaltic sandstone believed to be of similar age crops out in several places (Localities 11 and 12).

Both the Keasey and the Pittsburg Bluff formations contain hard limy concretions ranging from the size of a baseball to 3 or more feet in diameter. These concretions are difficult to break open, but are usually worth the trouble as most have something of interest inside, such as the carapace of a crab or some beautifully preserved shells.

Fossil Localities

1. Mist crinoid locality

An unusual crinoid zone in the Keasey formation is located in a high bluff on the west side of the Nehalem River 0.3 mile south of the junction of Oregon highways 47 and 202 in Mist. The outcrop is plainly visible from Highway 47. To reach it, cross the Nehalem River on the Burn Road bridge just south of Mist and walk upstream several hundred feet along the west bank of the river to the bluff and then a short distance along the base of the bluff at the water's edge. The whole bluff is composed of gray fine-grained tuffaceous siltstone of the Keasey formation. Since the crinoid zone is only a few feet above the river at low-water stage, it can be reached only in late summer.

Crinoids, popularly known as sea lilies, resemble plants but are actually marine animals of the echinoderm family. Fossil crinoids of Tertiary age have been found in only a few places in the world, and nearly complete specimens, including stem, cup, and branching arms, such as occur at the Mist locality, are especially rare. Consequently, this remarkable deposit should be treated with respect, and care taken not to cause unnecessary destruction of the bed. Other fossils found with the crinoids include spiny echinoderms (sea urchins) and various molluscs.

2. Pittsburg locality

The sandstone bluffs along the Nehalem River near the town of Pittsburg in Columbia County are the type locality for the Pittsburg Bluff formation of Oligocene age. The formation is well exposed a short distance north of Pittsburg in road cuts along State Highway 47, especially at 0.2 mile north of the Scappoose road junction. At this location the massive sandstone contains narrow bands thickly crowded with gastropods.

3. East Fork of Nehalem River locality

A richly fossiliferous zone about 20 feet thick in the Pittsburg Bluff formation crops out on both sides of the East Fork of the Nehalem River valley, and is reached via the highway that connects Oregon 47 and Scappoose. Most of the fossils are in hard concretionary masses and some are so well preserved that even the mother-of-pearl is still present.

The locality is near the highway bridge that crosses the East Fork of the Nehalem River 5 miles southeast of Oregon State Highway 47 (or 16 miles northwest of Scappoose). One outcrop is near a power line about 30 feet above the highway on the steep hillside at the west end of the bridge. The same fossil bed crops out at about the same elevation, but much more extensively, along an abandoned railroad on the opposite side (north) of the valley. This latter outcrop is about $\frac{1}{4}$ mile northwest of the highway bridge and above a small ranch on the highway. To reach it, start from the east end of the highway bridge and walk northwest across a wooded pasture to the west end of the first railroad trestle. Climb up to the railroad bed, about 30 feet, and continue west a short distance along the old railroad grade to a second trestle. Cross this trestle. The fossil bed is continuously exposed for several hundred feet west of the second trestle and many excellent fossils can be collected here.

4. Rock Creek locality

The original collecting area for Keasey fossils, the type locality for the Keasey formation of Oligocene age, is in the banks of Rock Creek between Vernonia and Keasey. The locality is largely of historical interest today because the Keasey formation is now exposed elsewhere in less weathered and more accessible places.

A road and a railroad follow up Rock Creek, crossing it a number of times between Vernonia and the Keasey railroad station. A large suite of fossils is reported from the steep, high bank at the south end of the fourth railroad bridge. To reach this locality from Vernonia, start at the intersection of State Avenue and Oregon 47. Follow State Avenue toward Keasey for 8 miles to the point where the second highway bridge and the third railroad bridge are side-by-side and about 20 feet apart. From here, follow the railroad on foot southwest around curve to the next (fourth) railroad bridge, a distance of about $\frac{1}{4}$ mile.

Fossils also occur near water level in the low bank of Rock Creek at the north end of the third highway bridge, 8.8 miles from Vernonia (or 0.8 mile east of Keasey railroad station).

5. Rocky Point quarry locality

The locality is at a small basalt quarry west of the Nehalem River and on the west side of the Timber-Vernonia road (surfaced). It is 5.8 miles via this road north of Sunset Highway (or 4.7 miles south of the junction with Oregon 47). At this mileage there is a Longview Tree Farm sign on the east side of the road. Opposite is a private road which leads west about $\frac{1}{8}$ mile to the quarry. Basalt is exposed at the base of the quarry, but overlying the basalt is about 15 feet of basal conglomerate of the Cowlitz formation containing many Eocene marine fossils. These include numerous pelecypods and an occasional shark tooth.

6. Nehalem River locality

A fossiliferous outcrop of the Keasey formation occurs in a prominent cut along the Nehalem River on the east side of the road from Timber to Vernonia, 3.0 miles north of the junction with Sunset Highway. The locality is about 3 miles south of Locality 5. Large pelecypods of the genus Thyasira are found at this outcrop.

7. Sunset Tunnel locality

Sunset Tunnel is a well-known landmark on Sunset Highway. For a few years after this highway was constructed, fossils were abundant in the prominent road cuts in shale beds for about 2 miles at either end of the tunnel. Now, however, weathering has caused the soft shales to disintegrate and most of the road cuts are seeded to grass. In a few places, harder beds are still exposed, particularly at the east end of the tunnel. At the opposite end of the tunnel (west end), Keasey shale is freshly exposed in the Empire Lite-Rock quarry, and many well-preserved fossils can be found here. Permission to hunt for fossils should be obtained at the quarry.

8. Railroad trestle locality

An abundantly fossiliferous zone in the Keasey formation is exposed in the cliffs at both ends of a high-curving railroad trestle which crosses Oregon State Highway 47 between Sunset Highway and Vernonia. The trestle is 6.2 miles north of Sunset Highway and about $8\frac{1}{2}$ miles south of Vernonia. There is a parking space beside the highway at the base of this trestle. To reach the fossil localities at either end of the trestle climb a steep foot trail to the railroad bed above and continue along the tracks for a short distance. Many well-preserved fossil shells of Oligocene age may be collected from outcrops along the railroad. Fossil crinoids have been discovered at both ends of the trestle.

About $\frac{1}{4}$ mile beyond the north end of the trestle and adjacent to the railroad is the Smithwick Haydite quarry in which Keasey shale is freshly exposed and fossils are unweathered. Permission should be obtained to hunt for fossils in the quarry.

9. Timber locality

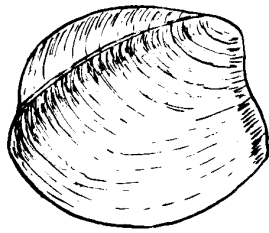
The Keasey formation crops out in a prominent cut at a sharp bend in the Timber-Glenwood road (surfaced). The locality is 1.3 miles south of the railroad crossing in Timber, or 5.2 miles north of Glenwood. Fossil shells in this outcrop are well preserved.

10. Gales Creek locality

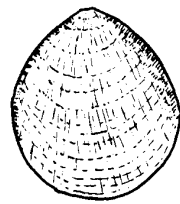
The Keasey formation crops out in two road cuts on Oregon State Highway 6 on the north side of Gales Creek valley, west of Forest Grove. The first road cut is $3\frac{1}{2}$ miles west of the center of Forest Grove, and the second cut is 1.2 miles beyond the first. Although weathered, both outcrops still preserve a few Oligocene fossil shells in the harder sandstone layers. Concretions are numerous and some when broken open reveal fossil crabs.

11. Scoggin quarry locality

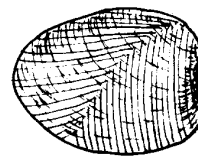
A massive basaltic sandstone containing fossils of Oligocene age crops out in an old quarry on the north side of Scoggin Creek road. To reach the quarry go 5 miles south from



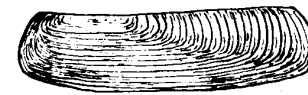
THYASIRA



GLYCYMERIS



ACILA



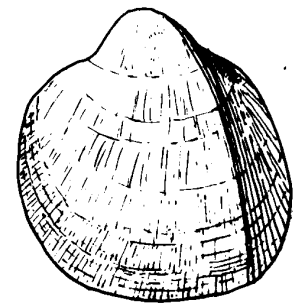
SOLEN



DELECTOPECTEN



NUCULANA



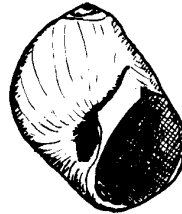
NEMOCARDIUM



EPITONIUM



EXILIA



POLINICES



BRUCLARKIA



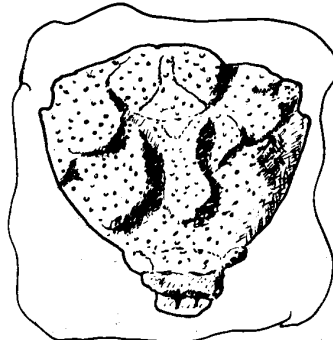
MOLOPOPHORUS



CANCELLARIA



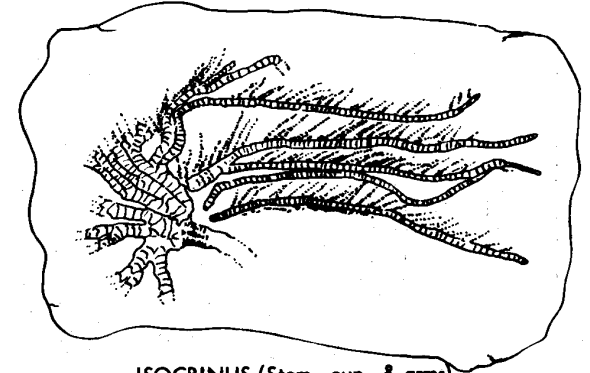
DENTALIUM



ZANTHOPSIS (Carapace)



SHARK TOOTH



ISOCRINUS (Stem, cup, & arms)

SOME TYPICAL FOSSILS OF THE SUNSET HIGHWAY AREA, OREGON
(Approximate natural size)

Forest Grove on Oregon 47 (or 2 miles north from Gaston) to Scoggin Creek road; turn west and go 1.0 mile. The quarry is right beside the road. Fossils are extremely numerous and well preserved, but difficult to remove from the hard rock. A triangular mollusk called Pachydesma gastonensis is especially plentiful at this site.

12. Cherry Grove road locality

A hard sandstone ledge containing fossils of Oligocene age crops out in the open hillside on the north side of the Cherry Grove road. To reach the outcrop, go 6 miles south from Forest Grove via Oregon 47 (or 1 mile north from Gaston) to the Cherry Grove road; turn west and go 1.0 mile. The sandstone ledge, which has been quarried in the past is visible from the road and is about a hundred feet above it. Fossil shells are abundant and well preserved, though difficult to extract from the hard rock.

Fossils to Look For

Hundreds of species of fossil shells have been collected from the Sunset Highway area and identified by paleontologists, and there are many new fossil species that have never been described. A few of the fossils typical of the area are illustrated on the opposite page. Molluscs, chiefly pelecypods (clams) and gastropods (snails), make up the majority of the large fauna, but other types of marine fossils such as shark teeth, crabs, and crinoids (sea lilies) are also represented. Plant remains in the form of woody material and poorly preserved leaves are locally present. Names of some of the fossils commonly found in the Cowlitz, Keasey, and Pittsburg Bluff formations, together with those less common but of special interest, are listed below. For a more complete list of species see the references cited at the end of this report.

Cowlitz formation (upper Eocene)

Pelecypods:

Acila decisa (Conrad)
Glycymeris eocenica (Weaver)
Ostrea griesensis Effinger
VolSELLa cowlitzensis (Weaver and Palmer)

Gastropods:

Exilia dickersoni (Weaver)
Ficopsis cowlitzensis (Weaver)
Polinices nuciformis (Gabb)
Siphonalia sopenahensis (Weaver)

Plant remains

Shark teeth

Keasey formation (lower Oligocene)

Pelecypods:

Acila nehalemensis Hanna
Delectopecten (new species)
Nemocardium weaveri (Anderson and Martin)
Nuculana (new species)
Thyasira disjuncta (Gabb)
Yoldia chehalisensis (Arnold)

Gastropods:

Cancellaria (new species)
Epitonium keaseyense Durham
Exilia lincolnensis Weaver
Gemmula bentsonae Durham
Polinices (new species)
Scaphander stewarti Durham

Keasey formation (lower Oligocene) cont.

Scaphopods (Dentalia)

Echinoderms (sea urchins)

Crinoids:

Crustacea (crabs):

Isocrinus oregonensis Moore and VokesZanthopsis vulgaris RathbunIsocrinus nehalemensis Moore and VokesEumorphocorystes naselensis RathbunPittsburg Bluff formation (middle Oligocene)

Pelecypods:

Gastropods:

Acila shumardi (Dall)Brucarkia columbiana (Anderson and Martin)Nuculana washingtonensis (Weaver)Macrocallista pittsburgensis (Dall)Molopophorus gabbi DallSpisula pittsburgensis ClarkPerse pittsburgensis DurhamSolen townsendensis ClarkPolinices washingtonensis (Weaver)Tellina pittsburgensis ClarkThracia condoni Dall

Plant remains

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- Weaver, Charles E., 1942, Paleontology of the marine Tertiary formations of Oregon and Washington, Parts 1, 2, and 3: Wash. Univ. Pub. in Geol., v. 5. (Contains pictures and descriptions of most of typical fossils of the Sunset Tunnel area)

NEW OIL AND GAS PERMIT ISSUED

Permit No. 25 was issued to Sunray Mid-Continent Oil Company - Lloyd Corporation, May 10, for a test drilling in northwestern Multnomah County. According to the permit the drilling is to be in the NW $\frac{1}{4}$ sec. 12, T. 2 N., R. 2 W. The test is to be made on land leased from Ralph and Helen Kappler, Mulino, Oregon, and is to be known as the Kappler No. 1 well.

ASSESSMENT TIME NEARS

The current assessment year ends at noon on July 1, 1957. By that time a total of \$100 worth of work and improvements must be done on all unpatented mining claims in the State if they are to remain in good standing. Within thirty days after completion of the work a proof of labor must be filed in the county courthouse for the county in which the claim is located. Law publishing firms stock these forms which provide for the following necessary information: (1) name of claim or claims and book and page where original location notice is recorded; (2) number of days' work done and kind and value of improvements made, together with their location; (3) dates of performing labor and making improvements; (4) at whose instance or request work was done; and (5) amount paid for labor and improvements and by whom paid when same was not done by claim owner.

The Department has published a bulletin, Mining Laws of the State of Oregon, which contains state and federal regulations pertaining to both quartz and placer claims. Copies of the bulletin may be obtained from Department offices in Portland, Baker, and Grants Pass at a cost of 50 cents.

OREGON HAS NEW DREDGE MINING LAW

House Bill 655 was passed by the Senate May 10 and only awaits the Governor's signature to become law. The bill, which would require a permit, a bond, and establish certain practices for dredging operations, was introduced by Representative Steward (Keating) and Senators Hopkins (Imbler) and Musa (The Dalles). After one public hearing and several amendments, the Legislature passed the bill - something that practically every Legislature in the past had refused to do when confronted with similar measures. In order to introduce mining interests to Oregon's new law, the important parts of the bill are given below. Ed.

A BILL FOR AN ACT

Relating to mining operations; appropriating money; and prescribing penalties.

Be It Enacted by the People of the State of Oregon:

Section 1. As used in this Act:

- (1) "Board" means the State Land Board.
- (2) "Consulting committee" means the committee established by section 10 of this Act.
- (3) "Dredging operation" means any dredge mining operation, except industrial mineral or sand and gravel production, conducted in this state which substantially disturbs more than 15 acres per year of the topsoil or ground cover of the land on which it is conducted, if the land so disturbed constitutes the floor of a valley.

Section 2. (1) No person shall conduct a dredging operation without securing a license from the board as provided in this Act. . . . If the applicant is not the owner of the lands described in the application, the owner thereof shall indorse his approval on the application. The application shall be accompanied by an application fee of \$50 for each 50 acres of land, or fraction thereof, covered by the application. The fees received shall be deposited in the General Fund to the credit of a special account, hereby established; and such fees are continuously appropriated for the purpose of this Act.

(2) A majority of the consulting committee shall conduct a field examination of the land covered by the application and at its discretion may require the applicant to file with the board a surety bond not to exceed the sum of \$300 for each acre of land, or fraction thereof, covered by the application. . . . The bond shall run in favor of the State of Oregon and shall be conditioned upon the faithful performance by the applicant of all the requirements imposed by the board within the limits of the provisions of this Act. . . .

Section 3. (1) The board shall issue a license to any applicant complying with the requirements of section 2 of this Act. The license shall contain where possible an accurate legal description of the land on which the dredging operation is to be conducted and shall specify the number of acres thereof. The license shall be conditioned upon the licensee's doing all things which in the opinion of the board are necessary to restore the land on which the dredging operation is to be conducted as nearly as practicable or desirable for future use. At the discretion of the board, the license may be conditioned upon the licensee's:

(a) Replacing the topsoil and ground cover disturbed in the course of the dredging operation and restoring the area involved in the dredging operation to its reasonably useful condition.

(b) Replacing any stream disturbed in the course of the dredging operation and with a pool structure conducive to good fish habitat and recreational use.

(c) Constructing settling ponds of sufficient capacity and character to remove silt caused by the dredging operation before the water is discharged into a stream.

(2) The license, unless terminated as provided in section 4 of this Act, shall permit dredging operations upon the lands described therein beginning on the date of the license.

Section 4. (1) The board may revoke any license for any violation of the provisions of this Act or the conditions of the license. No license shall be revoked until after a hearing on the alleged violation is held by the board or its examiner. . . . The board shall make findings based on the evidence introduced at the hearing, and shall revoke the license if violations of the provisions of this Act or the conditions of the license are found.

(2) In revoking the license, the board may declare forfeited so much of the bond or cash deposit as may be necessary for the restoration of lands and streams damaged by the dredging operation, not to exceed \$300 per acre of land to be restored. The amount so forfeited shall be applied by the board to the restoration of the lands and streams in accordance with the conditions specified in the license.

Section 5. (Provides for an appeal to the circuit court.)

Section 6. The board shall make periodic inspections of dredging operations to determine whether this Act is being complied with.

Section 7. (Charges circuit courts to restrain any operation which violates section 2.)

Section 8. The board may make necessary rules and regulations to carry out the provisions of this Act.

Section 9. . . . The issuance of a license under section 3 of this Act shall not relieve any licensee of any obligation imposed upon him by other law.

Section 10. (1) A consulting committee hereby is established. The committee shall be composed of the State Game Director, the Director of the Department of Geology and Mineral Industries, the Director of Agriculture and the Clerk of the State Land Board, who shall serve as the committee chairman. In addition to the foregoing members, when a field examination of the land covered by an application is conducted under section 2 of this Act, the members of the county court or board of county commissioners of the county or counties in which such land is located shall also be members of the consulting committee.

(2) The consulting committee shall convene at the call of its chairman for the purpose of performing its duties under this Act.

Section 11. Any person conducting a dredging operation in violation of the provisions of this Act is guilty of a misdemeanor.

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
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LONG-RANGE MINERAL POLICY ANNOUNCED

For almost two years the domestic mineral producer has been anxiously awaiting announcement of a national long-range mineral policy by the United States Department of Interior. On June 4, 1957, Secretary Fred A. Seaton appeared before the Senate Committee on Interior and Insular Affairs to present and discuss with members of the committee this long-promised program. Given below are direct quotations from Secretary Seaton's prepared statement before the committee and extracts from the description of the Interior Department's "Long-Range Program for Development of Domestic Mineral Resources" filed at the time of the statement. It should be noted that the quoted material is from two prepared articles and represents only a small part of the complete texts and that the quotations are mainly out of context. Following the quoted material are comments by the Director of the State of Oregon Department of Geology and Mineral Industries on the proposed policy as it concerns mineral commodities found in Oregon.

Ed.

A Long-Range Program for Development
of Domestic Mineral Resources

In the development of a long-range mineral program, the Department of the Interior first examined the security status of the Nation as to mineral raw materials. In cooperation with the Office of Defense Mobilization a systematic and critical review has been made, mineral by mineral, of the position of the Nation from a security viewpoint. Programs have been developed and are being implemented to assure an adequate mobilization base. The Nation's ready store of essential minerals and metals has been increased and the mobilization base for minerals substantially strengthened. Generally speaking, mobilization programs are now adequate to meet the immediate requirements of an emergency. Longer-range considerations, with respect to the security of the Nation as well as its economic well-being, make it prudent that we look beyond the more immediate mobilization requirements to the long-term health and vigor of our mineral industries.

The major emphasis of the program outlined herein is upon those activities of the Government which are long-range in nature and designed to provide the kind of assistance which will promote and sustain the health and vigor of the domestic mineral industries. The program also provides assistance to the lead and zinc industries to minimize injury as a result of imports; and special encouragement to producers of beryl, columbium-tantalum, chromite, and asbestos. It is believed that technical advances will eventually make these latter four industries competitive.

Research and development

The Department will recommend that work in these fields of activity (research and development) be expanded during the fiscal year 1959 to a level approximately 20 percent above that anticipated for fiscal year 1958. Increased appropriations for the Geological Survey and the Bureau of Mines in an amount of five-million dollars will be needed for this purpose during fiscal year 1959.

The development of the mineral resources of the public domain

The Department, through the Bureau of Land Management, maintains the official records of all transactions pertaining to the leasing, sale, or disposal of public domain lands, both mineral and nonmineral. This record system is now being modernized and upon completion will provide quick status information on all public lands.

The Department has now under further study the problem of revising the mining laws to facilitate the use of newer geophysical exploration techniques. There are conflicts to be resolved with existing laws such as the Homestead and Public Sale Laws. It is hoped that these may be worked out in the near future and an acceptable draft of legislation submitted.

Fiscal measures

The Department of the Interior, in cooperation with the Treasury Department, has reviewed carefully the income tax laws to determine whether or not changes should be recommended. Existing provisions for percentage depletion and deduction for exploration and development costs recognize the high risks in the extractive industries and the fact that their incomes are derived from wasting assets. No recommendations are made at this time except that a continuous review of the tax law as it affects mining should be maintained.

Financial assistance to private industry for exploration

Exploration should be a long-range activity and not subject to current variations in market prices and supply and demand. Exploration could be greatly strengthened if an agency were established to provide financial assistance for exploration and related development projects, but oriented to the long-term needs of the economy as well as to the longer term defense needs. Accordingly this Department recommends that a program of financial assistance to private industry for exploration assistance be authorized and made a responsibility of the Department of the Interior under new legislative authority.

Programs of special assistance

Public Law 733 (84th Congress) provides programs of interim assistance to tungsten, acid-grade fluorspar, columbium-tantalum, and asbestos. The Department will continue to support its request for appropriations for this purpose. These programs should be carried on to completion.

Elimination of tariffs and imposition of excise taxes

In order to provide more adequate protection to the domestic producers of lead and zinc without at the same time materially restricting needed imports of these commodities, the Department of the Interior recommends the imposition of excise taxes in lieu of the existing tariffs (on lead and zinc).

Proposals for payment of production bonuses

For some minerals, the costs of developing and mining known deposits are so high that no reasonable expenditure of public funds is likely to result in the development of a competitive industry within the foreseeable future. For some others, there is a possibility that competitive domestic industries may eventually be developed. Known reserves of certain minerals in this latter category are substantial, but the grade of ore is so low that production at this time is not

profitable at world prices. With respect to these, research to improve mining, milling, and smelting, coupled with the depletion of high-grade foreign ores, may in time make domestic ores competitive.

The basically short world supply coupled with the strategic nature of three of these minerals, namely, beryl, columbium-tantalum, and chromite, as well as the heavy dependence of the United States on distant overseas sources of supply, underscore the desirability of making every effort to develop and maintain some production of these commodities from domestic sources. Furthermore, the maintenance of some production will stimulate and give purpose to the research program.

In view of longer term security considerations the Department proposes that a continuing program be established to pay bonuses for a limited production of these commodities as research continues to seek ways of making these industries competitive. These programs are set out below, commodity by commodity. They should be reviewed at intervals of no longer than two years.

Beryl - A production bonus of \$70.00 per short ton (10% BeO) for not to exceed 750 short tons annually of domestically produced beryl concentrates, with a 100 short ton limitation upon the quantities to be supplied by any one producer from any one mining district.

Chromite - A production bonus of \$21.00 per long dry ton (46% basis) for not to exceed 50,000 long dry tons annually of domestically produced commercial grade, metallurgical chromite; 10,000 long dry tons annual limitation upon the quantity supplied by any one producer from any one mining district. It is contemplated that this production bonus will stabilize production at the present level of 37,000 long dry tons per year and permit a modest increase. The program should go into effect at the termination of the existing Defense Production Act Program. (On or about July 1, 1959)

Columbium-tantalum - A production bonus of \$2.35 per lb. (combined contained pentoxides) for not to exceed 25,000 lbs. annually of domestically produced columbium-tantalum concentrates; 5,000 lbs. annual limitation upon the quantity supplied by any one producer from any one mining district.

Special asbestos program

The production of low-iron, long-fiber, chrysotile asbestos from the San Carlos and Fort Apache Indian Reservations, Arizona, has been supported by Government purchase programs since 1952. The commercial possibilities of this unique resource can best be realized by establishment of a mill to produce asbestos for the West Coast market. The Department of the Interior, as a part of its Indian Industrialization program, is exploring the possibilities of providing a loan to the Indians to assist in establishing a mill. It is contemplated that markets for the product would be developed through private enterprise and that the loan would be repaid out of operations.

Statement on Long-Range Mineral Policy

This listing of minerals which now need long-range assistance is neither final nor exhaustive. We recognize that other mineral commodities may need similar assistance in the future when defense or interim purchase programs near completion. On the basis of the current position of such minerals, we believe that long-range plans should be formulated after these commodities have had an opportunity to adjust to non-defense markets.

Many minerals of economic and defense importance are covered by this program only through the general provisions for research and development and financial assistance for exploration. There are a variety of reasons for not including some of the more important minerals in the program for direct Government assistance at the present time. For example:

Antimony - (1) requirements for primary antimony are decreasing; (2) The Nation's resource

base in antimony, on the basis of the best available information, is insufficient to support a sustained high level of output of this commodity.

Barite - No special program beyond that of the Bureau of Mines, which is directed toward the development of improved methods of separation of barite from complex ores is necessary at this time.

Bauxite - There is no present necessity for any special assistance for this commodity.

Boron - No special Government action is indicated beyond present limited research programs.

Cobalt - Cobalt does not meet the criteria for commodities requiring special programs.

Copper - Copper has not been included in view of the continuing good price and the fact that a 2-cent excise tax comes into effect when the price falls below 24 cents. Current rate of domestic production is expanding, and market situation is stable at current conditions.

Fluorspar (acid-grade) - At the conclusion of the Public Law 733 program we shall review the situation with respect to this commodity.

Fluorspar (metallurgical-grade) - Government buying for the defense stockpile is providing a floor under the domestic price. It is expected that with the continuance of the stockpile purchase program for a while longer, the industry will be reoriented at reasonable price and production levels.

Gypsum - The present health and vigor of this industry make unnecessary the provision of any special governmental program beyond research conducted by the Bureau of Mines on the problem of hydration of gypsum plaster.

Iron ore - At the present time there is no requirement for special Government program.

Magnesium - There are no particular problems with respect to this commodity which are amenable to treatment through special governmental programs in peacetime.

Manganese - The Nation's resources of manganese are for the most part low grade and complex. The basic solution to the domestic manganese problem lies in research to advance the technology of this commodity. The existence of a special Defense Production Act purchase program which will continue into 1960 makes unnecessary the provision for any further programs of special assistance at this time. Approximately one million dollars a year is being spent by the Bureau of Mines on research directed toward improved beneficiation methods.

Mercury - Since 1952 the market price for this commodity has been sufficiently high to cause domestic production to more than double in volume. At the present time, and through 1958, a Defense Production Act purchase will provide a floor of \$225 per flask. At this time there is no requirement for an additional Government program. With the duty paid, the current price in New York is approximately \$257 per flask.

Mica (strategic) - The long-range problem in strategic grades of mica can best be solved by emphasis upon research leading to synthesis of mica, and development of mica substitutes.

Mica (nonstrategic) - There is at the present time no requirement for a special program.

Molybdenum - The increased level of production of this commodity, together with the health and vigor of its industry, indicates that there is no requirement for any special Government program beyond a modest program of research conducted by the Bureau of Mines and directed toward the production of massive, ductile molybdenum.

Nickel - Prior to 1953 domestic mine production of nickel was negligible. Currently the United States is producing about 4,500 short tons of this commodity, some three percent of our requirements. This production is under Government contracts. The long-term outlook for nickel is for continued dependence upon Canadian and Cuban sources of production. In all probability there will eventually be established on a sound commercial footing a small production in the United States, probably not greatly in excess of that currently prevailing. There is no requirement for any special Government program for this commodity beyond those now being conducted under Defense Production Act authority and by the Bureau of Mines. The Bureau is spending approximately \$150,000 per year to develop an efficient economic method

of separating cobalt and nickel and a process for extracting nickel, cobalt, iron, and chromium from nickeliferous laterite deposits of low metal content.

Phosphate rock - The growth and high level of activity in this industry make unnecessary the provision of any special Government program beyond that of the Bureau of Mines, which is designed to conduct mining and processing investigations.

Potash - There is no requirement for any special Government program beyond that now conducted by the Geological Survey directed toward expanding knowledge of United States reserves of this commodity.

Sulphur - Steadily expanding domestic and export markets for this commodity, in conjunction with the health and vigor of the producing industry, make unnecessary the provision of any special Government assistance beyond the Bureau of Mines research on processes for the development of economical supplies of sulphur from presently marginal or submarginal sources.

Tin - There is no requirement for a special program of assistance in this country, because we have no known commercial deposits and have never developed a producing industry.

Tungsten - The Department of the Interior has supported and will continue to support the tungsten purchase provisions of P. L. 733. We feel that it is right and proper that the domestic industry be enabled to amortize investments made at the urgent request of the Government during the Korean conflict, and be given an opportunity to reorient their operations to the market. Continuation of P. L. 733 is the best method of assuring these objectives. We believe that if the industry operates under this program until December 1958, the production then existing, coupled with new and reasonably anticipated demands from industry, will provide a more realistic basis from which to evaluate the position of the industry in our over-all economy.

Other minerals were included in the administration's review, but they are not mentioned in the above list because the reasons for their exclusion from the direct assistance program require no detailed explanation. In one category are minerals of national significance - such as sand and gravel or clay - which have problems largely local in character. In another category - gold or uranium, for example - are minerals of which the production or price is regulated by the Federal Government. In the case of a third group, which includes germanium and cadmium, production is primarily a by-product of the mining of other minerals, which have been discussed. A final category includes minerals like titanium, and the rare earths, which have only lately entered into commercial use.

Comments

The proposed Long-Range Mineral Policy of the Interior Department (see above) offers no encouragement to Oregon's strategic-mineral miners. The mercury miners are told that their status is to revert to pre-war standing. The chrome miners are offered a bonus far below their mining costs. Nickel mining will still depend on special government contract. Possible antimony miners are told that need for the metal is decreasing and if subsidized they would soon exhaust known reserves, and possible manganese and tungsten producers are informed the present program (for which there is no money) makes it unnecessary for further programs of special assistance at this time. As usual, gold mining is ignored.

The history and problems of mercury mining in Oregon were given in the March issue of The Ore.-Bin. This article brought out that domestic production is very erratic due to international conditions and manipulations of the market by foreign producers. It also stated that the present "floor plan," which so far has operated at no cost to the government, has deterred price manipulations. From the long-range standpoint, the end (December 1958) of the "floor plan" places the mercury miner in his pre-war position - at the mercy of the foreign controlled market.

It is not clear just what the chrome miner is to receive as no mention is made of chrome-iron ratio, penalties or bonuses or cutoff point on grade of ore, or whether the proposed bonus refers to lump, fines, or both equally. It would appear, however, that the chrome miner is offered nothing. Assuming (a dangerous thing to do) that the \$21 bonus is for 46 percent Cr_2O_3 lump ore having a 3:1 chrome-iron ratio, a price of \$78 a ton would be received by the domestic miner for this grade ore. (This is based on the June 13, 1957, E&MJ Metal & Mineral Markets quotation of \$55 to \$57 for Turkish ore.) A \$78 a ton price is a far cry from the \$109 that would be paid under the present purchase plan if this grade ore could be produced. It is important to note that the average grade of ore submitted to the stockpile has been much less than this. Since the present purchase program was established in 1953, mining costs have risen approximately 40 percent. It is unlikely the domestic miner could exist with a 1 percent reduction in price. A 30 percent reduction, as proposed, would not be a long-term program nor would it be a short-term program. It would be quick and instant death to domestic chrome production.

The failure of the Government program to include a recommendation on income tax relief is a disappointment. It is certain that if the tax climate of mining projects could be made more attractive, perhaps along the lines of Canadian revenue laws, incentive for private enterprise to undertake mining exploration would be increased greatly. In this way, the mining industry would get Government bureaucratic control off their necks and private enterprise would accomplish much more and at much less cost than Government bureaus along the lines as recommended in the report.

H.M.D.

GOVERNOR MAKES NEW APPOINTMENT

Clint P. Haight, Jr., eastern Oregon motel operator with a long-standing interest in the mineral development of the State, has been appointed by Governor Robert D. Holmes to the Governing Board of the State Department of Geology and Mineral Industries.

Haight, a native of Oregon and a resident of Baker for the past 17 years, succeeds Austin Dunn, also of Baker, on the three-man board. Dunn, whose term expires March 16, 1959, resigned due to the press of other activities. The new board member, an active prospector who has mineral holdings in eastern Oregon, attended the University of Oregon where he studied journalism and geology. After publishing the Joseph newspaper for a time he entered the motel business in Baker.

DRILLING PERMITS ISSUED IN 1957

Permit No. 27 - Issued May 31 to General Petroleum Corporation, operator. Lease: Long Bell No. 1. Location: SW $\frac{1}{4}$ sec. 27, T. 20 S., R. 10 W., Douglas County. Elevation, 100' ground. Location to be surveyed. Lessee: Sinclair Oil and Gas Company. Lessor: International Paper Company, Kansas City, Missouri.

Permit No. 26 - Issued May 27 to Miriam Oil Company. Lease: Bliven No. 2. Location: SE $\frac{1}{4}$ of SE $\frac{1}{4}$ sec. 10, T. 8 S., R. 5 W., Polk County. Elevation, 282' ground. Location to be surveyed. Lessor: Walter and Arthur Bliven, Dallas, Oregon. Officially suspended.

Permit No. 25 - Issued May 10 to Sunray Mid-Continent Oil Company - Lloyd Corporation. Lease: Kappler No. 1. Location: 1901.21' south and 431.10' east from the NW corner of sec. 12, T. 2 N., R. 2 W., Multnomah County. Elevation: 288.88' ground. Lessor: Ralph and Helen Kappler, Mulino, Oregon.

Permit No. 24 - Issued February 4 to Miriam Oil Company. Lease: Bliven No. 1. Location: 1300' south and 937' east of the quarter corner between sections 10 and 11, T. 8 S., R. 5 W., Polk County. Elevation: 290' ground. Lessor: W. and A. Bliven, Dallas, Oregon. Officially abandoned.

OREGON MINING NEWS

Eastern Oregon

Construction is well advanced on the lime-burning plant being erected at Wingville, Baker County, by the Chemical Lime Company of Baker. Primary crusher installations have been completed at the quarry in Marble Mountain and stockpiling of rock at the plant is scheduled to start soon. Burning facilities now being installed are expected to turn out about 200 tons of burned lime products a day.

The Bretz mercury mine near McDermitt, Malheur County, reopened in December 1956 by Arentz-Comstock Mining Venture, recently installed a 10-ton Herreschoff furnace. The furnace will replace the previously used D-retorts which proved inadequate to handle concentrates from the 150-ton flotation plant. Open-pit mining of the new ore body was begun early in May after some 25,000 tons of unexpected ore recovered during stripping operations was depleted. The management has planned a rather extensive exploration program for this summer.

Messrs. John Allen and Ernie Craig of Richland, Oregon, have acquired the old Miller and Lane property on Gold King Creek in the Eagle Creek district of Baker County. On the basis of findings disclosed by rehabilitation of some of the old workings last year, they are now engaged in driving an exploratory tunnel on what is known as the old arrasta level. The ore minerals consist chiefly of gold and copper sulphides in a quartz vein matrix. This property was operated with an arrasta in the 1870's or 1880's and again with a 5-stamp mill in 1912, but has been inactive since the mill burned in 1912 after only 6 months of operation.

William Gardner and Sons of Canyon City have taken over operation of the Haggard and New chromite mine on Dog Creek, Grant County, and have stripped the overburden from the surface from around the old glory-hole workings in preparation for the mining of a lens of milling-grade ore situated underneath. This property has been a consistent producer since December 1953, at which time it was operated by Burt Hayes of John Day. Throughout 1956 the property was operated by the Comstock Uranium-Tungsten Company, Inc. Total value of shipments by all lessees from 1953 to January 1, 1957, is in excess of \$250,000.

Mr. J. E. Fitzpatrick is engaged in making pilot sampling tests of ore's from a tungsten prospect situated near the head of Chicken Creek in the lower Burnt River district of Baker County. The ore is scheelite which occurs in narrow seams in a decomposed quartz diorite. Several showings have been exposed by work begun last year. According to Fitzpatrick, a 5-ton test run yielded 350 pounds of 68.4 percent WO_3 concentrates. Heads reportedly assayed 2.7 percent WO_3 .

The Molybdenum Corporation of America has just completed exploration of a tungsten prospect on Pedro Mountain in the Mormon Basin district of Baker County. The prospect, which consists of scheelite in a pyritic-limonite matrix in a decomposed granite, has been known for many years but little work was done until 1956 when the owners, Joe Frisco and Jim Coleman, ran a 50-foot exploration tunnel into the hill and intersected the surface showing some 20 feet below its outcrop.

Prospect exploration work is being continued by the Frank Phillips interests on a group of copper prospects in the Lower Powder area of Baker County. Mr. Glen Engle, Baker, is in charge.

Southwestern Oregon

Carl Stevens leased the Four Point Chrome claim in April from L. H. Wiese, Glendale. A road was recently built to the deposit which is located at the head of Quines Creek in sec. 1, T. 33 S., R. 5 W., Douglas County. The ore is of marginal grade and some has been hauled to the Shippen and Meyers mill at Canyonville for up-grading.

The Queen of Bronze mine located near Takilma has been reactivated for a short time and the tunnels opened up. A carload of copper ore containing about 70 tons was shipped to the Tacoma smelter during May. Max Pokorney is the operator.

A 20-ton shipment of low-grade copper ore was shipped to the Tacoma smelter from the Copper Bell mine by Kindell B. Weir. The mine owned by Fred A. Vargas and Tom Moloney, both of Grants Pass, is located in sec. 28, T. 35 S., R. 7 W., on Panther Gulch, a tributary to Pickett Creek, in Josephine County. The shipment was reportedly made during the first week in May.

The Fort Knox copper mine located in sec. 28, T. 33 S., R. 4 W., Jackson County, also reported a small truck shipment of copper ore in January 1957. The mine is owned by the Minerals and Metals Development Company of Grants Pass.

The Old Dry Diggings Mine in sec. 14, T. 36 S., R. 5 W., Josephine County, about 3 miles east of Grants Pass, has been reactivated recently by Mr. Walter J. Cannon, Grants Pass. Cannon has uncovered gold-bearing ore in place in the decomposed diorite country rock. Values reportedly run from \$16 a ton and up. A small mill (Little Giant Straub) is being installed on the property and exploration work is being done. The deposit, originally worked as a hillside placer, reportedly produced \$200,000 in gold.

Two nickeliferous laterite areas are being explored in southwestern Oregon, one in Josephine County and the other in Curry County. In Josephine County the Nickel Corporation of America is drilling on Woodcock and Eight Dollar mountains near Kerby. Alex Skrecky is in charge of the work. Field office and laboratory are located at Cave Junction. The Department of Geology and Mineral Industries investigated the nickel occurrence on Woodcock Mountain in 1947 at which time several shallow hand-auger holes were put down and samples were analyzed in the Department laboratories (see Ore.-Bin, May 1948 and March 1949). Pacific Nickel Corporation has leased 12,000 acres at Red Flat in Curry County and has announced plans to start drilling in the near future. Red Flat is located about 10 miles south-east of Gold Beach. The laterite has been investigated numerous times in the past, and in 1946 and 1947 the Department drilled some shallow holes and determined the nickel content in the cuttings. (See Ore.-Bin, March 1947 and May 1948; and U.S. Bureau of Mines Report of Investigations 5072.)

CHROME ORE RECEIPTS TOLD

Despite the fact the bad weather has somewhat hampered deliveries of chrome ore and concentrate to the Grants Pass chrome depot, receipts in the first quarter of 1957, according to the Federal Register, amounted to 6,040 tons, bringing to 143,740 tons the amount purchased under the government support agreement which is scheduled to expire, when 200,000 tons have been delivered or by June 30, 1959.

The local depot, of which Dan Beyer is manager, received ore and concentrates not only from Josephine County mines but from all northwest states and Alaska as well as from Northern California. Beyer said that at the present rate of purchase the quota would be reached only slightly before the termination date. (From the Grants Pass Courier, May 27, 1957.)

NEW GEOLOGIST AT GRANTS PASS

Norman V. Peterson has been hired to aid Len Ramp in operating the Department's field office at Grants Pass. Peterson is a native of Minnesota. He served with the armed forces for 7 years, after which he entered the University of Oregon where he majored in geology. He graduated in 1956 and obtained his master's degree this spring. Field work for his thesis covered the geology of the southeast third of the Camas Valley quadrangle, Douglas County, Oregon. Peterson replaces Max Schafer who left the Department March 1, 1957, and will continue the research project begun by Schafer on uranium occurrences in Oregon.

MINING CLAIMS EXAMINED

Federal bureaus have written the Department as follows concerning examination of Public Lands under the Multiple-Use Mining Law:

We are pleased to inform you that this Region of the Forest Service, which includes the States of Washington and Oregon, plans to examine in Oregon this year, for the determination of surface rights, the areas outlined below. As examinations are completed the areas will be advertised and hearings will be scheduled as provided under Public Law 167. Areas to be examined in Fiscal Year 1958 are:

Forest	Name of Area	Acres N.F. Land
Deschutes	Bend	29,760
	Ground	1,120
	Tolo	970
	Total	31,850
Fremont	Gold Creek	3,200
Malheur	Dixie	36,070
Ochoco	Round "B"	16,320
	Sulphur	3,180
	Total	19,500
Rogue River	Union "A"	100,400
Siskiyou	Elk "B"	123,650
	Illinois	45,350
	Total	169,000
Umatilla	John Day "B"	9,985
Umpqua	Bohemia "A"	33,000
	Bohemia "B"	22,000
	Total	55,000
Wallowa-Whitman	Baker "A-1"	59,920
	Bull Run	21,520
	Eagle	60,560
	Total	142,000
	Grand Total	567,005

In addition, areas for which the preliminary examination has been completed, the 150-day advertising period will be completed as shown:

Forest	Name of Area	End 150-day Period
Deschutes	Chemult	7-29-57
Fremont	"	7-29-57
Siskiyou	Wildhorse	7-22-57
"	Fuller	7-22-57
Whitman	Dooley Mtn.-Buffalo	7-22-57
"	Pine	7-22-57
"	Woodley	7-29-57
"	Unity	7-22-57
Willamette	Little N. Fork Santiam	7-29-57
"	Quartzville	4- 1-57

Very truly yours,
/s/ Frank B. Folsom
Assistant Regional Forester

We are pleased to report for your monthly publication that preliminary examinations under Public Law 167 of lands under the administration of the Bureau of Land Management have just been completed in the following townships:

T. 41 S., Rs. 8 and 9 W., W.M.
39 S., Rs. 7 and 8 W.
38 S., Rs. 7 and 8 W.
37 S., Rs. 6, 7, and 8 W.
36 S., Rs. 5, 6, and 7 W.
31 S., R. 14 W.
19 S., R. 9 W.
14 S., R. 30 E.
13 S., Rs. 30, 31, and 34 E.
12 S., Rs. 32 and 33 E.
12 S., Rs. 40 and 41 E.
11 S., Rs. 40 and 41 E.
9 S., R. 41 E.

Additional townships were advertised March 20, 1957, as follows:

T. 39 S., Rs. 5 and 6 W.
38 S., R. 6 W.
30 S., R. 2 W.

Preliminary examinations will start in Jackson and Josephine counties and will include:

T. 31 S., R. 4 W.
32 S., Rs. 3, 4, and 5 W.
33 S., Rs. 1 to 5 W., inclusive

We expect to complete examinations of Townships 12, 13, 14 S., Rs. 31 to 34 E., inclusive, in Grant County, by June 15.

We have under examination 15 townships in Baker County containing public land under Bureau of Land Management. We will probably complete the examinations within the next two months. Thereafter, within a short time, the lands will be advertised.

Sincerely yours,

For the State Supervisor
/s/ Elton M. Hattan
Lands and Minerals Officer

NORTHWEST LIMESTONE REPORT PUBLISHED

Limestone Resources of the Pacific Northwest, has just been published by the Raw Materials Survey, Inc. Author is F. W. Libbey, mining engineer and former Director of the Oregon Department of Geology and Mineral Industries. The report is an up-to-date appraisal of the limestone resources of Oregon, Washington, Idaho, British Columbia, and Alaska. It summarizes the pertinent information on the existing limestone quarries in each of these areas and describes the undeveloped deposits of potential value. Each of the five geographic areas is treated individually and is accompanied by an index map showing the principal limestone occurrences. An introductory chapter describes briefly the composition of limestone, its origin, distribution, uses, and production. An appendix presents an analysis of the current lime market in the Northwest.

Mr. Libbey has been successful in bringing together in a concise and well-organized way a great deal of information that was formerly either scattered through the literature or contained in the unpublished records of mining departments and limestone producers.

The 92-page report, designated as Resource Report No. 9, is available from the Raw Materials Survey, Inc., 824 S.W. Fifth Avenue, Portland 4, Oregon. Price is \$5.00.

BOOKLET ON OPERATING SMALL MINES AVAILABLE

The Montana Bureau of Mines and Geology has just published a very useful and informative booklet entitled Operating Ideas for Small Mines. It is designed primarily to help the prospector and small-mine operator who is not technically trained in the mining industry. Author is Koehler S. Stout, Chief of the Bureau's Mining Division. The booklet, designated as Miscellaneous Contribution No. 14, is a companion to the author's Practical Guide for Prospectors and Small-Mine Operators in Montana, published in 1955 as Miscellaneous Contribution No. 13.

The new booklet contains 81 pages and numerous illustrations in a convenient pocket-size format. Subjects covered include drilling, blasting, underground transport, loading, timbering, shafts, ventilation, equipment, and costs. The booklet may be obtained for \$1.00 from the Montana Bureau of Mines and Geology, Room 203-B, Main Hall, Montana School of Mines, Butte, Montana.

F. E. WORMSER RESIGNS INTERIOR DEPARTMENT POST

Felix E. Wormser, assistant secretary of the interior for mineral resources, will resign his position at the end of the week, June 15, to return to St. Joseph Lead Company where he had been vice president before joining the Eisenhower executive team in Washington four years ago, it was reported.

His resignation, submitted early last week, was accepted by President Eisenhower "with regret."

The president praised Wormser's work as "a large contribution to the formulation of administration policies" with respect to conservation and development of mineral resources. The tangible evidence of this effective work, he said, will be available to the American people in the decades ahead as they "continue to benefit from these resources." (From The Wallace Miner, June 13, 1957.)

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DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
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RECONNAISSANCE GEOLOGY OF THE MARCOLA,
LEABURG, AND LOWELL QUADRANGLES, OREGON

By
Herbert G. Schlicker*
and
Hollis M. Dole**

Introduction

Mapping of the Cascade Range is part of the work undertaken jointly by the State of Oregon Department of Geology and Mineral Industries and the U.S. Geological Survey towards completion of the geological map of the State. The present mapping is of a reconnaissance nature, and detailed mapping in the future will undoubtedly show revision of units and formation boundaries.



Index Map

Although the geology of the Marcola, Leaburg, and Lowell quadrangles was mainly the responsibility of the State, definite boundaries were not drawn. State and Federal geologists worked together in an attempt to solve the many problems of the area. Most of the eastern third of the area was mapped by Dallas Peck of the U.S. Geological Survey. Dr. Roland W. Brown, paleobotanist with the Survey, gave age determinations for fossil leaf localities in the area. Responsibility for the statements contained herein are, however, to be borne entirely by the authors.

General geology

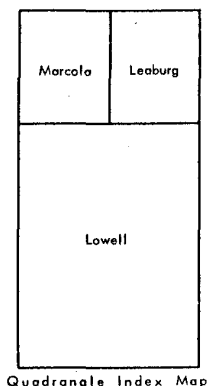
The mapped area is in the central portion of the western part of the Cascade Range in Oregon. It is bordered by the southern Willamette Valley on the west and by the peaks of the High Cascades on the east.

The rocks of the area are a series of lava flows, flow breccias, tuff breccias, and tuffs of Cenozoic age. The Eocene rocks of the Willamette Valley south of Cottage Grove can be traced eastward into the edge of the map area where they underlie or grade into the tuffs of the Oligocene Mehama volcanics. The rocks of the Mehama volcanics are predominantly pebbly tuffs, but interbedded welded tuffs and great thicknesses of basalt flows occur locally. The next younger rocks of the Western Cascades are volcanics of Miocene and Pliocene age. These are mainly lava flows, which vary in composition from basalt to andesite, and subordinate tuffs. The youngest rocks are the High Cascade lavas (olivine basalts) of upper Pliocene to Recent age. The most recent of these rocks are intracanyon flows.

* Geologist, State of Oregon Department of Geology and Mineral Industries.

** Director, State of Oregon Department of Geology and Mineral Industries.

The structure of the Cascade Range in this area can best be described as a pile of volcanics. The dips of the strata are generally to the northeast, averaging about 10° . Anticlinal folds are not apparent, and no evidence of mountain building due to folding could be determined. Reconnaissance mapping does not readily reveal faulting in interbedded volcanics since key beds, if present, are difficult to recognize. Indirect evidence indicates that faulting may be extensive. At the Dorena, Lookout Point, and Hills Creek dam sites, detailed studies by the U. S. Army Engineers* have revealed extensive faulting trending northwest to north. The major streams such as Mosby Creek, Sharps Creek, Row River, and the Middle Fork of the Willamette River, trend northwest and may be fault controlled.



Stratigraphy

Fisher formation: In the map area rocks assigned to the Fisher formation are poorly exposed. The outcrops are found in the North Fork of Calapooya Creek and 5 miles to the north in Big River. Better exposures of the formation occur just south of the map area in the main branch of Calapooya Creek. At this location the lowermost material is a coarse boulder conglomerate about 50 feet thick overlain by a welded tuff. The welded tuff grades upward into an indistinctly bedded pebbly feldspathic tuff which appears to grade westward into a well-bedded fluviatile tuff. Correlation of this material with the Fisher formation was based on the similarity of the conglomerate and pebbly feldspathic tuff to the rocks described in mapping to the northwest (Vokes, et al, 1951). The welded tuff is considered to be a part of the Mehama volcanics. The sequence of conglomerate-welded tuff- fluviatile tuff is interpreted as interfingering of Mehama volcanics with Fisher formation.

West of the mapped area, fossil leaves found at Comstock have been dated Eocene while those from the new Goshen locality are upper Oligocene age (Vokes, et al, 1951). The rocks of both areas are considered by the authors to be part of the Fisher formation; thus the Fisher formation extends from upper Eocene throughout the Oligocene epoch. Fossil leaves determined to be of Eocene age were found in the fluviatile tuff just west of the map area. On this basis rocks shown on the map as Fisher formation are most likely Eocene in age and represent the lower part of the formation. According to Vokes, et al (1951), the Fisher formation interfingers with the marine Eugene formation and hence they are partly contemporaneous in age.

Mehama volcanics: The Mehama volcanics are typically a coarse, indurated tuff and pebbly tuff breccia with interbedded basalt, flow breccia, and welded rhyolitic and dacitic tuff flows. Occasionally the tuffs are well bedded indicating deposition in a fluviatile environment. Some basalts in the Mehama volcanics are locally thick and may represent intracanyon flows. Welded tuff occurs flanking Coburg Ridge about 3 miles north of Springfield, near Mohawk Post Office, along the Row River northwest of Dorena, in the Table Mountain area, in the Mosby Creek area southwest of Palmer Ranch, in the Layng Creek area near Junetta Creek, and in the canyon of Brice Creek. Smaller, less prominent exposures of welded tuffs occur in many other localities throughout the area mapped as Mehama volcanics. The welded tuffs frequently contain large rounded quartz grains, glassy feldspars, and large flattened glass shards in a matrix of finer-grained material. In several localities the tuff contains considerable biotite. The outcrops are generally steep, or smoothly rounded from weathering, and are pink to buff colored. The upper portion of the thicker flows grades into unwelded lapilli tuff.

The greenish-colored pebbly tuff breccias are generally quite massive and frequently contain large pebbles and carbonized wood fragments. Usually the tuffs show coarse, indistinct

* Personal communication, Lloyd L. Ruff and Paul Howell.

CORRELATION TABLE

Western Cascade Mountains

	Western Cascades	Foothill Area	Southern Willamette Valley
Recent		Surficial deposits	
Pleistocene	High Cascade lavas		
Pliocene			
Miocene	Miocene and Pliocene volcanics		
Oligocene	Mehama volcanics	(gradational) Fisher formation	(Goshen flora) Eugene formation
Eocene	?	?	(Comstock flora) Spencer formation Tyee formation Umpqua formation

bedding. They are best exposed northeast of Marcola near Wendling, along the railroad near Dexter, and in the Fall Creek area. They are also extensive both above and below the welded tuffs. Numerous basalt dikes and a few dioritic stocks and dikes intrude the Mehama volcanics.

In general, the Mehama volcanics have an easterly dip averaging about 10°. Where westerly dips have been observed they appear to be primary features or possibly the result of faulting. The prominent northwest trend of the major streams may be the result of a series of strike faults.

Allison and Felts (1956) believed that the Mehama volcanics could "most reasonably" be referred to the Oligocene but that the lower part of the formation may range downward into the Eocene. Numerous occurrences of Oligocene and Oligo-Miocene leaves have been found throughout the area of Mehama volcanics. According to Thayer (1939), the Mehama volcanics are believed to interfinger with the Oligocene marine sediments of the Eugene formation. Apparently the Fisher formation is the finer-grained, water-laid equivalent of the Mehama volcanics while the Eugene formation is the marine equivalent. All three formations (Mehama volcanics - Fisher formation - Eugene formation) are believed to be at least partly equivalent in age.

Eugene formation: The Eugene formation is exposed in a small area about 3 miles west of Prune Hill along the west edge of the Lowell quadrangle and also in a small area just west of Dorena Dam. It is a fossiliferous marine sandstone of Oligocene age and is not considered as part of the Western Cascades. References to literature describing the Eugene formation are given in the selected bibliography at the end of the text.

Miocene and Pliocene volcanics: The Miocene and Pliocene rocks of the Western Cascades are mainly andesite and basalt flows. Pebbly tuffs and lapilli tuffs occur locally. The lavas and tuffs are interbedded and the sequence varies considerably from area to area. The basaltic lavas are mainly dark and fine grained; however, deviations from this texture are not rare. At Bear Mountain about 5 miles north of Dorena the dominant lava is a gray basalt having numerous black phenocrysts of augite averaging about a quarter of an inch across. Feeder dikes of this material can be seen cutting the Mehama volcanics in the valley of Gettings Creek near the west edge of the Lowell quadrangle.

In the Marcola and Leaburg quadrangles the Miocene and Pliocene volcanics are widespread. In the Lowell quadrangle they cap only a few of the higher ridges such as Prune Hill, Bear Mountain, Buckhorn Mountain, Mount June, Swastika Mountain, and Holland Point. These volcanics can be distinguished from the Mehama volcanics by the greater percentage of lava, by the lack of greenish tuff breccia and welded tuff interbeds, and by stratigraphic position. Furthermore, the lavas are more dense and are less weathered and the tuffs are not so firmly cemented as those found in the Mehama volcanics.

The Miocene and Pliocene volcanics are probably partly correlative with the Columbia River basalt, Boring agglomerate, Rhododendron formation, and Fern Ridge tuffs observed farther north along the western flank of the Cascade Range. They unconformably overlie the Mehama volcanics and are, in turn, capped by the High Cascade lavas to the east. They have variable dips which probably represent the initial dip from local volcanic sources. Although some folding may have occurred in these rocks it has not been of sufficient magnitude to greatly modify the primary structure.

High Cascade lavas: The High Cascade lavas are distinctive light-gray olivine-bearing basalts ranging in age from upper Pliocene to Recent. They occur extensively at higher elevations in the Cascade Range and are also found as intracanyon flows at lower elevations.

In the map area, High Cascade lavas occur in three small patches as follows: on Saddle-blanket Mountain in the northeast part of the Lowell quadrangle, just north of Armet along the Middle Fork of the Willamette River, and as an intracanyon flow in the vicinity of Westfir where lava flowed down the valley of the Middle Fork of the Willamette River and came to rest on relatively young gravels. Dips in the High Cascade lavas are primary and not the result of folding.

Dioritic intrusives: Coarse-grained intrusives occur throughout the Cascade Range, but are mostly restricted to the mineralized areas (Callaghan and Buddington, 1938). Minerals in the intrusives, identified with the hand lens, are intermediate plagioclase, augite, and hornblende, and occasional biotite. In the map area, the largest intrusion is the diorite stock at Mount Nebo which is about 2 miles long and 1 mile wide with the longest dimension running east and west. Two smaller diorite stocks about three-fourths to a mile wide occur at Vida on the McKenzie River and at Eagle Rock on the Middle Fork of the Willamette River. In the Bohemia mining district about a dozen diorite bodies are exposed which range in size from several hundred feet to a mile across. Only a few of the larger intrusives are shown on the map.

The diorites of the Cascade Range intrude the Mehama volcanics and the Miocene and Pliocene volcanics. It is difficult to establish a definite age for them as a group and it is quite likely there was more than one period of intrusion. The intrusives may be as late as middle Pliocene and as early as Oligocene.

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Vokes, H. E., Snavely, P. D., Jr., and Myers, D. A., 1951, Geology of the southern and southwestern border areas of the Willamette Valley, Oregon: U.S. Geol. Survey Oil and Gas Invest. Map OM 110.

SURVEY GEOLOGISTS IN OREGON

The U. S. Geological Survey again has several field parties in Oregon this summer making geological investigations for the State Geologic Map, a cooperative project with the State of Oregon Department of Geology and Mineral Industries.

Mr. Dallas Peck is doing reconnaissance mapping in the Antelope quadrangle of central Oregon. During August and September, Mr. Peck will continue his work of the past two summers in the western Cascade Mountains.

Dr. Thomas P. Thayer, with assistant Irving Brown, is continuing his geologic mapping in the John Day area. This summer Dr. Thayer will be working in the Izee quadrangle.

Mr. Richard Lewis will work with Dr. Thayer in central Oregon in order to familiarize himself with the geology of northeastern Oregon. Mr. Lewis will be largely responsible for compilation of the geologic map of northeastern Oregon.

Dr. Ralph Imlay, Survey authority on Mesozoic formations, is doing field work north of Burns in central Oregon. Later in the summer Dr. Imlay will do collecting in southwestern Oregon.

Prof. Aaron Waters of Johns Hopkins University, on temporary duty with the Survey, is doing reconnaissance mapping in the area east of the Deschutes River and north of Latitude 45°.

For the first time in approximately 25 years Dr. Francis G. Wells, who is in charge of the Survey's program on the State Geologic Map, will not be in the field in Oregon. Dr. Wells reports that the compilation of the geologic map of western Oregon has been completed and that black and white preliminary copies should be available some time in mid-1958. Approximately a year later the map will be published in color.

GOVERNOR MAKES NEW APPOINTMENT

Lester R. Child of Grants Pass, long active in State oil exploration work and a one-time leasing and geology representative for Phillips Petroleum Company, was appointed by Governor Robert D. Holmes to the governing board of the State Department of Geology and Mineral Industries.

Child, a resident of Oregon since World War I, is a native of Ogden, Utah, where he was born November 2, 1886. He is a graduate of Ogden High School and has been in the geology and sales business since.

Child was appointed to the unexpired term of Niel R. Allen, also of Grants Pass, who resigned. Allen's term would have expired March 16, 1960.

The new board member was on the staff of Oil Exploration Company and Union Oil Company during the three test drills of 1950 in Coos and Douglas counties. He was with the Phillips firm for two years and was in charge of mapping the Oakland-Sutherlin area of Douglas County for Community Gas and Oil Company and Yoncalla Oil Company.

A Democrat, Child has been a resident of Grants Pass since 1940.

DEPARTMENT FIELD ACTIVITIES

Mr. Herbert G. Schlicker is doing reconnaissance work in the Coast Range on magmatic differentiation in the sills and dikes. He is also collecting material in northwestern Oregon for testing at the U.S. Bureau of Mines laboratories in Seattle, Washington, to determine suitability for lightweight aggregate.

Mr. R. E. Stewart is continuing his studies of Oregon micropaleontology. His present major project is a revision of three Ore.-Bin papers on stratigraphic implications of some Cenozoic foraminifera from western Oregon to be issued as Department Bulletin 36, Part IX.

Miss Margaret L. Steere is completing the investigations for her bulletin of western Oregon fossil localities.

Mr. N. S. Wagner is doing mapping in the Imnaha River area and in the Dale and Desolation Butte quadrangles of northeastern Oregon for the State Geologic Map.

Mr. Howard Brooks is mapping in the Huntington quadrangle for the State Geologic Map. Brooks has also begun work on the quicksilver deposits of the State to revise and bring up to date Department Bulletin 4, "Quicksilver in Oregon."

Mr. Len Ramp is completing his studies on the occurrence of chrome in southwestern Oregon. This project was delayed the first of the year in order to furnish prospector service to callers at the Grants Pass office.

Mr. Norman V. Peterson has taken over the work of Max Schafer, resigned, on the uranium deposits of the State. Peterson has just begun work with the Department at the Grants Pass office and is spending some time in general reconnaissance to acquaint himself with the area.

Dr. George Koch, professor of economic geology at Oregon State College, has been retained by the Department to make a study of the mines and surface geology of a part of the Granite mining district, Grant and Baker counties. Dr. Koch is assisted by Mr. Stephen Pilcher, graduate student at Oregon State College.

Mr. H. J. Buddenhagen has been engaged by the Department on a while-actually-employed basis to make a geologic interpretation of the pre-Tertiary rocks of central Oregon. It is anticipated that this will be a long-term project.

D. FORD McCORMICK

D. Ford McCormick died at Medford, July 14. His death ended a career devoted whole heartedly to the mining profession. Born 70 years ago in Texas, he attended the University of Texas where he received a degree in civil engineering. In 1910 he obtained a mining engineering degree from the Colorado School of Mines and during the ensuing 11 years practiced in Costa Rica, Mexico, and Cuba. Returning to the United States in 1921 he settled in New Jersey where he was a consulting mining engineer associated with the Georgia Kaolin Company. He moved to Medford in 1933 to manage the Sterling Placer mine and since that time Medford has been his permanent home. Governor Hall appointed Ford McCormick to fill out the unexpired term of John Butler on the State Board of Engineering Examiners in January 1948, and reappointed him for a 6-year term a month later. He was serving his second term on the board when he passed away. McCormick was a member of the American Institute of Mining, Metallurgical, and Petroleum Engineers and was active on numerous mining committees in the Pacific northwest.

NEW DRILLING PERMIT ISSUED

Drilling Permit No. 28 was issued July 24 to Oregon Petroleum Corporation, 1344 N.E. Sandy Blvd., Portland, Oregon. The test is to be in the SW $\frac{1}{4}$ sec. 27, T. 7 S., R. 19 E., Wheeler County and is to be known as the Clarno No. 1. Surveyed location is not available but will be filed with the Department within 60 days. The test is to be drilled on U.S. Government land that is under the administration of the Bureau of Land Management. Officers of the Oregon Petroleum Corporation are: Claude B. Brown, 3546 Las Flores Blvd., Lynwood, California, President; O. H. Maryatt, 26 E. Sola Street, Santa Barbara, California, Vice President; and Robert J. Lewis, 150 Alamos Road, Menlo Park, California, Secretary.

LIME PLANT AND QUARRY TO OPERATE IN BAKER COUNTY

According to the Baker Record-Courier of July 4, the Chemical Lime Company quarry on Marble Creek, Baker County, will get into production the week of July 20 and the big burning plant at Wing Siding will begin operation 60 days later. General Manager Robert Vervaeke reports that three 360-ton steel bins have been installed at the quarry where a total of 5600 feet of new conveyors, jaw and gyratory crushers, feeders, and quarry machinery is on the site. The hauling contractor will use 25-ton truck-trailer units for the 12-mile haul to the 30,000-ton stockpile facility at Wing. The Company will install two kilns, both 150-foot by 7-foot rotary gas-oil burning types. Additional air purification equipment is being installed. The plant will produce burned chemical-grade lime, hydrated lime, and pulverized quicklime, in addition to quarry waste, agricultural rock, etc. It will employ 25 to 30 men.

LAKEVIEW MINING COMPANY ADDS BIG DRILL

The Lake County Examiner reports that the Lakeview Mining Company has purchased a new drill rig for deep exploration. The drill is a Mayhew 2000 and is capable of sinking a 12-inch hole from 2000 to 3000 feet deep. It will be used for making deep test holes for the Company's uranium exploration program in the Lakeview area.

PROPOSED LAND WITHDRAWALS

<u>Date of Notice</u>	<u>County</u>	<u>Location</u>	<u>Area</u>	<u>Acres</u>	<u>Purpose</u>
May 7, 1957	Morrow and Umatilla	T. 5 N., R. 27 E. T. 4 N., R. 27 E.		1,560	Expansion of Umatilla Ordnance Depot
May 29, 1957	Harney	T. 33 S., R. 32 3/4 E.		116	Administrative site
June 5, 1957	Klamath	T. 39 S., R. 9 E.		40	Public housing, Klamath Falls airport
June 11, 1957	Wasco	T. 2 N., R. 14 E.		5	The Dalles Dam project (flooded land)
June 12, 1957	Benton and Lane	T. 15 S., R. 7 W.		111	Air navigation facilities site
June 14, 1957	Klamath	T. 40 S., R. 10 E.		160	Air navigation facilities site
July 16, 1957	Sherman and Wasco	T. 3 S., R. 14 E. T. 2, 3 S., R. 15 E. T. 1, 2 S., R. 16 E.		5,018	To provide access for fishing.
		Total		7,010	

The U.S. Bureau of Land Management has notified the Department that the above withdrawals of public land in Oregon have been proposed. These are in addition to the six proposals listed in the April 1957 Ore.-Bin. So far this year, proposed withdrawal of public land for special purpose usage totals 14,668 acres.

The total amount of land withdrawn in Oregon since the withdrawal practice was begun many decades ago is unknown - even the Bureau of Land Management could not supply the figure when asked. The U.S. Forest Service tells us that approximately 1 million acres out of their total of 24 million acres in the Pacific Northwest Region is reserved for special purpose use.

It was hoped that after passage of the Multiple-Use Mining Law, withdrawals prohibiting claim staking would be reduced, for the new law allows management of the surface rights of unpatented mining claims by the federal bureaus even to the point of game management and recreation. Because the withdrawals continue unabated, it would appear that the mining industry alone must live up to the principle of multiple-use of public land and that the search for minerals is to be restricted to an ever-decreasing area.

H.M.D.

HEARINGS SCHEDULED FOR CHROME

Senate Committee hearings on the administration's long-range minerals program recommendations to Congress (see Ore.-Bin, June 1957) have been scheduled to open July 29, it was announced July 15 by Chairman James E. Murfay of the Senate Interior and Insular Affairs Committee. The hearings will start at 10 o'clock in the morning July 29 in Room 224, Senate Office Building, Washington, D.C. Two days of hearings, July 29 and July 31, have been scheduled, with industry witnesses testifying the first day and government witnesses being heard on the second. Persons unable to appear are urged to submit written statements to Senator Murray or congressional delegates.

NEW MILL ON DIXIE CREEK

The Standard Milling Company is erecting a 50-ton flotation-table concentrating mill on Dixie Creek, about 2 miles above Prairie City, Grant County, Oregon. Officers of the company are Ray E. Summers, D. L. Olling, and Vernon Jacobsen. The mill is scheduled for completion by August 1st and is designed to handle ore from the Standard and other mines in the Dixie Creek area.

GEOLOGY OF UMATILLA BASIN DESCRIBED

Geology and ground-water resources of the Umatilla River basin area, Oregon, by G. M. Hogenson, has been released as an open-file report by the U.S. Geological Survey and the Oregon State Engineer. At the present time the report is in mimeograph form and subject to revision, but will ultimately be published as a Water-Supply Paper. It contains 310 pages, geologic maps, and numerous tables and graphs giving hydrologic information on streams, wells, and springs. Copies may be seen at the offices of the Survey and the Oregon Department of Geology and Mineral Industries in Portland, at the office of the State Engineer in Salem, in local public libraries, and in offices of county agricultural agents in Umatilla and Morrow counties.

The area covered by the report is the region drained by the Umatilla River. It includes most of Umatilla County and adjoining parts of Morrow and Union counties. The area extends southward into the Blue Mountains where pre-Tertiary metamorphic and intrusive rocks are exposed. The pre-Tertiary rocks are overlain unconformably by Eocene volcanics and sediments of the Clarno formation. A thick series of flows of Columbia River basalt of Miocene age overlies the older rocks. The basalt flows have been warped into broad gentle folds and somewhat faulted and fractured. The basalt is overlain by Pliocene to Recent alluvium.

Large quantities of water are available in the Columbia River basalt where structural conditions are favorable, and moderate quantities are present in the overlying fluvial deposits. With few exceptions, the quality of the ground water is considered excellent.

FIELD TEST FOR SELENIUM

Two simple and reliable tests for field detection of selenium in rocks and soils have been devised by the U.S. Bureau of Mines and printed in Report of Investigations 5328, "A field test for selenium." The 7-page pamphlet is available free of charge from: Bureau of Mines, Publications Distribution Section, 4800 Forbes Street, Pittsburgh 13, Pa.

Both methods involve fusion of the sample in a test tube to form elemental selenium that will volatilize and condense as a red deposit on the cooler upper portion of the test tube. The methods are sensitive to 10 parts per million, or 0.001 percent. Chemicals and equipment for making the tests are common items carried by most laboratory supply houses. Any type of gas burner such as a blow torch or camp stove can be used as long as it produces a flame temperature of at least 800 degrees.

GEOLOGY STUDENTS HOLD SUMMER CAMP

The Department of Geology of the University of Oregon held its third annual summer camp at the Sunday Hill mine in the Mormon Basin, Baker-Malheur counties. Twenty students under the direction of Dr. Lloyd W. Staples attended the camp between June 19 and July 4 to study ore deposits of the area and make geologic maps.

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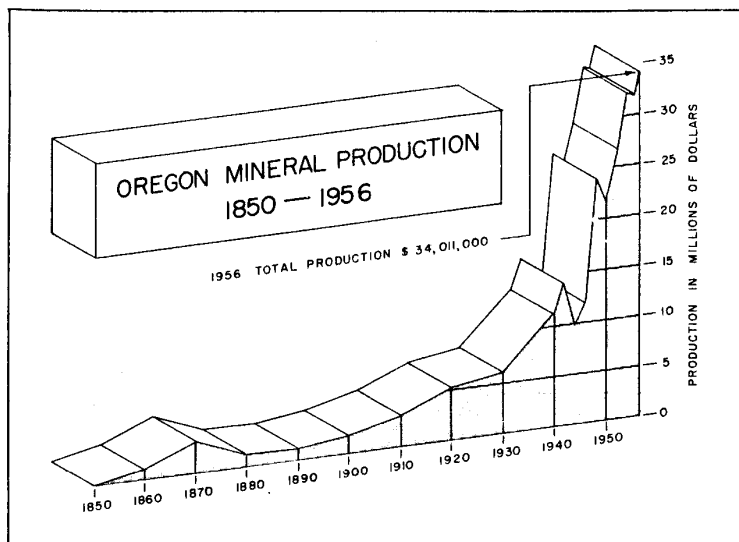
OREGON'S MINERAL INDUSTRY HITS NEW PEAK IN 1956

Mineral production in the State in 1956 increased 7 percent over 1955 and reached an all-time high in dollar value and number of men employed. In 1956 production totalled \$34,011,000, an increase of \$2,271,000 over 1955. Since 1947 the value of minerals produced in the State has increased 104 percent. Employment in mineral industries subject to the Oregon Unemployment Compensation Law now totals 8,201. The payroll earned by mineral industry employees amounted to \$42,743,678 in 1956, a 40-percent increase over 5 years ago.

The accompanying map shows the value of mineral production in each of the counties of the State. It is interesting to note that half of the counties reported increases over the previous year, and that the impact of the mineral industry was felt in all the counties generally on a year-around basis.

A bright spot in the State's growing mineral economy is the rapid increase in titanium and zirconium production. In addition to the U. S. Bureau of Mines facilities, two firms commenced reduction and reprocessing of these metals in the Albany area during the year. Approximately 300 workers are employed in the three plants. Of considerable significance is the fact that all of the raw materials used in these plants is imported from out of State. The many natural advantages available in Oregon make it attractive to industries of this type and a continued growth in metallurgical processing should be expected. The stabilizing effect of the presence of a metallurgical plant in a community is considerable since it provides steady employment, often on a seven-day, three-shift basis; does not deplete local resources; and is unaffected by local swings in the economy.

Oregon's mineral industry embraces a wide variety of raw materials and finished products. The diversification tends to smooth out the peaks and valleys experienced by other industries lacking a broad base of widely varied products. More than 20 mineral commodities are produced in Oregon, and 112 mills and smelters are in operation currently. Gold mining, long a major industry in the State is now almost nonexistent, but in its place have appeared, in steadily increasing volume, a host of new minerals. Expanded shale, nickel, and uranium are examples of these newcomers, all of which were produced for the first time within the past 10 years. The trend since 1850 is clearly shown on the graph on page 68. The increasing industrialization of the State will place ever greater demands on the basic raw materials supplied and processed by the mineral industry.



Domestic mining in general and Oregon miners in particular are continually harassed by vacillating and short-sighted federal mineral policies. Oregon is a top producer of quicksilver and chromite, both strategic metals, but unless effective legislation is enacted promptly to insure a long-term program for either stockpiling or some form of protection against dumping of foreign supplies the mines will close. The United States cannot afford to become dependent upon importation of its critical minerals, and Oregon will suffer a severe blow

to its economy if the 57 chromite and mercury mines and mills are forced to close.

Information on Oregon's mineral industries is obtained through a cooperative agreement with the Department and the U.S. Bureau of Mines, Mineral Industry Division. The following table is taken from the Bureau's Advance Summary Area Report B-52.

R.S.M.

Table 1
Mineral Production in Oregon, 1955 - 1956^{1/}

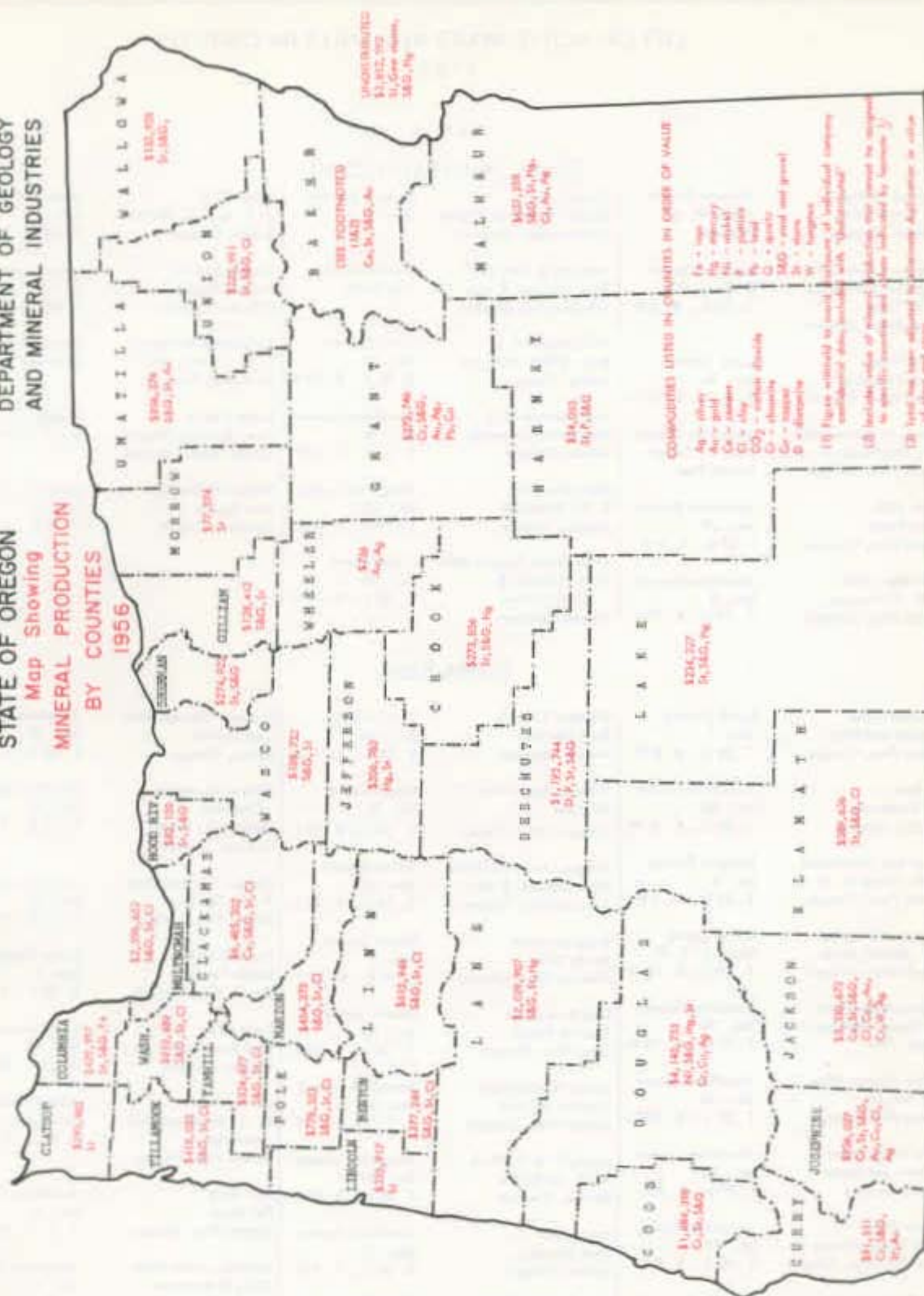
Mineral	1955		1956	
	Short tons (unless otherwise stated)	\$ Value	Short tons (unless otherwise stated)	\$ Value
Chromite - gross weight	5,341	463,514	54,577	2,001,083
Clays	250,608	275,916	256,942	278,205
Copper (recoverable content of ores, etc.)	4	2,984	7	5,950
Gold (recoverable content of ores, etc.) - fine ounces	1,708	59,780	2,738	95,830
Iron ore (limonite)	2,000	2/	1,893	2/
Lead (recoverable content of ores, etc.)	3	894	5	1,570
Mercury - 76-pound flasks	1,056	306,610	1,893	492,029
Nickel ore - nickel content	4,181	2/	6,866	2/
Sand and gravel	11,953,878	11,832,344	11,637,183	11,646,367
Silver (recoverable content of ores, etc.) - fine ounces	8,815	7,978	13,537	12,252
Stone	7,741,937	9,417,834	6,097,965	7,890,197
Tungsten (recoverable content of ores, etc.) - 60 percent WO ₃ basis	1	2/	2/	2/
Value of items that cannot be disclosed: Carbon dioxide, cement, coal (1955), diatomite, gem stones, mineral pigments (1956), pumice and values indicated by footnote 2/.		10,504,356		12,929,235
Total	3/	31,740,000	3/	34,011,000

^{1/} Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

^{2/} Figure withheld to avoid disclosure of individual company confidential data.

^{3/} Total has been adjusted to eliminate duplication in the value of clays and stone.

STATE OF OREGON
Map Showing
MINERAL PRODUCTION
BY COUNTIES



...countries' limits in countries in order of value.

- silver	- top
- gold	- mirror
- saucer	- (vial)
- clay	- potter
	- head
	- quartz
	- and
	- store

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includes value of primary production and forest products.

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LIST OF ACTIVE MINES AND MILLS IN OREGON 1957

METALS

Chrome Concentrating Plants

Ashland Mining Co. Van Curler Bros. Ashland, Oregon	Jackson County 1 mile W. of Ashland	Gazley Mill Glenn and Harry Shippen Canyonville, Oregon	Douglas County Gazley	Selma Mill J. T. & T. K. Seifert Selma, Oregon	Josephine County Sec. 11 T. 38 S., R. 8 W.
Birdseye Creek Mill Lone Star Mining Co. C. A. Wise Rogue River, Oregon	Jackson County SW $\frac{1}{4}$ sec. 27 T. 36 S., R. 4 W.	Haggard & New Mill Wm. Gardner & Sons Canyon City, Oregon	Grant County Dog Creek	Sourdough Mill Howard Beasley O'Brien, Oregon	Curry County Sec. 2 T. 40 S., R. 11 W.
Bristol-Baker Howard Beasley Grants Pass, Oregon	Curry County Sec. 36 T. 40 S., R. 11 W.	McCaleb Mill B. A. & R. E. McCaleb Selma, Oregon	Curry County Sec. 11 T. 38 S., R. 10 W.	Tri-County Milling Co. J. A. Curzon, Mgr. John Day, Oregon	Grant County John Day
Chrome Industries Mill Elzie Mayfield, Jr. & Sr. Grants Pass, Oregon	Josephine County NW "F" Street Grants Pass	McTimmonds Mill Everett McTimmonds Selma, Oregon	Josephine County Sec. 16 T. 37 S., R. 9 W.	Triple L Mill Harry & Lester Shippen Myrtle Creek, Oregon	Douglas County Myrtle Creek
Foster Mill Ernest Foster Grants Pass, Oregon	Josephine County Sec. 29 T. 37 S., R. 8 W.	Radcliffe Mill R. W. Radcliffe Merlin, Oregon	Josephine County Sec. 26 T. 34 S., R. 8 W.	Waldo Milling Co. Jack Eggers Takilma, Oregon	Josephine County Sec. 27 T. 40 S., R. 8 W.
Gallagher Mill J. G. Gallagher Grants Pass, Oregon	Josephine County Sec. 2 T. 37 S., R. 7 W.	Rock Creek Chrome Mill Carl Wikstrom & O.K. Foster Powers, Oregon	Coos County Sec. 33 T. 33 S., R. 12 W.		

Chrome Mines

Babyfoot Mine Langley and Dean Grants Pass, Oregon	Curry County Sec. 3 T. 38 S., R. 9 W.	Gardner Chrome Fred Gardner Harbor, Oregon	Curry County Sec. 10 T. 39 S., R. 11 W.	Mohawk Chrome Mine Carl Stevens Selma, Oregon	Josephine County Sec. 29 T. 38 S., R. 9 W.
Big Bear Lee Sanderson Merlin, Oregon	Josephine County Sec. 35 T. 36 S., R. 8 W.	Gardner Ranch No. 1 Al Dunn Canyon City, Oregon	Grant County Sec. 8 T. 14 S., R. 32 E.	Nickel Mountain Chromite Dorothy A. Kartes Azalea, Oregon	Douglas County Sec. 20 T. 30 S., R. 6 W.
Black Boy (Starveout) T. M. Petrie et al Grants Pass, Oregon	Douglas County Sec. 5 T. 33 S., R. 4 W.	Haggard and New Mine Wm. Gardner & Sons Canyon City, Oregon	Grant County Sec. 21 T. 14 S., R. 32 E.	Oregon Chrome Mine W. S. Robertson Grants Pass, Oregon	Josephine County Sec. 21 T. 37 S., R. 9 W.
Chetco Mining Co. F. I. Bristol, et al Grants Pass, Oregon	Curry County Secs. 2, 3, 10 T. 39 S., R. 10 W.	Kingsley Mine Bandy Sintay Canyon City, Oregon	Grant County Sec. 9 T. 14 S., R. 32 E.	Pearsoll Mine Ernest Foster Grants Pass, Oregon	Curry County Sec. 2 T. 38 S., R. 10 W.
Chrome King Mine Roy Hansen Mining Co. Selma, Ore.	Josephine County Sec. 36 T. 37 S., R. 10 W.	Lost Buck Mine Short & Bailey John Day, Oregon	Grant County Sec. 28 T. 14 S., R. 31 E.	Rosie Mine Fred Baumgartner, et al Harbor, Oregon	Curry County Sec. 11 T. 39 S., R. 11 W.
Crown Chrome Mine Carl Stevens Grants Pass, Oregon	Josephine County Sec. 28 T. 37 S., R. 9 W.	Lucky Hunch Mine Langley & Dean Grants Pass, Oregon	Josephine County Sec. 33 T. 37 S., R. 9 W.	Sad Sack Mine W. S. Robertson and associates Grants Pass, Oregon	Josephine County Sec. 23 T. 36 S., R. 9 W.
Deep Gorge Mine Grisson and Inman Selma, Oregon	Josephine County Sec. 32 T. 37 S., R. 9 W.	Lucky L. & R. Mine R. W. Radcliffe Merlin, Oregon	Josephine County Sec. 35 T. 35 S., R. 9 W.	Salt Rock Pat Arnot Grants Pass, Oregon	Josephine County Sec. 6 T. 36 S., R. 7 W.
Esterly Mine Black Sheep Mining Co. Cave Junction, Oregon	Josephine County Sec. 22 T. 40 S., R. 8 W.	Lucky Star Pete Neubert Selma, Oregon	Josephine County Sec. 21 T. 37 S., R. 9 W.	Saturday Anne Mine Craig & Weishaar Selma, Oregon	Josephine County Sec. 9 T. 37 S., R. 9 W.
Four Point Chrome Carl Stevens Grants Pass, Oregon	Douglas County Sec. 1 T. 33 S., R. 5 W.	McCaleb Chromite McCaleb & Kaiser Selma, Oregon	Curry County Secs. 11, 12 T. 38 S., R. 10 W.		

Chrome Mines (cont.)

Seifert Mine J. T. & T. K. Seifert Selma, Oregon	Josephine County Sec. 3 T. 37 S., R. 9 W.	Sourdough Mine Howard Beasley Grants Pass, Oregon	Curry County Sec. 36 T. 40 S., R. 11 W.	Wm. Gardner Ranch (Al Dunn lease) Mr. Lambert Canyon City, Oregon	Grant County Sec. 8 T. 14 S., R. 32 E.
Shade Mine McShane & Adams Grants Pass, Oregon	Josephine County Sec. 21 T. 37 S., R. 9 W.	Stewart Ranch Mine Burt Hayes John Day, Oregon	Grant County T. 13 S., R. 33 E.	Zero Mine Wm. Gardner Canyon City, Oregon	Grant County Sec. 8 T. 14 S., R. 32 E.
Sordy Mine Tulare & Binder Gold Hill, Oregon	Josephine County Sec. 14 T. 36 S., R. 9 W.	Ward Mine Wm. Gardner Canyon City, Oregon	Grant County Sec. 6 T. 14 S., R. 32 E.		

Gold Lode Mines

Bald Mt. Mine Kenneth Grabner Sumpter, Oregon	Baker County Sec. 3 T. 3 S., R. 36 E.	Charlotte Prospect Lloyd Warner & Dave Williams Grants Pass, Oregon	Jackson County Sec. 5 T. 40 S., R. 4 W.	Greenback Mine Wes Pieren Grants Pass, Oregon	Josephine County Sec. 32 T. 33 S., R. 5 W.
Buffalo Mine J. P. Jackson, Jr. Granite, Oregon	Grant County Sec. 14 T. 8 S., R. 35½ E.	Dry Diggings Walt Cannon Grants Pass, Oregon	Josephine County Sec. 14 T. 36 S., R. 5 W.	Union Leader S. Vaughn & Sons Glendale, Oregon	Douglas County Sec. 36 T. 32 S., R. 5 W.

Gold Placers
(Mostly seasonal operations)

Cal.-Ore. Placers Ed Carlson Galice, Oregon	Josephine County Secs. 2, 3 T. 35 S., R. 8 W.	Leipold Placer Pieren & Connolly Galice, Oregon	Josephine County Sec. 3 T. 35 S., R. 8 W.	Pankey Placer Bert Pankey Merlin, Oregon	Josephine County Sec. 10 T. 35 S., R. 8 W.
Federal Placer Orville Snively Jacksonville, Oregon	Jackson County Sec. 13 T. 39 S., R. 3 W.	Lewis Placer Bud Lewis Galice, Oregon	Josephine County Sec. 36 T. 34 S., R. 8 W.	Smith Placer A. C. Smith Grants Pass, Oregon	Josephine County Sec. 10? T. 33 S., R. 5 W.
Golden Bar Placer R. L. Pancost Merlin, Oregon	Josephine County Sec. 2 T. 35 S., R. 8 W.	Palmar Creek Placer (China Diggings) Lewis Brothers Sierra Land Co. Grants Pass, Oregon	Jackson County Sec. 7 T. 40 S., R. 3 W.	Speaker Placer Henry Speaker Wolf Creek, Oregon	Josephine County Sec. 9 T. 33 S., R. 5 W.
				Sterling Placer Paul Pearce Jacksonville, Oregon	Jackson County Sec. 33 T. 38 S., R. 2 W.

Mercury

Black Butte Mine Mercury & Chemicals Corp. Black Butte, Oregon	Lane County Sec. 16 T. 23 S., R. 3 W.	Bretz Mine Arentz-Comstock Mining Venture McDermitt, Nevada	Malheur County Sec. 3 T. 41 S., R. 41 E.	Horseheaven Mine Cordero Mining Co. Ashwood, Oregon	Jefferson County Sec. 12 T. 10 S., R. 18 E.
Bonanza Mine Bonanza Oil & Mine Corp. Sutherlin, Oregon	Douglas County Sec. 16 T. 25 S., R. 4 W.	Glass Buttes Mine Oregon Uranium Co. Hampton, Oregon	Lake County Sec. 34 T. 23 S., R. 23 E.	Maury Mountain Mine F. D. & H. W. Eickemeyer Prineville, Oregon	Crook County Secs. 10, 15 T. 17 S., R. 19 E.
				Towner Quicksilver Mine Frank Towner Post, Oregon	Crook County Sec. 10 T. 17 S., R. 19 E.

Miscellaneous Metals

Hanna Nickel Smelting Co. (Nickel) Riddle, Oregon	Douglas County Nickel Mountain T. 30 S., R. 6 W.	Lakeview Mining Co. (Uranium) Lakeview, Oregon	Lake County T. 37 S., Rs. 18, 19 E.	Standard Mine (Copper, cobalt) Roy Summers John Day, Oregon	Grant County Sec. 12 T. 12 S., R. 33 E.
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Miscellaneous Processing Plants

Electro Metallurgical Co. (Carbide, ferroalloys) Div. Union Carbide Co. Portland, Oregon	Multnomah County Plant in St. Johns	Oregon Metallurgical Corp. (Zirconium, titanium) Albany, Oregon	Linn County Albany	Pacific Carbide & Alloys Co. (Carbide) N. Columbia Blvd. & Hurst, Portland, Oregon	Multnomah County Plant in N. Portland
Harvey Aluminum Co. (Plant under construction) The Dalles, Oregon	Wasco County	Oregon Steel Mills (Steel) 5200 N.W. Front Ave. Portland, Oregon	Multnomah County	Reynolds Metals Co. (Aluminum) Troutdale, Oregon	Multnomah County
Industrial Processing Co. (Calcium hydrate) 5005 N.W. Front Avenue Portland, Oregon	Multnomah County	Orr Eng. & Chemical Co. (Limonite) James M. Orr Scappoose, Oregon	Columbia County Plant in Scappoose	Supreme Perlite N. Suttle Road Portland, Oregon	Multnomah County Plant in N. Portland
Nat'l. Metallurgical Corp. (Aluminum silicon/silicon) Springfield, Oregon	Lane County Springfield	Owens-Illinois Glass Co. (Glass containers) 5535 N.E. 101 Avenue Portland, Oregon	Multnomah County	Vermiculite-Northwest, Inc. (Vermiculite) 2303 N. Harding Portland, Oregon	Multnomah County
				Wah Chang Corp. (Zirconium) Albany, Oregon	Linn County Albany

NONMETALLICS

Building Stone

Northwest Granite Co. Haines, Oregon	Baker County Sec. 27 T. 7 S., R. 39 E.	Rainbow Rock Quarry (Tuff) Madden & Burk Maupin, Oregon	Wasco County Sec. 11 T. 6 S., R. 11 E.	Tuff Stone Co. Sublimity, Oregon	Marion County Sec. 29 T. 8 S., R. 1 E.
Pacific States Cut Stone Co. (Tuff) E. L. Keeter Madras, Oregon	Jefferson County Sec. 9 T. 9 S., R. 15 E.	Rocky Butte Quarry (Basalt) Joe Marston Portland, Oregon	Multnomah County Quarry at Rocky Butte		

Lightweight Aggregate Producers

Cascade Pumice Lloyd A. Williamson Bend, Oregon	Deschutes County Sec. 5 T. 18 S., R. 12 E. and Sec. 36 T. 16 S., R. 11 E.	Deschutes Concrete Products Co. (Pumice) Chester T. Lackey Redmond, Oregon	Deschutes County Sec. 30 T. 16 S., R. 12 E. and Sec. 33 T. 14 S., R. 13 E.	Northwest Aggregates, Inc. (Expanded shale) Portland, Oregon	Washington County Sec. 24 T. 3 N., R. 5 W.
Central Oregon Pumice Co. W. E. Miller Bend, Oregon	Deschutes County Sec. 7 T. 17 S., R. 12 E. and Sec. 7 T. 18 S., R. 12 E.	Great Lakes Carbon Corp. (Diatomite) Dicalite Division Lower Bridge, Oregon	Deschutes County Sec. 16 T. 14 S., R. 12 E.	Smithwick Concrete Products Co. (Expanded shale) Portland, Oregon	Washington County T. 3 N., R. 4 W.
Cinder Hill Quarry (Cinders) Leroy E. Grote Redmond, Oregon	Deschutes County Sec. 33 T. 14 S., R. 13 E.	Harney Concrete Tile Co. (Pumice) Don Robbins Burns, Oregon	Harney County Sec. 3 T. 24 S., R. 30 E.		

Limestone

Chemical Lime Co. (Burnt lime) Baker, Oregon	Baker County Plant at Wing- ville	Greely Lime Co. (Quarry near Enterprise) Portland, Oregon	Wallowa County Sec. 19 T. 2 S., R. 44 E.	National Industrial Products Co. Durkee, Oregon	Baker County Sec. 10 T. 12 S., R. 43 E.
Dewitt's Polk County Lime Co. Dallas, Oregon	Polk County S.W. of Dallas	Ideal Cement Co. (Quarry at Marble Mt.) Gold Hill, Oregon	Josephine County Sec. 30 T. 37 S., R. 6 W.	Oregon Portland Cement Co. (Quarries at Lime and Dallas; plant at Oswego) Portland, Oregon	Baker and Polk counties Secs. 26, 27, 34, 35 T. 13 S., R. 44 E. and Sec. 12 T. 8 S., R. 6 W.

Miscellaneous Nonmetals					
Alkali Lake Sodium (Salines) A. M. Matlock Eugene, Oregon	Lake County Alkali Lake	Bristol Silica Co. (Crushed granite & quartz) F. I. Bristol Rogue River, Oregon	Jackson County Sec. 30 T. 36 S., R. 3 W.	Gas-Ice Corporation (Dry ice) Portland, Oregon	Jackson County Sec. 7 T. 39 S., R. 2 E.
				Willhoit Coal Mine T. G. Mandrones Portland, Oregon	Clackamas County Sec. 15 T. 6 S., R. 2 E.

R. S. M.

OREGON'S CONGRESSIONAL DELEGATION URGES REALISTIC MINING PROGRAM

At the hearing on the Department of Interior's long-range minerals policy held before the subcommittee of the U.S. Senate Committee on Interior and Insular Affairs, Oregon's two senators and its congressman from the second district representing eastern Oregon testified to the effect that the proposed program was inadequate and that a realistic program should be worked out immediately.

Senator Wayne Morse stated, "Chrome is a metal of high strategic value in time of defense emergency. Thus it would seem to be plain common sense to work out at once a plan to supplement the present program which expires June 30, 1959. We need an adequate incentive program to insure exploration for chromite deposits in the continental United States. . . . I urge the Committee to make a careful study of incentives that will enable small chrome mining operations to explore and produce this vital defense mineral and reap reasonable returns on their investments."

Senator Richard L. Neuberger stated, "We seem to be arriving at a point where we could very easily immobilize our domestic mineral industry. To allow this to happen would be very poor business. . . . Today Oregon's mining industry faces a most uncertain future. To play its part in the event of a national emergency would be difficult if not impossible unless it is bolstered by a friendly and helpful domestic program."

Congressman Ullman stated, "I think the only realistic approach to the problem of domestic chrome production is the adoption of a program similar to that which is now in effect. Certainly our defense needs are such that we could not tolerate the demise of this industry. . . . Ore producers have consistently been at the mercy of foreign mines which pay their workers fantastically low wages. I know from first-hand information that the miners in the district which I represent have barely been able to keep their heads above water. The high cost of mining plus high freight rates have indeed made it difficult for the development of a stable mining industry in the West. We cannot afford to lose the foothold which we have gained."

Besides deploring the inadequacy of the proposed chrome program, Oregon's delegation went on record as favoring continuation of the "floor plan" for quicksilver.

U.S. GEOLOGICAL SURVEY FUELS DIVISION ACTIVE IN OREGON

Parke D. Snively, Jr., Regional Supervisor, Fuels Division, is doing geological mapping in the Newport embayment of the Oregon coast. His mapping this year is emphasizing the Eocene sediments and volcanics of the area. Mr. Snively is also continuing his studies on Coast Range intrusives.

Linn Hoover is completing his field mapping in the Drain and Anlauf quadrangles of the southern Willamette Valley. Field work was started by Mr. Hoover in this transitional area between the Coast Range and the Cascade Mountains in 1955.

Dr. Weldon Rau is measuring sections and systematically sampling for microfossils in the Yaquina and Alsea river basins of the Oregon Coast. John Fryberger, graduate student at the University of Oregon, is assisting Dr. Rau.

Dr. Ewart M. Baldwin, professor of geology at the University of Oregon, is doing geological mapping in the Hubbard Creek and Camas Valley quadrangles of southwestern Oregon for the Survey.

EXPANDED SHALE INDUSTRY TAKES STEP FORWARD

The first production of expanded shale in Oregon began ten years ago with the firing up of a small kiln, operated by Robert Brooke, near Sunset Tunnel in Washington County. Brooke conceived the idea of bloating Oregon clays a year earlier, and the Department of Geology and Mineral Industries assisted in locating likely areas, running preliminary bloating tests, and finally selecting a suitable quarry and plant site. The plant was taken over in 1948 by Northwest Aggregates, a wholly owned subsidiary of Empire Building Materials Company, and considerably enlarged. It has been in steady operation ever since, except for shut-downs due to bad weather during the winter months.

A second producer entered the field in 1950 when Smithwick Concrete Products Company opened a kiln in Portland. Raw shale was quarried in northern Washington County a few miles south of Vernonia and railed to the kiln. This month Smithwick completed the transfer of its kiln at Portland to the quarry site where the removal of large quantities of shale during the past 7 years had provided a suitable level space for its construction. The plant is located on tracks of the Spokane, Portland & Seattle Railway.

Both producers operate concrete block plants in addition to their quarries and kilns. Smithwick has plants in Portland and Eugene, and Empire produces blocks and pre-cast and pre-stressed structural members at its Portland plant. Both companies also supply lightweight aggregate for monolithic concrete which is much used in bridge deckings and other applications where a saving in weight is essential in concrete construction. Both firms are quarrying a fossiliferous gray marine shale of Oligocene age which crops out widely over parts of Washington, Columbia, and Clatsop counties.

WATER QUALITY DATA INVENTORIED

As a part of its program for studying the use and control of Oregon's water resources, the State Water Resources Board, in cooperation with the Engineering Experiment Station at Oregon State College, has prepared an index to all available information on the quality of Oregon's surface and subsurface waters. Compilers are Warren C. Westgarth and Martin Northcraft of the Engineering Experiment Station.

The index has been published in two successive bulletins. Bulletin no. 1, "Water quality data inventory," is an index to all available published and unpublished information on quality of Oregon waters as of June 1956. Bulletin no. 2, "Water quality data inventory supplement," is an index to the results of a State-wide water-sampling program, conducted between June 1956 and June 1957, in which water from approximately 400 stations was collected and analyzed. In both bulletins the data on streams and wells are arranged in tabular form according to drainage basin and are accompanied by a bibliography to which the reader is referred for particulars regarding any water sample.

These two useful inventories have a number of important applications, one of which is to serve as an aid in selecting suitable locations for industrial plants in the State. The two bulletins may be obtained from the Oregon State Water Resources Board, Capitol Building, Salem, Oregon.

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
Head Office: 1069 State Office Bldg., Portland 1, Oregon
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THORIUM, THE RARE EARTHS, AND THEIR USES

By
T. C. Matthews*

Introduction

One of the richest areas for exploration in the field of metals today is in that versatile group of elements known as the rare earths. The 15 elements commonly grouped together as rare earths are those with atomic numbers 57 through 71 (see Chart 1). Added together they are about as abundant as copper in the earth's crust. Found with these 15 elements are their closely related cousins, thorium and yttrium; and because of their similarity any discussion of processing or development of uses must include them. The rare-earth elements are conveniently divided into two major groups. The cerium group of "light" rare-earth elements contains those from lanthanum to europium, inclusive. The yttrium group of "heavy" rare-earth elements contains those from gadolinium to lutetium plus yttrium, atomic number 39. Chart 1 lists the rare earths, showing selected characteristics.

The rare earths are remarkably alike in their chemical behavior because of their atomic structure. This characteristic has made chemical separation so difficult that only in recent years have metallurgists and engineers had relatively pure metals to use in testing and alloying. It has been found that the rare earths offer enormous potentials and already many of these metals are being used in a variety of industrial fields.

History

In the early 1900's, incandescent gas lamps were lighting the homes, industries, and streets of America. The heart of these glowing lamps was the gas mantle. The basic material required for the manufacture of mantles was thorium nitrate, which was obtained from Germany prior to World War I. The Allied blockade during that conflict stopped shipments of thorium nitrate, forcing domestic companies, of which Lindsay Chemical Company of Chicago was a leader, to develop methods for making the nitrate in the United States. The only commercial ore of thorium at that time, and the primary one at present, was monazite sand, which contains from five to twenty times as much of the rare earths as it does thorium. Most of the rare earths were discarded during the early days, since at that time they had little or no commercial value. After World War I, significant uses for the rare earths were developed and monazite became valuable for the rare earths as well as for the thorium it contained.

Thorium and rare-earth minerals

While nearly all thorium compounds are produced from the mineral monazite, and most rare-earth compounds are produced from monazite and bastnaesite, there are a number of other minerals which have produced these compounds in the past or will do so in the future. Some of

* Spectroscopist, State of Oregon Department of Geology and Mineral Industries.

Chart 1

The Rare Earths and Thorium*

Element		Atomic No.	Relative abundance	Density	Neutron absorption X-section (approx.)	Oxide formula	Price per lb. comm. oxides	Price per gram oxide 99.9%
Yttrium	Y	39	105	4.472	1.4	Y ₂ O ₃	80% - \$24.00	\$ 1.10
Lanthanum	La	57	35	6.162	8.9	La ₂ O ₃	99% - \$10.90	.90
Cerium	Ce	58	155	6.768	.70	CeO ₂	90% - \$ 2.20	.75
Praseodymium	Pr	59	25	6.769	11.2	Pr ₆ O ₁₁	50% - \$20.00	1.75
Neodymium	Nd	60	90	7.007	44	Nd ₂ O ₃	75% - \$ 2.52	1.10
Promethium	Pm	61	0		No stable isotopes			
Samarium	Sm	62	35	7.540	10,000	Sm ₂ O ₃		1.80
Europium	Eu	63	1	5.166	4,300	Eu ₂ O ₃		50.00
Gadolinium	Gd	64	35	7.868	36,000	Gd ₂ O ₃	99% - \$ 2.00	3.00
Terbium	Tb	65	5	8.253	44	Tb ₄ O ₇		35.00
Dysprosium	Dy	66	35	8.556	1,000	Dy ₂ O ₃		5.00
Holmium	Ho	67	5	8.799	64	Ho ₂ O ₃		10.00
Erbium	Er	68	30	9.058	166	Er ₂ O ₃		5.55
Thulium	Tm	69	5	9.318	120	Tm ₂ O ₃		75.00
Ytterbium	Yb	70	35	6.959	36	Yb ₂ O ₃		12.50
Lutetium	Lu	71	5	9.849	108	Lu ₂ O ₃		65.00
Thorium	Th	90	60	11.5	7.0	ThO ₂	97% - \$ 8.25	11.22

* Prices are taken from price lists by Lindsay Chemical Company and the Gows Chemical Company.

these minerals, although quite high in rare-earth elements, have been found only in small deposits. Others, known to exist in larger deposits, present still unsolved metallurgical problems before they can be of use. The usual occurrence of thorium and rare-earth minerals is as accessory minerals in granitic rocks. Some of them occur in veins and placers. A partial list of thorium and rare-earth minerals is given below:

Monazite. Essentially a phosphate of cerium and lanthanum, containing most of the other rare earths and small variable quantities of yttrium, thorium, and uranium. Economic deposits are found generally in placers derived from granitic rocks, but a large commercial lode deposit has recently gone into production in South Africa. Monazite contains 3 to 10 percent thorium oxide and 50 to 60 percent rare-earth oxides.

Bastnaesite. A fluocarbonate of the rare earths, primarily cerium and lanthanum, usually containing less than 1 percent uranium and thorium. It occurs in veins associated with fluorite, barite, and carbonates.

Thorite. A silicate of thorium containing 25 to 63 percent thorium oxide and as much as 10 percent uranium oxide.

Thorianite. An oxide of thorium with small amounts of the rare earths, which may contain 70 percent thorium oxide.

Gadolinite. A complex silicate of beryllium, iron, and the yttrium and cerium rare earths.

Allanite. A complex variable silicate of aluminum, iron, the cerium rare earths, and, in smaller quantities, those of the yttrium group.

Cryptolite. An altered zircon containing uranium, thorium, yttrium, and other rare earths.

Fergusonite. A niobate and tantalate of yttrium, with erbium, cerium, uranium, etc., which is found in pegmatites.

Pyrochlore. Chiefly a niobate of the cerium metals, calcium, and other bases, containing thorium, titanium, and fluorine. It is known in large, low-grade deposits.

Xenotime. Essentially an yttrium phosphate. Cerium and erbium are sometimes present, also thorium. It is a primary source of the yttrium group metals.

Euxenite. A niobate and titanate of yttrium, cerium, erbium, uranium, and iron.

Samarskite. Similar to euxenite.

Polycrase. Similar to euxenite.

Yttrotantalite. A tantalate and niobate of iron, calcium, yttrium, and other rare earths.

Uses of thorium

The largest single use of thorium materials today still is in the manufacture of gas mantles. These are made from thorium nitrate, the standard commercial salt and the base for the manufacture of other thorium compounds and metal. The chemical industry uses thorium compounds as catalysts in producing ammonia from nitric acid, producing sulphur trioxide from sulphur dioxide, and producing water gas from carbon monoxide. Some thorium salts find application in creams and lotions, because of their astringent and tonic properties. Thorium is incorporated with tungsten to produce mechanical shock-resistant filaments for vacuum tubes because of its electron emissive power.

The practice of adding as much as 3 percent thorium to magnesium alloys is increasing. A notable example is the Dow-developed HK31 because of its greater fatigue resistance, good forming properties, and strength at elevated temperatures. The alloy, weighing only one-fourth as much as steel, can be heat treated and welded and is available from fabricators in cast and wrought forms. It is being used in the earth satellite, Project Vanguard.

Thorium is especially important because of its value as fuel for the nuclear breeder reactor. Natural isotope 232 is not fissionable, but when it is bombarded by slow neutrons it is transformed into thorium 233, which degrades through protactinium 233 to uranium 233, a fissionable element. This is the breeder reaction, in which more neutrons are produced than are consumed. The major unsolved problem is production of low-cost thorium metal which is refined by the Ames vacuum process to 99.97 percent purity. It is reported that as much as five parts per million of gadolinium will absorb enough neutrons to stop the reaction. Three breeders are now in the works, of which the largest is the 250,000-KW Indian Point heat plant under construction for Consolidated Edison of New York. A breeder this size will need about 21,000 pounds of thorium per year, which will require processing more than 230 tons of 6 percent monazite.

Uses of individual rare earths

Cerium, the most abundant member of the rare-earth group, is an iron-gray metal. It is soft and ductile and burns brilliantly when heated. The metal is a powerful reducing agent and is used effectively in alloys. Cerium oxide is widely used as a polishing agent for optical and other forms of glass. It is used as an opacifier in porcelain coatings for signs and in the manufacture of dielectric ceramic bodies. Cerium hydrate is used as an ingredient in the glass face

plates of color television tubes to prevent darkening of the tube face and also in the special optical glass for atomic energy piles. In glass, cerium oxide imparts ultraviolet absorbency without materially affecting the color of the glass. Oxide of high purity is used in windows to view atomic reactor proceedings.

Lanthanum increases the hot workability of steel and the hardness of magnesium. The oxide is an ingredient of infrared transparent glass and of highly refractive optical glass, particularly for aerial photographic lenses. The hydrate is used as a drier for paint and alcohols.

Neodymium and praseodymium, like many of the other rare earths, have characteristically sharp absorption bands. Because neodymium and praseodymium absorb the yellow sodium lines at 589 to 590 μ ,* they are used in lenses for welders' and glass blowers' goggles. The usual glass coloring agents lower the light permeability and index of refraction, but the use of neodymium or praseodymium does not affect these qualities. Neodymium, used in tableware, yields a changing color tone between red and lilac, and praseodymium a color tone between green and yellow. Praseodymium oxalate is used in the fabrication of high-temperature crucibles. Neophane glass, containing neodymium, is ideal for spectacle lenses. These two elements are also used in the manufacture of artificial gems and infrared-absorbing glass.

Gadolinium has by far the highest thermal neutron cross-section (great tendency to capture neutrons or a high opacity to neutrons) of any known element. It will therefore be useful in nuclear reactor control rods and in neutron shields. It also has possible uses as a phosphor activator and as a low-temperature transistor.

Yttrium has a very low thermal neutron cross-section and is believed to also have use in reactor construction. It is used in fluoride-free glass and in electrically conductive ceramics.

Dysprosium has a high thermal neutron cross-section and has uses as a phosphor activator.

Europium is a neutron absorber and is used as an activator in lithium iodide scintillation counter crystals.

Thulium, made radioactive, emits x-rays of proper length and strength for diagnostic use. A pea-sized bit of thulium will last a year as a source of rays in a small portable x-ray unit.

Lutetium and samarium have isotopes which are naturally radioactive. Lutetium is being used as a tracer in medical research. Samarium is a neutron absorber, used in reactor construction, and when added to glass produces luminescence.

Erbium has an absorption band which makes it useful in the production of infrared-absorbing glass and is a phosphor activator.

Uses of rare-earth mixtures

Although separation of rare earths into compounds of individual elements probably offers the greatest chance for future profits, the quantity of separated material is presently small compared with that used as mixtures. Since the characteristics of individual rare earths are similar, mixtures of rare earths such as those obtained directly from the various ores are often entirely adequate. Such a compound is rare-earth chloride, which serves as a dryer for paint and ink and is used in textile waterproofing and dyeing. It acts as a caries inhibitor in toothpaste and is used in chrome plating baths and for hot-dip coatings on aluminum.

Rare-earth fluorides and oxides are used as cores for high-luminosity carbon electrodes. Ordinary carbon arc lamps dissipate much of their high intensity in the infrared spectrum.

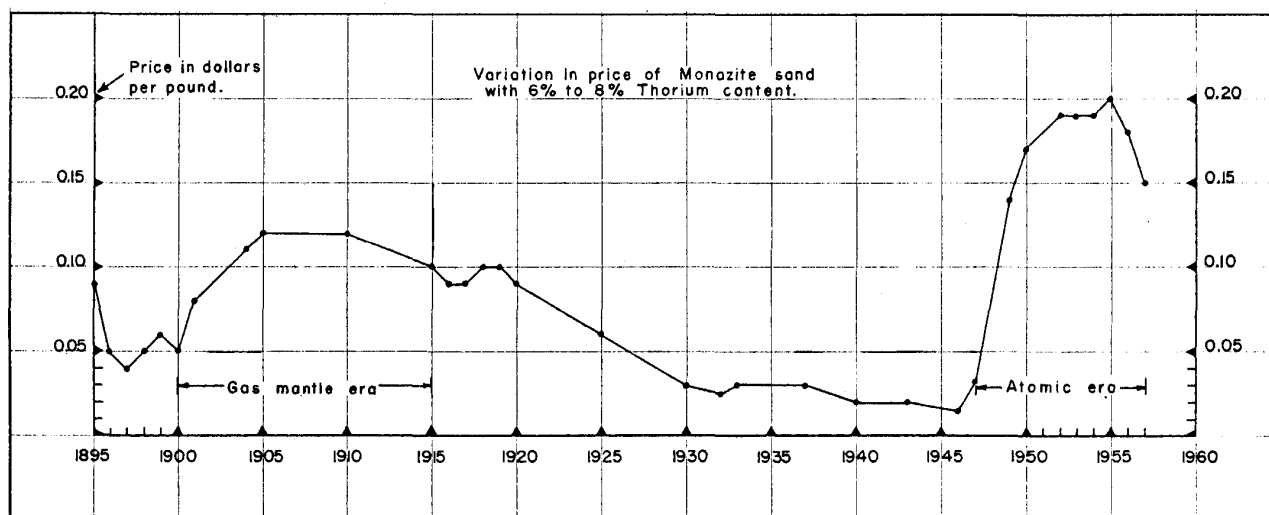
* Equivalent to spectral wave lengths of 5890 to 5900 angstrom units.

Addition of rare-earth compounds results in a brilliant white light which makes high-speed photography and projection of moving pictures possible. Army, Navy, and airport search-lights also use these rare-earth cored carbons.

The largest single use of rare-earth chloride is in the preparation of misch metal (mixed rare-earth metals). For many years it has been alloyed with about 30 percent of iron to make lighter flints, and now it is being used in alloys of aluminum, magnesium, and steel to increase strength and hardness. Such alloys are used in jet planes, gas turbines, and other equipment demanding increased tensile strength at high temperatures. Small quantities added to steel in the ladle result in a strong, fine-grained metal with great resistance to low temperature oxidation and corrosion. Rare earths added to cast iron act as powerful deoxidizers and help remove sulphur from the metal. They are responsible for cast iron that is resistant to corrosive atmospheres and to scaling at high temperatures.

Another commonly used mixture consists of the didymium elements. The common usage of the term means a mixture of neodymium and praseodymium, but Lindsay Chemical Company prefers to restrict the name didymium to the cerium-free group of rare earths extracted from monazite sand. Such mixtures are reasonably constant in composition and no doubt are considerably cheaper to manufacture. Didymium carbonate is used as a glass decolorizer and in temperature compensating condensers for radio and television. Since the mixture provides a neutral gray glass with a sharp cutoff of ultraviolet light, it is used in manufacturing lenses for better-grade sun glasses.

Chart 2



Market values

According to E&MJ Metal and Mineral Markets, June 13, 1957, monazite type ore with a minimum rare-earth plus thorium content of 55 percent brings 14 cents per pound, massive; sand 55 percent grade is 15 cents; sand 66 percent grade is 18 cents. It is probable that the thorium oxide content of these ores must not be less than 6 to 8 percent. No prices are quoted for bastnaesite, but the mineral probably commands a price comparable to monazite. Michigan Chemical Corporation stated that there are no fixed prices for the other ores. The grade of ore required and the price paid will depend on a number of factors including mineral purity, transportation, and amenability to concentration. Chart 2 shows the approximate variations in the price of monazite during the past 60 years.

The market for thorium and rare earths appears to be restricted at present to certain chemical companies. Therefore any project involving these materials should be assured of a

market before proceeding to the production stage. Prices paid for rare-earth ores in general are not as high as the prices quoted for refined materials would lead one to believe. The cost of refining is extremely high, especially when nearly pure compounds are desired.

Prices of commercial oxides and 99.9-percent pure oxides are shown on Chart 1 (p.76). Prices of representative miscellaneous materials are listed below:

Thorium nitrate (gas mantles), 46% ThO ₂	\$ 3.60 per pound
Thorium metal, 2% impurities, powder	35.00 per kilogram*
Thorium metal, 2% impurities, .005 sheet	50.00 per kilogram
Thorium metal, reactor grade	43.00 per kilogram
Rare-earth chloride, 44% total oxides	0.42 per pound
Rare-earth oxide, 94% total oxides	1.80 per pound
Misch metal	4.50 per pound
Ferrocium (for lighter flints)	8.00 per pound
Pure cerium metal.	18.00 per pound
Didymium chloride, 44% total oxides	0.72 per pound
Didymium carbonate, 65% total oxides	1.02 per pound

Companies understood to be processing or refining thorium or rare-earth ores or compounds include the following:

Lindsay Chemical Company, West Chicago, Illinois
Marine Minerals, Inc. (Crane Company), Aiken, South Carolina
Maywood Chemical Company, Maywood, New Jersey
Metal Hydrides, Beverly, Massachusetts
Michigan Chemical Corporation, Saint Louis, Michigan, and Golden, Colorado
Norton Company, Worcester, Massachusetts
Rare Earths, Inc. (Davison Chemical Company), Pompton Plains, New Jersey
St. Eloi Corporation, 3509 Debolt Road, Newtown, Ohio
The Gows Chemical Company, Inc., Box 443, Laramie, Wyoming
United States Yttrium Company, Laramie, Wyoming
Westinghouse Electric Corporation, Lamp Division, Bloomfield, New Jersey

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* 1 kilogram = 2.2 pounds.

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GEOLOGIC MAP OF PORTLAND QUADRANGLE

PUBLISHED BY U.S. GEOL. SURVEY

"Geology of the Portland quadrangle, Oregon-Washington," by Donald E. Trimble, has just been published by the U. S. Geological Survey as Map GQ 104. The map has a scale of 1 inch to the mile and depicts in color and pattern the various geologic formations present. A text describing these formations accompanies the map on a single folded sheet. The map may be obtained from the Denver Federal Center, Denver, Colorado. Price is \$1.00.

Mapping of the Portland quadrangle was done by Mr. Trimble during the years 1948 to 1953 as part of a larger field investigation in the Portland region, results of which will be published in bulletin form by the Survey at a later date.

The area occupied by the Portland quadrangle is a broad structural basin in which the bedrock is largely mantled by surficial deposits. The bedrock consists of two series of Tertiary basaltic lavas, Columbia River basalt and Boring lava, separated by more than 1,000 feet of sedimentary rocks of the Troutdale formation. A careful study of the Troutdale formation in this and adjacent areas has revealed an upper and lower member in the unit. The surficial deposits in the quadrangle consist of Pleistocene clayey silt believed to be of windblown origin capping the Portland hills; widespread lacustrine gravel, sand, silt, and clay deposited by ponded Pleistocene flood waters; Pleistocene alluvium; and Recent sand, silt, and bog deposits.

Mineral resources in the area consist of construction materials and ground water. Sand and gravel, available in abundant supply in the Pleistocene lacustrine deposits, are used extensively for road metal and concrete aggregate. Columbia River basalt and Boring lava are used satisfactorily for road metal, riprap, and building stone. Two clay deposits in the area support brick and tile plants. Columbia River basalt and Troutdale gravels are the chief sources of ground water in the Portland quadrangle.

NEW CHROME OPERATION

The Cynthia chrome mine, Josephine County, has been reactivated by the Thunderbird Mining Corporation of Medford, organized by Frank Grover, Nate Smith, and E. C. Brittsan. The mine is located in the NE $\frac{1}{4}$ sec. 15, T. 41 S., R. 5 W., at about 5,000 feet elevation in the rugged Whiskey Peak area. Starting last June, about 5 miles of road were constructed from the end of Cougar Creek Road through Cougar Gap, and around the south side of Whiskey Peak to the mine. The first shipments of chromite were made the middle of August and to date (September 12, 1957) about 100 tons of good grade chromite, assaying from 46 to 48 percent Cr₂O₃ with a 2.3 to 2.5 Cr:Fe ratio, has been received at the Grants Pass chrome-purchasing depot. Earlier production of the mine was taken out on the trail by pack animals. During World War I some ore was reportedly packed out by Chancy Florey, Medford; and about 35 tons in 1942 by Max Hughes, Murphy, Oregon.

PETROLEUM ENGINEER JOINS DEPARTMENT STAFF

Vernon C. Newton, Jr., has joined the Department staff as Petroleum Engineer and in that capacity will handle problems connected with oil and gas exploration in the State. Mr. Newton is a native of Alhambra, California, and a graduate of the University of Southern California, where he specialized in geology and petroleum engineering.

During World War II, Newton served with the 301st Infantry in France and Germany. Following his graduation in 1949 from the University, he received 5 years training and experience in the various phases of oil-well drilling while working first with Amerada Petroleum Corporation and later with Union Oil Company of California. At Union Oil he acted in capacity of Assistant Division Petroleum Engineer. Mr. Newton became interested in petroleum exploration in the Northwest and came to Oregon in 1954. Since that time he has done mineral exploration and diamond drilling in Nevada, and has worked for the Oregon State Highway Department and the U.S. Soil Conservation Service.

TITANIUM METAL INDUSTRY

Titanium Metal Industry Statistics, short tons		
	1st Quarter 1957	Total 1956
Titanium tetrachloride production for making metal	1/ 27,000	1/ 62,000
Sponge metal production	5,897	14,595
Sponge metal imports for consumption	915	2,048
Sponge metal consumption	4,013	10,936
Scrap metal consumption	738	2,033
Ingot production	4,536	11,688
Ingot consumption	4,734	10,860
1/ Estimated by producers.		

In keeping with the past upward trends in the production and use of titanium metal, the domestic titanium metal industry displayed increased activity in the first quarter of 1957, producing 41 percent more sponge metal and 10 percent more ingot than in the last quarter of 1956. The new high level of sponge production was achieved despite the shortage of argon gas which threatened to disrupt production at several sponge metal plants.

The price of titanium sponge metal remained unchanged during the first quarter of 1957 and was quoted at \$2.75 per pound for Grade A-1 and \$2.50 per pound for Grade A-2.

A new development during the first quarter of 1957 was the announcement that Oregon Metallurgical Corp., Albany, Oregon, and Firth Sterling, Inc., Pittsburgh, Pennsylvania, had entered into a joint venture whereby Firth Sterling will process titanium ingots made by Oregon Metallurgical into bars and forged rounds. (From U.S. Bureau of Mines Quarterly Titanium Metal Report No. 1.)

GROUND-WATER EXPLORATION NEAR COOS BAY CONTINUES

Construction of a third pumping station was begun Wednesday, September 18, 1957, on Oregon coast sand dunes north of Coos Bay-North Bend where Pacific Power & Light Company has been conducting extensive field investigations directed at development of underground sources of fresh water supply for bay area industry. Site of the newest PP&L work is about 1 mile north of the Southern Pacific railway bridge crossing of the bay shipping channel and half a mile west of the railroad spur at Cordes.

The latest installation, designed after PP&L made studies based on data assembled during the utility's 30-month-long preliminary explorations, will consist of three, perhaps four, vertical wells, according to C.P.Davenport, PP&L engineer in charge of the work. The wells will be 41-inch-diameter holes in which will be set slotted wood pipe of 14-inch diameter. The wood pipe will be surrounded with filter-zones of sand and gravel. Some 4,000 feet of 10-inch diameter steel pipe will carry the water to an outfall at the edge of the bay, it was reported. Drillings will be a few hundred yards apart and about 70 piezometers will be placed in the vicinity to determine the water table configuration during pumping.

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OREGON'S OPALITE MINING DISTRICT
ACTIVE AGAIN

By
Howard C. Brooks*

Introduction

The Bretz mine in the Opalite mining district of southern Malheur County, Oregon, is again producing a substantial amount of quicksilver after lying idle for more than ten years. Ore is being mined from a newly developed open pit located 200 feet northwest of earlier workings and is being treated in a flotation plant and furnace which were placed in operation in late 1956 by the Arentz-Comstock Mining Venture of Salt Lake City, Utah. In the years 1931 to 1944 the property was operated by the Bradley Mining Company during which time it produced 10,309 flasks of quicksilver to become one of Oregon's major producers of this strategic metal.

The Opalite mining district includes two other deposits having considerable past production as well as several unproved prospects. In Oregon, the Opalite deposit 7 miles west of the Bretz mine was a major quicksilver producer before closing in 1944. In Nevada, the Cordero mine, about 10 miles southeast of the Bretz mine, has been active since 1940 and is presently one of the nation's leading quicksilver mines.

Location

The Opalite mining district is located a few miles west of McDermitt in southern Malheur County, Oregon, and northern Humboldt County, Nevada (see index map). McDermitt, on the Oregon-Nevada state boundary is 74 miles north of Winnemucca, Nevada, which is the nearest railhead. The quicksilver deposits occur near the margins of the broad grabenlike valley of McDermitt Creek, which flows eastward and drains the area. This creek, with some of its larger tributaries, is the only permanent stream in the semi-arid district. Elevations range from 4,400 feet on the valley floor to more than 7,500 feet in the higher reaches of the White Horse Mountains to the north.

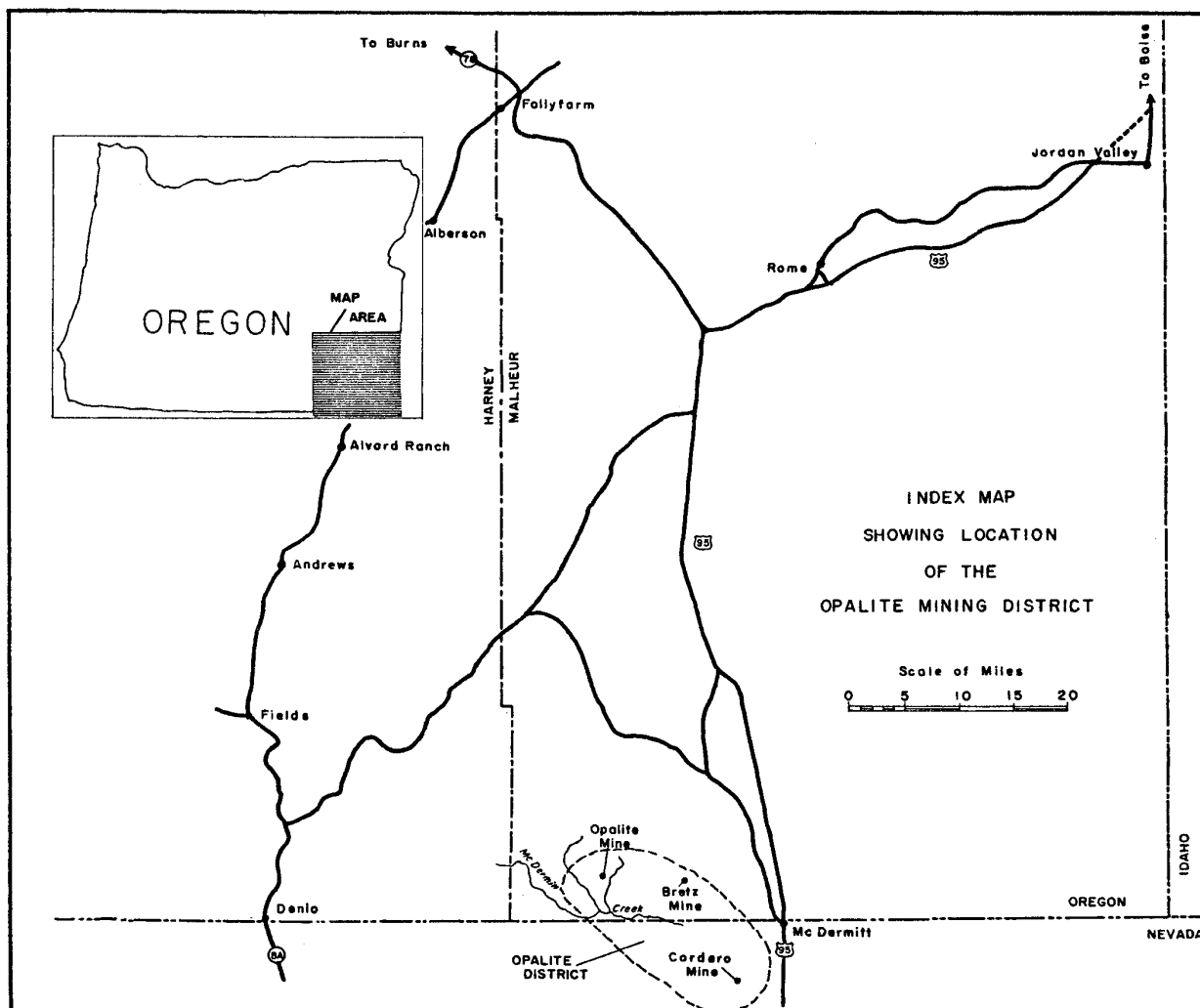
Geology

The geology of the area has been described by Schuette (1938) and by Yates (1942). Portions of the geologic data contained in the following summary and all of the quoted material were taken from the Yates report.

The rocks of the Opalite district consist of more than 3000 feet of nearly flat-lying Miocene lavas overlain by upper Miocene tuffaceous lake beds. These lake beds which in places are more than 200 feet thick contain the Bretz and Opalite ore bodies. Quaternary alluvium is locally present. Intrusive rocks appear to be scarce but southwest beyond the district, lavas rest on an eroded surface of a granitic complex.

* Field Geologist, State of Oregon Department of Geology and Mineral Industries.

The lavas range from basalt to rhyolite. The siliceous lavas locally associated with tuffs range from obsidian to porphyritic rhyolite, and in general exhibit well-developed flow banding. The darker basaltic and andesitic lavas are characterized by vesicularity, columnar structures, flow brecciation, and porphyritic texture. Individual lava flows are from a few feet to more than 100 feet thick and are horizontal or nearly so, except locally where they have been tilted by faulting. The lake beds consist mainly of well-bedded tuffs, shales (including clayey, carbonaceous, tuffaceous, and diatomaceous varieties), and sandstone, but include small lenses of conglomerate. The constituent fragments are dominantly of volcanic origin. Age of the lake beds is based on fossil plants and fresh-water gastropods. The Quaternary rocks include two ages of deposits -- an older precanyon alluvium composed of angular rock fragments capping eroded surfaces of the lake beds in interstream areas and a younger alluvium occurring as valley fill and slope wash within the present stream valleys.



The Miocene rocks are cut by steep normal faults which probably developed during the Pliocene. "The throw on any single break cannot be measured, but the aggregate displacement, which accounts directly for much of the relief in the area, was more than 2,000 feet. The McDermitt Creek Basin is a result of such distributed faulting and all the quicksilver deposits of the district are related to faults within or along the borders of this grabenlike area." Minor

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faulting related to the larger faults occurs in all the mineralized areas. Locally the soft lake beds are inclined as a result of drag along faults and possibly such drag structures were in part responsible for the concentration of the cinnabar.

"Mineralization probably began during or shortly after the Pliocene faulting." Some of these faults acted as channelways for rising hydrothermal solutions and in places the adjacent tuffs and lake beds were silicified into lenticular masses called "opalite." * The silicification was accompanied by kaolinization, but while both the lavas and lake beds were silicified, only the lake beds were kaolinized.

"All the ore deposits are either in or in contact with silicified rocks, and it is believed that the quicksilver was deposited at a late stage of the hydrothermal activity that produced the silicification." The northern limit of the Bretz ore bodies is an east-trending fault along which (mainly on its north side) occur local masses of silicified rock. This fault, adjacent to which the lake beds show steep drag folds, was probably the channelway for the solutions which formed the ore bodies to the south and that silicified the rocks to the north. "Quicksilver solutions presumably came up the same channelways that the silicifying solutions followed but were diverted into unsilicified rocks as they approached the surface."

While the Opalite ore body occurs in a mass of chalcedony some 1,200 feet long, 800 feet wide, and more than 100 feet in maximum thickness in which the cinnabar is finely divided and is generally intimately mixed with the silica, the Bretz ore occurs mainly in unsilicified shale and sandstone. Crystalline cinnabar fills open spaces in the shales and is deposited between grains in the coarser, more porous sandstone.

History and development

Cinnabar was discovered in the vicinity of the Bretz mine by William S. Bretz in 1917. For many years assessment work was confined largely to exploration of low-grade "opalite" outcrops revealing little ore, though some mercury may have been recovered with a small retort operated by Bretz and his brother.

Bretz continued to prospect the surrounding country and in 1924, with a partner named Murphy, discovered the Opalite ore body. The Opalite property was sold to the Mercury Mining Syndicate organized in April 1925 by F. W. Bradley. Construction of a rotary furnace 4 feet in diameter and 70 feet long was completed late in 1926. The furnace would handle from 80 to 100 tons per day of the hard "opalite" ore and was then the largest furnace of its type.

The Opalite deposit was developed by the "glory hole" method. Tunnels were driven beneath the ore body some 80 feet below the outcrops and raises were driven through to the surface. Ore from the surface open pit and from various sublevels was drawn down through the raises to the 80-foot level and hauled to the furnace stockpile.

Operations at the Opalite mine were discontinuous. Severe winters caused the mine and plant to be shut down for as much as three months, and in December 1938 the furnace buildings burned and the plant was closed until early 1940. Between 1927 and 1944 the Opalite mine produced 12,333 flasks from ore averaging approximately 6 pounds of mercury per ton. Production since 1944 has been confined to clean-up operations by lessees and amounts to about 25 flasks. The Bradley Mining Company, which succeeded the Mercury Mining Syndicate in about 1931, continues to hold the property.

In 1931, Bretz discovered high-grade ore in the soft lake beds near his original location. This property, now known as the Bretz mine, was leased to the Bradley Mining Company and was worked in conjunction with the Opalite mine. The ore was mined from open pits with a 3/8-yard shovel and trucked 11 miles to the Opalite furnace. Between 1931 and 1936, 7,751 flasks of mercury were recovered from 33,058 tons of ore. In 1936, reserves minable under existing conditions were exhausted and the property reverted to Bretz on expiration of the Bradley lease.

* A rock consisting of a mixture of chalcedony, quartz, and opal.

The sharply rising price of quicksilver immediately prior to World War II stimulated search for new ore and in 1940 a discovery was made some 2,000 feet northwest of the 1931-1936 workings. Production from 1940 through 1942 from the new ore body amounted to 2,531 flasks. Little more was produced before final abandonment by the Bradley Mining Company in 1944. This was the last major work at the Bretz mine until 1954 when the preliminary developments leading to the present operation began. Total production for the two early periods of the mine's activity amounted to 10,309 flasks from ore averaging 18.8 pounds of quicksilver per ton.

During World War II, quicksilver prices rose to unprecedented heights and, in meeting the wartime demands of this country and allied nations, developed reserves of domestic producers were rapidly depleted. Materials and labor to develop reserves were scarce and production costs rose. As a result, some mines closed early in the war. Some of these such as the Bretz, could probably have produced much longer at a decelerated rate combined with an adequate development program if a realistic national mineral policy had been established by the government near the end or immediately following the war. Instead, as a thank you for the tremendous efforts of domestic producers, the United States Government in 1944 began purchasing large stocks of quicksilver from abroad. This metal was probably sold at prices well below production costs in order to obtain United States dollar credit. This, of course, caused immediate oversupply and brought about the destruction of the domestic industry. United States production of quicksilver, which reached an all-time peak of 51,929 flasks in 1943, dropped to 37,688 flasks in 1944, to 30,763 in 1945, and by 1950 production had decreased to 4,535 flasks, the lowest point in at least 100 years.

Recent developments at the Bretz mine

Encouraged by rising quicksilver prices and the government stockpiling program initiated in 1954, John Ruiz, a rancher from McDermitt, relocated several of the old Bretz claims and attempted to interest capital in additional exploration. In October, 1954, Ruiz leased the property to the U.S. Mercury Corporation of New York. Jay A. Carpenter, Reno, Nevada, former Director of the Nevada Bureau of Mines, acted as intermediary and manager of initial development. In April 1955, drilling of the property began and application was made for a Defense Minerals Exploration Administration loan. In July 1955, a contract for 4,000 feet of drilling was granted to the Shawano Development Corporation which had, in May 1955, absorbed the U.S. Mercury Corporation. Several new claims were located by Shawano surrounding those held by Ruiz and drilling continued under the direction of J. P. Hart through the latter part of 1955.

The exploratory drilling of the ore body was done with a truck-mounted rotary drill using a 4½-inch roller-type bit. The cuttings were blown from the hole by air and from each 5 feet of hole the cuttings were rolled and sampled. The grade of each sample was determined approximately by panning, and samples estimated to run more than 3 pounds of quicksilver per ton were assayed. Most of the holes were drilled to a depth of about 60 feet. The deepest was 105 feet.

New ore was discovered about 200 feet northwest of the 1940-1944 Bradley pit. According to John Ruiz, two substantial ore bodies were found -- one about 97 by 280 feet and the other about 14 by 345 feet. The ore averages 25 feet in thickness and is covered by 30 to 50 feet of overburden.

Under the terms of an operating agreement drawn up during 1956, Samuel S. Arentz, mining engineer of Salt Lake City, Utah, agreed to construct a treatment plant and to equip and operate the mine for half-interest in the property. Arentz, retaining the right of management, obtained a portion of the necessary capital for the venture through an agreement with the Comstock Uranium and Oil Company, also of Salt Lake City. This operating combine is known as the Arentz-Comstock Mining Venture.

When the operation began, it was reported that developed reserves were sufficient to maintain production of 150 dry tons per 24 hours through 1957 from ore averaging 8 to 10 pounds of quicksilver per ton. During this past summer, nearly 7,000 feet of exploratory drilling was done toward the development of future reserves. Some additional ore has been found but much more drilling must be done to determine its extent. Several new claims, located about midway between the Bretz and Opalite deposits, remain to be explored when time permits.

Mining and milling at the Bretz mine

Stripping of the ore to develop an open-pit mine was started at the Bretz mine in April 1956, and construction of the flotation plant was begun on August 1 after laboratory metallurgical test results had been checked in a pilot-plant operation conducted by the U.S. Bureau of Mines at Albany, Oregon. The original metallurgical test work leading to the design of the present plant was done by Mr. Keith Kunze (Kunze, 1957), general superintendent for Getchell Mine, Inc., at Golconda, Nevada. The plant was completed in December 1956 and by the end of the year was operating at its rated capacity.

During the process of stripping the ore body in the fall of 1956, approximately 25,000 tons of rock averaging between 3 and 4 pounds of quicksilver per ton was segregated and stockpiled for winter operation. Actual mining of the ore was begun in May 1957 by Wells Cargo, a Nevada trucking firm which has a contract for the mining and hauling of the ore. Mining operations ceased September 1, 1957, and are to be resumed next spring. During the 5-month period, more than 25,000 tons of ore were stockpiled to supply the mill operation during the coming winter months.

Because the ore is erratic, sample holes are drilled on 10-foot centers, and the ore is selectively mined. The ore is very soft and little blasting is required; in general, only alternate sample holes are shot to loosen the ground. Benches are carried approximately 22 feet high, and ore is loaded into dump trucks with a 1 3/4-yard shovel and trucked about a quarter of a mile to the mill stockpile in front of the crushing plant.

From the mill stockpile the ore is fed by scraper through an 8-inch bar grizzly where the small amount of oversize, mainly boulders of "opalite," is removed. From the grizzly the ore crosses a 1-inch vibrating screen. The oversize from the screen, about 25 percent of the feed, is fed to a 10- by 20-inch jaw crusher, then the fines and the crushed product are carried up an incline belt to a 100-ton circular ore bin. From the bin the ore is ground to 90-percent minus 48 mesh in a 5- by 5-foot ball mill in closed circuit with a double-rake classifier. The classifier overflow is fed to a conditioning tank and from there to a 6-cell flotation machine. The flotation concentrates, which contain 50 to 60 percent mercury (dry weight), are pumped to a thickener and then to a 4-foot American-type leaf filter. The resulting filter cake contains about 30 percent water.

From the filter the concentrates are screw-fed to a 6-hearth 54-inch Herreshoff furnace. The furnace, being of larger capacity (about 10 tons per day) than is required for roasting the 1 to 2 dry tons of concentrates, is not operated continuously. The furnace was installed in the latter part of May to replace two 20-inch by 10-foot D-retorts previously used. Good metallurgical results were obtained with the retorts but their capacity was inadequate.

Water for the mill operation is pumped at the rate of 275 gallons per minute from a 600-foot well located near the new site, and power is derived from diesel generators. Approximately 12 men are employed in the operation of the mill. Roy E. Hickman, who had charge of the mill construction, is superintendent and Paul E. Sorenson is chief engineer. A geologic study of the deposit was recently made for the company by S. Alderman of Salt Lake City.

The concentration of cinnabar by flotation before roasting is a process not widely used, although it has long been known that cinnabar when liberated sufficiently from its gangue is easily floated. Grinding the ore to a fineness sufficient to liberate the cinnabar for concentration

is expensive and often economically impossible. Further difficulties arise because of the tendency of cinnabar to slime, and the roasting of the finely ground cinnabar concentrates is often troublesome. Generally the most economical method of treating mercury ores is to crush and roast them directly. However, since the Bretz ore contains 20 to 25 percent water, its treatment by direct roasting is much more expensive than comparable treatment of dry ore. Schuette (1938, p. 167) gives a good example of this in comparing the relative costs incurred by the Bradley Mining Company during the operation of the furnace at the Opalite mine in which ores from both the Opalite and Bretz mines were alternately treated. The capacity of the furnace which was designed to handle 80 to 100 tons per day of the hard dry Opalite ore was reduced by about one-half in treating Bretz ore, and fuel consumption rose from 6 gallons to 13 gallons per ton of ore treated. Fortunately the Bretz ore was of much higher grade.

Due to the difficulty in the direct roasting of the ore the present process was developed which the management reports is more successful economically. The ore is soft and the cinnabar is easily liberated as is attested by the fact that 150 tons of ore per day are ground to adequate fineness in a 5 x 5 ball mill. Recovery is high; less than half a pound of mercury per ton of ore milled is lost in the entire process.

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GEOLOGIC MAPS OF BEND QUADRANGLE AND CENTRAL HIGH CASCADES PUBLISHED

"A geologic map of the Bend quadrangle, Oregon, and a reconnaissance geologic map of the central portion of the High Cascade Mountains," has just been published by the State of Oregon Department of Geology and Mineral Industries in cooperation with the U.S. Geological Survey.

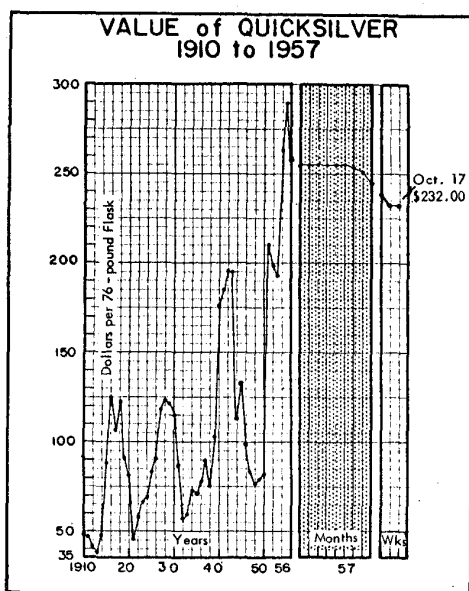
The publication comprises two maps and their descriptive texts printed on one large sheet which folds to a convenient 7- by 11-inch size. The various geologic formations and rock units are indicated by color and pattern. The map of the Bend quadrangle has a scale of 1 inch to 2 miles and shows in detail the geology and topography of the area surrounding Bend and Redmond. The larger reconnaissance map has a scale of 1 inch to 4 miles and shows in a generalized way the geology of the central part of the High Cascades extending from Mount Jefferson to Crater Lake and including the Bend and Newberry quadrangles on the plateau to the east.

Descriptive texts accompanying the maps are written in a nontechnical style, their purpose being to make the geology understandable to the many interested persons who visit or live in this scenic region and wish to interpret what they see.

Author is Howel Williams, Department of Geologic Sciences, University of California. Dr. Williams is an authority on volcanology and long familiar with this region of lava flows, volcanic peaks, and cinder cones. The geologic history, as he shows, is chiefly a complex series of volcanic eruptions of various types, ranging in age from Eocene to Recent, some occurring within the last 1,000 years.

The publication may be obtained from the Department's offices in Portland, Grants Pass, and Baker. Price is \$1.00.

QUICKSILVER PRICE BREAKS



The uneasy price condition which has characterized quicksilver since the middle of the year finally broke early this month. On September 1 the price was \$253 a flask (76 pounds). On the first of October the price was \$241; on October 17 it was \$232. How far the price will drop before leveling off depends on the price it takes to drive the domestic mines out of business. When the last major domestic mine has shut down, the price again will rise. At least that has been the pattern over the past 50 years (see graph) and there is no reason to expect a change.

Reason for the price drop is not hard to deduce. The Government has announced* ". . . sufficient capacity either is planned or now exists to meet presently known mobilization requirements." This can be interpreted to mean that the strategic stockpile for quicksilver has been completed and the substantial requirements of the undisclosed agency for its undisclosed use have been met. Further, the Korean crisis, which prompted the

present price rise, has relaxed. This means that the foreign metal which filled the stockpile and supplied the unknown agency for its secret use will seek the markets now being filled by domestic producers. In addition to a lessening of Government purchases, the price drop can also be attributed to the fact that domestic mines have finally reached a position where they are important producers. Historically when this occurs the foreign producers "pull the rug." The most domestic producers can look forward to is the "floor plan." This is a guarantee by the Government to purchase quicksilver at a price of \$225 a flask. This program ends upon purchase of 30,000 flasks or at the end of 1958, whichever occurs first.

From the national viewpoint it would seem to be good insurance if a nucleus of this very important strategic mining industry would be maintained. Experience over the past fifty years has proved that foreign imports cannot be depended on, and as it takes several years to bring a domestic property into production, an interim exists when quicksilver is not produced. Also, periodic mining destroys ore reserves as only the high-grade and easily accessible ore is extracted. Being placed at the mercy of a foreign controlled market just doesn't make good sense. If a domestic mining industry were allowed to become established, it would give the nation a dependable quicksilver supply and increase the ore reserves through continuing exploration and planned extraction.

The drop in the quicksilver market is of concern to the State of Oregon. Within the past year two new mines have come into production, and several properties, both new and old, are under exploration. In the second quarter of 1957, Oregon accounted for 13 percent of the nation's production. Four of the nation's 15 principal mines were located in Oregon. Loss of these mines will cut into the State's economy at a time when effort is being directed by many people and agencies toward broadening the State's economic base.

At the next session of Congress the domestic mining industry will fight for its existence. The industry will not ask for all of the nation's mineral business. It will try to get enough, from 10 to 50 percent, to stay alive. How this can logically be refused in light of past experience concerning national defense is difficult to see, but it appears from all present indications that this help will be refused. Quicksilver is just one of many strategic minerals that have been and are being turned over to foreign labor to be produced for us.

H.M.D.

* From U. S. Bureau of Mines Mineral Industry Surveys Mercury Report No. 123, prepared August 22, 1957

LIME PLANT DEDICATED

The Chemical Lime Company's burned lime plant at Wingville siding, Baker County, was formally dedicated on the evening of October 3, 1957, with Governor Holmes lighting the burner on one of the plant's two rotary kilns. Approximately 3,000 persons attended the ceremony and accompanying barbeque.

Construction of this plant was begun in the fall of 1956. When full production is attained, the plant will turn out a yearly total of 72,000 tons of calcined product. This will be marketed in the form of quicklime and hydrated to various industrial consumers - notably carbide manufacturers, steel mills, and paper plants.

Daily requirement of raw limestone needed for the kiln feed will be 400 tons. This will originate from the company's quarry at the head of Marble Creek, where reserves are present in sufficient quantity to insure several decades of sustained production.

Owners of the operation are Messrs. Anthony Brandenthaler and Thomas Dant. Mr. Robert Vervaeke is manager. An article by Mr. Vervaeke discussing all phases of this important new operation will appear in the Ore.-Bin in the near future.

GOVERNOR APPOINTS NEW BOARD MEMBER

A Baker woman, whose training and experience includes many years of mine development and geological survey work, was named Wednesday by Governor Holmes to the governing board of the State Department of Geology and Mineral Industries. The new board member is Miss Nadie Strayer, twice president of the Eastern Oregon Mining and Mineral Association and now its secretary. She will fill the vacancy left by the resignation of Clint Haight, Jr., also of Baker, who was recently appointed as Baker County representative to the special legislative session. She is the first woman to serve on the board.

Miss Strayer, for many years chief clerk of the senate committee on mining, helped draft the bill setting up the State Department of Geology and Mineral Industries. A graduate of the University of Oregon where she majored in mathematics, engineering, and geology, Miss Strayer was research assistant to the late Dr. Warren D. Smith on a project involving appraisal of mineral lands of southwestern Oregon. This project included writing a documented history of mining in the area from 1855 and was based on studies of records and reports on mines of Coos, Curry, Josephine, Jackson, Lane, and Douglas counties.

Active for 20 years in exploration, development, and mining in eastern Oregon, Miss Strayer developed manganese properties near Pleasant Valley, and tungsten operations in the Chicken Creek tungsten group. She is presently directing exploration work on large copper holdings and has interests in gold, copper, and silver properties of the area.

Miss Strayer's term on the three-member board will expire March 16, 1959. Other members are Mason L. Bingham of Portland, and Lester Child of Grants Pass.

NEW STONE QUARRY

Mr. Melvin W. Parker of Grants Pass has started a quarrying operation on a deposit of bedded, fine-grained, grayish-green sandstone (flagstone) located 5 miles southwest of Riddle on Cow Creek in Douglas County. The deposit is being leased from the owner, Darrel Carter, Riddle. The stone splits along parallel bedding planes into large slabs from 2 to 10 inches in thickness. Overburden was stripped in early September. Parker reports shipment of 35 tons and an additional 50 tons quarried. A large hydraulic clipping machine is planned for use in cutting the stone to standard widths.

RUSSIAN CHROME REACHES UNITED STATES MARKETS

Chrome ores continue to be in a most uncertain state. Heavier shipments of Russian chrome ores are due to enter the United States via Canada. The total appears to be enough to definitely affect the market situation in the United States. The Russian ore in most cases runs about 49 percent Cr_2O_3 ; some of it is as low as 48 percent and some as high as 51 percent. The ratio in some cases is 3 to 1, but often 2.9 or even 2.8. Generally it is classifiable as hard lumpy, though often it contains 25 percent fines - it has been known to contain one third fines.

Many factors indicate the chrome ore market is weak and some suggest that a sizeable drop in prices would bring in consumers. They describe the consumer situation as comfortable. Others believe some large suppliers have sold out for much of 1958 and therefore are asking high prices. There is some feeling ore they sold went to equipment suppliers and will reappear on the market. Doubtless a good amount of the Turkish high grade ore has been sold ahead but there seems little agreement about its being resold. But importers continue to get many offers and some offers come from supplying firms with which they have done business for years. If the lira is devalued, the chrome ore market may be affected.

(From E&MJ Metal and Mineral Markets, October 3, 1957.)

DIATOMITE EXPLORED IN LAKE COUNTY

The first diatomite mining operations in Northern Lake County got under way in mid-October when Babler Brothers Construction Company of Redmond began stripping overburden to obtain diatomite for testing by Great Lakes Carbon Company. The stripping will soon be completed, according to Bud Pollock of the construction firm, and will require the removal of 30,000 cubic yards. Two Euclid 20-yard scrapers and a D-8 Caterpillar are being used. Hauling to the company's processing plant at Lower Bridge, near Terrebonne, Deschutes County, should get under way October 21 or 22, Pollock said. They will haul on a 24-hour basis using a Hough loader and four truck and trailer outfits. Diatomite is used for filtering and if this test area yields the quality expected a larger area will be mined. Work is taking place on the Richard Schaub place 10 miles southeast of Fort Rock.

(From Lake County Examiner, October 17, 1957.)

EASTERN OREGON MINING NEWS

Mr. Frank Mayo, Sumpter, Oregon, is setting up a washing plant on a section of unworked placer ground on Cracker Creek, about three miles south of Bourne, Baker County. The plant will consist of a skid-mounted washer of about 75-yards-per-hour capacity. Mr. Mayo plans to work a dry pit, level the coarse tailings, and spread the sands on top. The operation, which will begin production early next year, will employ three men. It is estimated that the available ground, owned by Ed Leeck, Baker, will support a full season's operation.

* * * * *

Messrs. Wayne Waggoner, Weiser, Idaho, and Gordon West and Jack Milne, Portland, have leased the Paramount quicksilver property, near Greenhorn, Grant County. Attempts are being made to re-open some of the workings for sampling purposes this fall but the area is already under snow and most of the work will necessarily have to be deferred until next season. The property, owned by Mr. Helmer, Greenhorn, was last operated in 1941.

ASSISTANT SECRETARY FOR MINERALS NAMED

Royce A. Hardy, Jr., of Henderson, Nevada, has been named Assistant Secretary of the Interior for Mineral Resources, to replace Felix Wormser who resigned from this position June 15.

Hardy has been general manager of Manganese Inc., Henderson, Nevada, since February 1956. Prior to that he was general superintendent of the Getchell Mine in Humboldt County, Nevada, for ten years. Born in Reno, May 20, 1921, he received a bachelor of science degree in mining from the University of Nevada in 1947. He also attended the University of Arizona and Stanford University. He served with the United States Army from 1943 to 1946, with more than seven months in the Asiatic-Pacific Theater. Prior to his military service, he was employed for several months by the U.S. Bureau of Mines.

As Assistant Secretary for Mineral Resources, Hardy will supervise the programs of the Bureau of Mines, the U.S.Geological Survey, Office of Oil and Gas, the Defense Minerals Exploration Administration, the Office of Minerals Mobilization, and the Division of Geography. (From The American Mining Congress Bulletin Service, October 7, 1957.)

LAKE COUNTY U-ORE SHIPMENT MADE

Three carloads of uranium ore from the Lucky Lass mine were shipped by the Lakeview Mining Company on Tuesday, October 15, it was announced by James Poulos, company manager. The ore went to Vitro Chemical Company at Salt Lake City, Utah, for processing. Poulos said ore has been stockpiled at Lakeview for a larger shipment which will be made later.

(From the Lake County Examiner, October 17, 1957.)

WHAT CARS ARE MADE OF

A weight breakdown of the 1957 Plymouth Belvedere 4-door sedan shows a total of 167½ pounds of nonferrous metals contained in the over-all weight of 3,569.4 pounds. The figures below should closely approximate the other two low-priced cars, and could be projected for total United States production, if carbon steel were adjusted for the heavier weights of cars in the other price classes. The breakdown includes automatic transmission and power steering, but not ignition components, wiper motors, fuel, oil or coolant, items delivered in finished form by outside suppliers.

Metals in pounds:

Aluminum	77.8
Copper	45.3
Lead	28.5
Zinc	15.9
Plain carbon steel . .	2274.1
Plain cast iron	370.5
Alloy cast iron	195.2
Alloy steel	159.0
Malleable cast iron . .	71.3

Others:

Rubber	177.7
Glass	95.4
Pads, cloth	33.7
Misc.	25.0

(From E&MJ Metal and
Mineral Markets,
October 3, 1957.)

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
Head Office: 1069 State Office Bldg., Portland 1, Oregon
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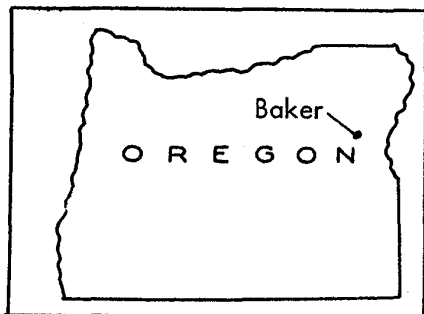
239 S.E. "H" Street
Grants Pass, Oregon

THE CHEMICAL LIME COMPANY OPERATION AT BAKER, OREGON

By

R. G. Vervaeke*

A new industry for eastern Oregon began producing in October 1957. This industry is the lime plant of the Chemical Lime Company at Baker, Oregon. The operation is owned by Mr. Anthony Brandenthaler and Mr. Thomas W. Dant, prominent Oregon lumbermen. Mr. Robert G. Vervaeke, General Manager, is responsible for the basic design and development of the flow sheet at the quarry and the plant. Engineering details were handled by Stoyanov and Johnson of Portland, Oregon. General Superintendent is Mr. Walter Taschek and the chemist is Mr. Raymond Fenn. Exclusive sales agent for the finished product is the Great Western Chemical Company of Seattle and Portland.



Lime is the second oldest material known to man, preceded only by burnt clay or brick. Evidence of lime's lasting quality as a building material is found in the pyramids of Egypt where it was used as the cementing material for the limestone blocks. Today there are some 7,000 uses for lime and it is a primary

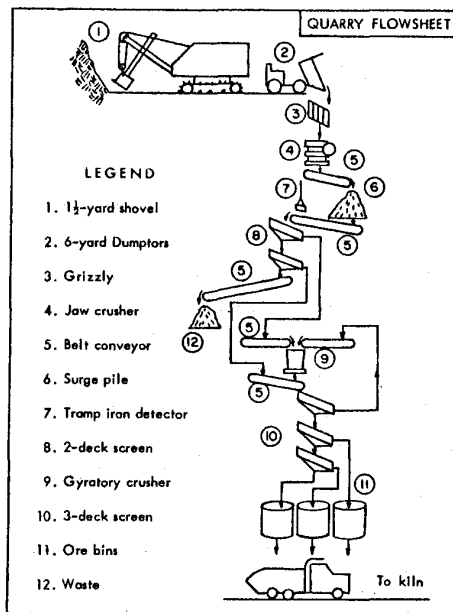
base for the chemical industry. Lime from the Baker plant will be used in the manufacture of acetylene gas, in the steel industry, nickel smelting, paper industry, water treatment, adhesives, insecticides, and building material.

The new plant which is of 75,000-ton yearly capacity is located at Wing Siding on the Union Pacific Railroad 5 miles north of Baker. Limestone for the plant is obtained from a quarry located 10 miles east of the plant at an elevation of 5400 feet on Marble Creek in the Blue Mountains. The plant's first 7½ by 150-foot Vulcan rotary kiln is now in operation and the installation of a second similar kiln alongside the first will be completed some time in January of 1958. The output from the plant includes chemical grade lime, pulverized quicklime, regular and superfine hydrate, and various other lesser products.

Outcroppings and extensive exploratory diamond drilling of the company's limestone deposit has indicated a proved reserve of 3 million tons of excellent quality high-calcium stone with an additional 3 million tons indicated in the same area. A second limestone deposit of equal quality is located 1½ miles east of the deposit being mined. The quarry face, which will eventually reach a height of 260 feet, is being developed on 20-foot benches with Worthington wagon drills and millisecond-delay blasting procedures. As the deposit consists largely of outcroppings, very little stripping is required.

* General Manager, Chemical Lime Company.

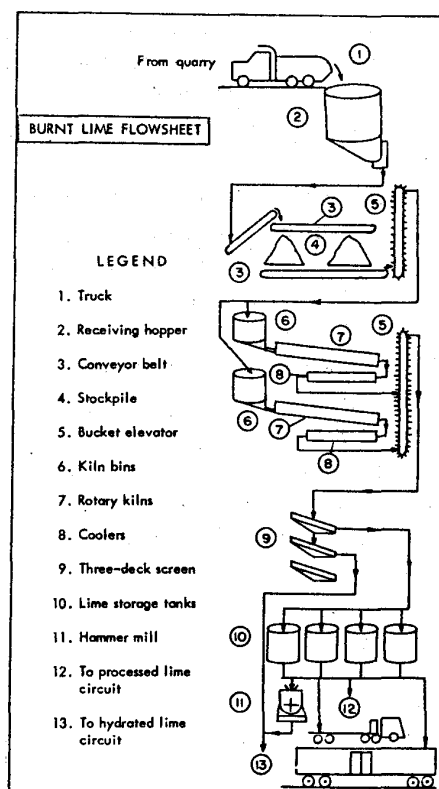
After blasting, the stone is loaded by a Bucyrus Eyrie $1\frac{1}{2}$ -cubic yard shovel into Koehring Dumpsters which haul an average of 350 feet to a hopper located on the mountainside. A Lippmann 42-inch by 15-foot apron feeder beneath the hopper passes the stone over a grizzly to a Pioneer 30 by 42-inch jaw crusher powered by a Westinghouse 150-hp V-Belt drive motor. The primary crusher is set to break everything down to minus 5 inches, a 30-inch by 70-foot belt conveyor building up a 2,000-ton surge pile. Recovery from a pioneer apron feeder located in the tunnel beneath the surge pile feeds a 30-inch by 70-foot belt conveyor which carries the stone to the screen house and secondary crusher.



First pass of the stone is over a Tyrock 5 by 10-foot double-deck screen, the top deck scalping off plus 3-inch oversize which goes to a Traylor 3-foot TY reduction crusher. This crusher is closed circuited with the sizing screen, an El-Jay 4 by 10-foot triple-deck unit. The finished product is conveyed by 3 belt conveyors for storage in three 360-ton steel truck loading bins; the kiln feed is being produced in two sizes -- minus $1\frac{1}{2}$ plus $\frac{3}{4}$ -inch, and minus $\frac{3}{4}$ plus $\frac{3}{8}$ -inch stone. The minus $\frac{3}{8}$ -inch limestone will be sold commercially either as produced or subject to further processing as required by the demand of the market.

Delivery to the plant at Wing Siding is by contract haul using International truck trailers carrying 26 tons per trip. David Galle and Jack Brach have the contract for the haul. The quarrying and crushing plant operate on an 8-hour shift while the trucks run on two shifts. Winters are severe so the quarry will shut down three months in mid-winter. A 30,000-ton capacity stockpile of stone will be established at the plant in order to permit year-around operation. The stockpile is built up by the trucks dumping their loads into a 40-ton live-bottom receiving hopper which feeds a 24-inch by 250-foot conveyor inclined upward to the 42-foot high by 700-foot long trestle. At the top of the trestle, transfer is made to an 18-inch by 700-foot horizontal conveyor. A Rex tripper discharges the stone as desired at any point along the 700-foot span. The kiln stone sizes are separated for uniformity in burning, one kiln utilizing the $1\frac{1}{2}$ -inch feed and the other the $\frac{3}{4}$ -inch in accordance with accepted calcining practice. The stone is piled as received to effect a rough blend, the 700-foot reclaim tunnel being equipped with 16 draw points for loading out onto the 18-inch by 800-foot belt operating in the tunnel and carrying to a 50-foot bucket elevator. This elevator, in turn, supplies the two 50-ton kiln feed bins.

Feed to the kiln is regulated to close limits by a Syntron vibratory feeder and the kiln is fired by Coen combination gas and oil burners. Natural gas became available in the past year in the Baker area and oil firing is expected to be resorted to only in the winter

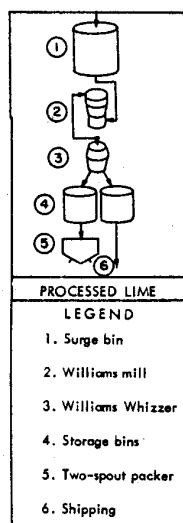


months. Each kiln is turned by a 40-hp motor, one of the drives being a Louis Allis motor transmitting power through a Western gear reducer; the other is a U. S. Motors Vari-Drive unit, believed to be the first adaptation of this variable-speed combination to kiln-drive service. In the event of public utility power failure, a 75-kva gasoline engine generator can supply standby power to the kiln directly through the drive motors.

The kilns are lined with Gladding-McBean Company refractories. Diablo Brand brick is used in the intermediate zone of the kiln, J-M 70-percent alumina brick in the hot zone, and Columbia brick in the preheat zone. Products from combustion from the kiln go through the dust chamber to four American blower dust collectors of the cyclone type and then to American blower induced-draft fans.

The kiln control panel is located inside a pressurized cubicle and instrumentation largely provided by Honeywell is quite complete. The panel mounts ammeters indicating current draw on the kiln and fan motors, gauges measuring and regulating draft within the dust chamber and at the fans themselves, automatic oxygen analyzers, optical pyrometers, and recording and control devices which measure exit and discharge end gas temperatures.

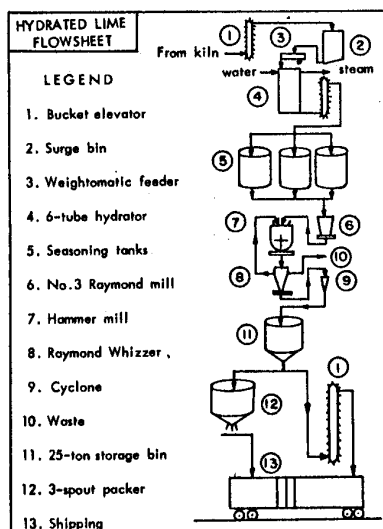
After cooling to 300° F. or less in a 7- by 60-foot rotary cooler, the lime is conveyed and elevated to an El-Jay screen for sizing over 3/4- and 3/8-inch mesh decks. A third deck is in reserve for any special requirement of customers. The pebble lime is stored in six 70-ton steel bins, the transfer to the elevator and from the screen being made by Link-Belt Coil-Mount natural-frequency conveyors. Lime may be withdrawn from any of the bins for loading into railroad cars or trucks or may be elevated to a 50-ton surge bin ahead of a Williams suspended four-roller mill equipped with air separation for pulverizing. Pulverized quick-lime goes to a cyclone and thence to a 20-ton bin which feeds a St. Regis two-spout packer, or to a screw conveyor and elevator for bulk loading into cars.



Base for hydrate may be drawn from any of the four storage bins and is elevated by a screw conveyor to the hydrate feed bin. The feed bin is equipped with high- and low-level Bindicators which automatically control the operation of the elevator and screw conveyors. Lime to be hydrated may be transferred directly or, depending on size, may first be ground in a Sturtevant swing-hammer mill. Hydrate is prepared continuously in a 6-tube Kritzer hydrator which is fed from the 15-ton surge bin by a Hardinge constant-weight feeder.

The finished hydrate is elevated to the top of the building and can either go to a surge bin ahead of a No.3 mill or to 60-ton seasoning tanks prior to milling. The mill is equipped with a double whizzer that has integral air separation. Prior to bagging or bulk loading, the hydrate is stored in 20-ton bins. Bagging is done on a three-spout St. Regis Packer or the Hydrate can go into railroad cars or bulk storage.

Since the water table at the plant site is only 4 feet below the surface all structures are on floating foundations except for the kiln supports. For the same reason, the 700-foot reclaiming tunnel beneath the stone-storage pile is above ground. A double-spur track parallels the mill building and provides ample car capacity and loading facilities. Conveyors are made of Rex rollers and idlers and Goodyear belting. Future plans call for the installations of carbon dioxide recovery equipment.



A large service building has a completely equipped laboratory, change room, shop, store room and mill office. The new plant provides the State of Oregon with commercial lime production for the first time in more than a decade.

AND NOW URANIUM

Mr. Jesse C. Johnson, Raw Materials Director for the Atomic Energy Commission, recently announced that the United States has arrived at the point "where it is no longer in the interest of the Government to expand (domestic) production of uranium concentrate." Johnson continued by saying that an "intensive" world-wide search for new uranium supplies must continue and a plea was made for continuation of domestic uranium exploration. How domestic miners can continue exploration and not be able to market their product, which can only be sold to the AEC, was not explained.

Uranium miners should take warning from the present predicament of their fellow strategic miners who opened up properties in response to urgent demands from Government when emergency supplies were essential. These miners and processors of copper, cobalt, lead, zinc, mercury, chrome, tungsten, antimony, aluminum, columbium and tantalum are now suffering a recession, see the end in sight, or are shut down altogether.

In almost every instance the pattern which has caused the plight of the domestic miner has been the same - solicitation by the Government for expanded production (by loans, incentive price, bonus, and price guarantees); procurement by the Government of world production (through price increase and barter) until it became so large as to inhibit absorption of total supplies; and finally stopping purchases, curtailing or eliminating loans, incentive prices and the like. The result has been excess of world production over world consumption, forcing the domestic miners into the untenable position of being unable to compete with foreign production because of much higher costs in this country.

Uranium miners have received loans and incentive prices and have been assured of a market for their product. Now it develops that Government participation in exploration loans is being reduced and a ceiling is to be placed on production. At the same time foreign production is being encouraged. The pattern appears to be the same as that followed by the Government on other strategic minerals, and the uranium miners should now expect that they will get the same treatment from Government as other metal producers.

The Government's vacillating policy of first encouraging and then discouraging mineral production is putting a blight on western mining. Requests to obtain a consistent long-range minerals policy which would strengthen the industry have been met with a hodgepodge of shortsighted plans on each individual metal. The net result has been to gradually discourage western mining and prospecting. If this is not corrected, most of the nonferrous mines in the West will be forced into closing.

H.M.D.

STATE WATER RESOURCES BOARD SETS HEARINGS

The State Water Resources Board has announced a series of hearings to assist the Board in formulation of an "integrated, coordinated program for the use and control of the water" in the McKenzie and Rogue River basins. Hearings on the upper portion of the McKenzie River Basin will be in Springfield, December 2; on the Rogue River Basin in Medford, December 11; and in Gold Beach, December 13. The Board announces that any person, including public agencies and civic associations, desiring to be heard may present his views at that time. Mining is included among the beneficial uses of the water.

LAKEVIEW URANIUM MILL APPROVED BY AEC

A new industry for Oregon was created on November 18 when the State's first uranium mill was assured by the Atomic Energy Commission in a contract signed with the Lakeview Mining Company of Lakeview, Oregon, for the sale of uranium concentrates (U_3O_8). The contract allows the Lakeview Company to proceed at once with plans for construction of a processing mill having a capacity of about 210 tons of uranium ore per day.

Dr. Garth Thornburg, president of the Company, told the Lakeview Examiner that the first step would be to retain an engineering firm to handle the engineering and designing of the mill. The Company hopes to negotiate for a construction contract in April with completion in 12 months. The mill will cost approximately \$2,600,000 and will be located at the northern outskirts of Lakeview. It is estimated that about 60 men will be employed to operate it.

The new mill will process uranium ores from the Lakeview Mining Company's properties, the White King and Lucky Lass claims, on Augur Creek about 14 miles northwest of Lakeview. The Company will also purchase amenable ores from independent producers in the area including northern California and Nevada.

At the present time the Lakeview Mining Company is conducting an exploration and development program at the White King mine where 40 men are employed. About 1800 feet of underground development has been done and this work will soon be accelerated. Exploratory drilling, on latest report, totals 86,000 feet in 265 holes, and the follow-up underground development work is verifying the indications gained through the drilling program. A large Mayhew rotary core drill is now in operation.

The uranium deposits in the Lakeview area have been under study by the Department ever since discovery of the ore in 1955, and progress reports describing the geology and mineralogy of the Lakeview deposits, as well as other uranium deposits in the State, were published in the December 1955 and December 1956 issues of The Ore.-Bin.

GAMMA-RAY LOGGING UNIT ACQUIRED BY DEPARTMENT

The State of Oregon Department of Geology and Mineral Industries now has available for use within the State a gamma-ray logging unit. This instrument is on loan from the Atomic Energy Commission, Division of Raw Materials, and will be used for logging drill holes for indications of radioactivity. The equipment consists of a Universal Counters Geiger counter, a probe containing a gamma-sensitive 900-volt 1B85 Geiger tube, and a stand and reel assembly for lowering the tube slowly down the hole.

The Department expects to check holes drilled for water wells and other drill holes where there is a possibility of discovering radioactive ores. Any person interested in having a drill hole logged should contact the Department, 1069 State Office Building, Portland 1, Oregon, for further information.

MINING NEWS

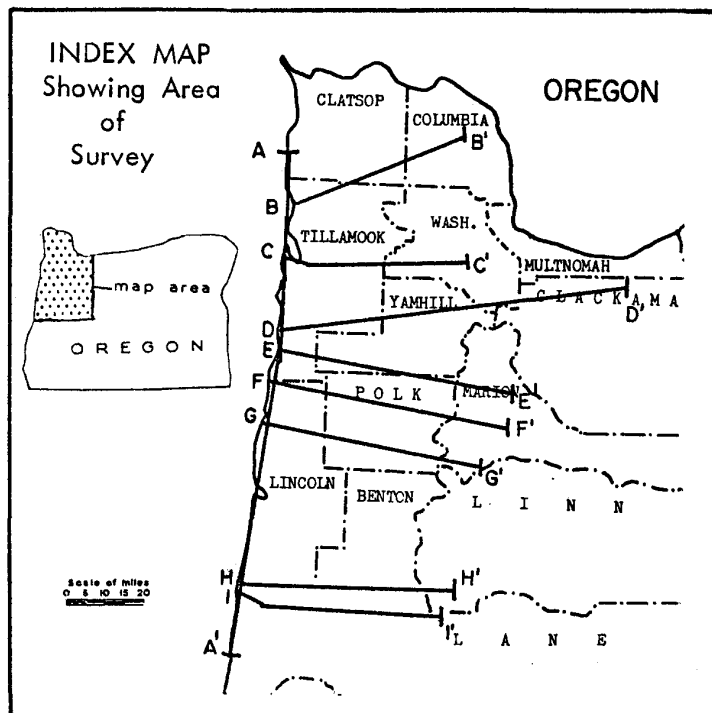
The Circle Star Mining Company, a partnership of Loren Stanciu, Roy Pickler, Clyde Smart, and Dave Aeder, P.O. Box 1055, Haines, Oregon, has leased the Chloride Mine in the Rock Creek District of Baker County. A 35-ton flotation mill has been erected. The ore is reported to contain values in gold, silver, lead, zinc, and copper.

AEROMAGNETIC PROFILES OF WESTERN OREGON AVAILABLE

The U.S. Geological Survey has just released nine aeromagnetic profiles of Western Oregon by R. W. Bromery. The nine profiles cover one north-south section along the coast from Florence to Seaside and eight east-west sections from the coast to the Cascade foothills (see index map).

The magnetic profiles were made from a total intensity aeromagnetic survey. Measurements were made by a continuously recording AN/ASQ-3A airborne magnetometer mounted in a Douglas DC-3 airplane. The pilot used sectional aeronautical charts for navigation, and the flight path of the aircraft was simultaneously checked by an observer using a vertical sighting device. The distance from the plane to the ground was measured with a continually recording radio altimeter.

The profiles, released without correction for regional gradient or editorial or technical review, are on file at the State of Oregon Department of Geology and Mineral Industries, 1069 State Office Bldg., Portland 1, Oregon, and they may be examined here. Copies are on file for inspection also at the Geological Survey Libraries, Federal



Center, Denver, Colorado, and at the Survey offices at 4 Homewood Place, Menlo Park, California; 1031 Bartlett Building, Los Angeles, California; and 724 Appraisers Building, San Francisco, Calif.

Information on how to purchase copies of the aeromagnetic profiles may be obtained from this Department or from the Survey at Menlo Park, California.

NEW DRILLING PERMITS

Permit No. 29 was issued to the Miriam Oil Company, McMinnville, Oregon, on October 29, 1957. This is to be a shallow test hole. The site is located 1089 feet north and 270 feet west from the SE corner sec. 10, T. 8 S., R. 5 W., Polk County. Ground elevation is approximately 280 feet above sea level. The lessors are Walter and Arthur Bliven, Dallas, Oregon. This test is to be called the Bliven No. 3.

Permit No. 30 was issued to the Sunnyvale Oil Company the last of this month. The tentative location of the drilling site is approximately 600 feet N. and 660 feet W. from the SE $\frac{1}{4}$ sec. 14, T. 16 S., R. 29 E., Grant County. Ground elevation is about 5000 feet above sea level. This is a Federal lease. The test is to be called the Mitchell No. 1. Headquarters of Sunnyvale Oil Company are at 520 South Murphy Avenue, Sunnyvale, California. Company officers are Mitchell Pusateri, president, and Burr Matthews, secretary.

DMEA REDUCES PARTICIPATION

The Defense Minerals Exploration Administration has recently announced a reduction in the Government's portion of allowable costs of exploration for certain commodities. The lowered participation percentages become effective on October 22, 1957, and will apply to all applications filed on or after that date. The following mineral commodities have been changed from 75 percent to 50 percent Government participation: asbestos (chrysotile only), columbium, corundum, diamonds (industrial), kyanite (strategic), mercury, monazite and rare earths, platinum group metals, quartz crystals (piezo-electric), tantalum, thorium, tin, tungsten, and uranium.

Other commodities which are eligible for 50 percent Government participation are: bauxite, cadmium, chromium, copper, fluorspar, graphite (crucible flake), lead, molybdenum, and zinc.

Under the DMEA order, the following commodities remain eligible for 75 percent Government participation: antimony, beryl, cobalt, manganese, mica (strategic), nickel, rutile-brookite, selenium, and talc (block steatite).

TITANIUM PUBLICATION AVAILABLE

The U.S. Bureau of Mines has recently published "Titanium, a materials survey," by Jesse A. Miller. The report centers on the increasing importance of titanium in the United States due to the rapid upward trend in output and use of the metal. The 202-page illustrated publication covers all phases of the titanium picture. It discusses mineralogy and geology of titanium deposits, sources, uses, methods of mining and beneficiation, metallurgy, marketing, research and development, and government policies. There is a short discussion of the occurrence of titaniferous minerals in Oregon in beach sands and bauxite deposits, and a brief summary of the electrometallurgical work at the Bureau of Mines laboratory in Albany, Oregon.

The report is designated as Bureau of Mines Information Circular 7791. It may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D.C., for \$1.00.

JOSEPH ROBERT McCUSKER

Notice has just been received of the death on November 25, 1957, of Mr. Joseph Robert McCusker.

Mr. McCusker was born November 16, 1900, in San Francisco, California, but lived most of the past 50 years in Portland, where he was for a time in the oil well supply business through ownership and operation of the United Supply Company. For many years his primary interest has centered in the search for petroleum and natural gas in the Pacific Northwest, and it is probably safe to say that he was the country's best informed authority on the history of oil and gas prospecting in this area. He owned and operated the Northwest Scouting Service, a firm whose purpose is the gathering and dissemination of information on all phases of local petroleum prospecting. The bi-monthly bulletins issued in connection with this service go by subscription to leading oil and gas companies in all parts of the United States. A file of these bulletins merits an important place among documents of Pacific Northwest history.

Joseph McCusker will be missed by many as a loyal friend, and by the petroleum industry as a man dedicated to the objective of developing commercial oil and gas production in the Pacific Northwest.

R.E.S.

WORLD PRODUCTION OF CHROMITE, * BY COUNTRIES ^{1/}
1947-51 (average) and 1952-56, in short tons ^{2/}

(Compiled by Pearl J. Thompson)

Country ^{1/}	1947-51 (average)	1952	1953	1954	1955	1956
North America:						
Canada.....	848	-	-	-	-	-
Cuba.....	114,218	68,132	77,205	80,011	85,107	2/59,248
Guatemala.....	592	116	441	146	320	4/650
United States.....	2,492	21,304	58,817	163,365	153,253	5/207,662
Total.....	118,150	89,552	136,463	243,522	238,680	267,560
South America: Brazil.....	1,603	2,920	3,942	2,108	4,546	4/4,000
Europe:						
Albania ^{4/}	34,000	57,000	61,000	107,000	135,000	147,000
Greece.....	10,104	35,452	40,520	29,508	27,902	52,900
Portugal.....	122	119	6	23	-	-
U.S.S.R. ^{4 6/}	560,000	600,000	600,000	600,000	600,000	600,000
Yugoslavia.....	101,823	118,192	139,950	137,216	139,119	130,913
Total ^{1 4/}.....	715,000	800,000	900,000	900,000	900,000	1,000,000
Asia:						
Afghanistan.....	7/597	-	-	-	-	-
Cyprus (exports).....	12,820	14,867	9,115	10,080	9,599	6,526
India.....	24,666	8/40,530	72,543	50,968	100,071	59,009
Iran ^{2/}	1,946	22,046	23,657	23,406	38,504	29,700
Japan.....	24,903	51,975	41,418	36,138	29,269	43,984
Pakistan.....	20,711	19,518	26,255	24,487	31,808	25,487
Philippines.....	283,043	599,121	614,086	442,230	655,882	781,598
Turkey.....	426,780	889,466	1,005,883	619,001	710,253	783,697
Total ^{6/}.....	795,466	1,637,523	1,792,957	1,206,310	1,575,386	1,730,001
Africa:						
Egypt.....	120	-	231	584	926	281
Sierra Leone.....	15,593	26,312	27,277	21,011	23,231	3/21,027
Rhodesia and Nyasaland, Federation of:						
Southern Rhodesia.....	269,217	355,679	463,028	442,506	449,202	448,965
Union of South Africa.....	491,973	639,366	798,562	706,935	597,368	690,851
Total.....	776,903	1,021,357	1,289,098	1,171,036	1,070,727	1,161,124
Oceania:						
Australia.....	775	1,565	3,070	5,536	-	6,828
New Caledonia.....	85,571	118,728	134,032	93,645	50,790	53,932
Total.....	86,346	120,293	137,102	99,181	50,790	60,760
World total (estimate) ^{1/}...	2,500,000	3,700,000	4,300,000	3,600,000	3,800,000	4,200,000

^{1/} In addition to countries listed, Bulgaria and Rumania produce chromite, but data on output are not available; estimates by senior author of chapter which will appear in Minerals Yearbook, 1956, included in total.

^{2/} This table incorporates a number of revisions of data published in previous chromite chapters. Data do not add to totals shown due to rounding where estimated figures are included in the detail.

^{3/} Exports.

^{4/} Estimate.

^{5/} Includes 45,710 short tons of concentrates produced in 1955-56 from low-grade ores and concentrates stockpiled near Coquille, Oregon during World War II.

^{6/} Output from U.S.S.R. in Asia included with U.S.S.R. in Europe.

^{7/} Average for 1949-51.

^{8/} Does not include 21,603 tons of low-grade ore accumulated from production from 1943 through 1948.

^{9/} Year ended March 20 of year following that stated.

* Prepared in the Division of Foreign Activities, Bureau of Mines, for publication in Minerals Yearbook, 1956. From U.S. Bureau of Mines Mineral Trade Notes, v. 45, no. 1, p. 10.

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DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
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239 S.E. "H" Street
Grants Pass, Oregon

MULTIPLE USE OF PUBLIC LAND

The following pages show the progress of the examinations to determine who has the right of management and use of the surface of mining claims. Examinations of the land are by the U. S. Forest Service and Bureau of Land Management and are being made under Public Law 167, the Multiple-Use Mining Law.

So far, approximately $4\frac{1}{2}$ million acres of government land in Oregon have been examined or will be examined in the near future by the two federal agencies. On the more than $2\frac{1}{2}$ million acres examined by the Forest Service, 365,000 acres have proceeded through the advertising period required by law. The Forest Service reports that 811 claims were involved in these areas of examination and that only sixty-eight verified statements have been filed contesting the Forest Service's right to manage the surface. This means that more than 90 percent of the claimholders have indicated a willingness to share the surface rights of their properties with other users of public land. Mining, once the prime target of criticism as a public land hog, has been "brought to heel" and from early indications appears ready to accept the concept of multiple use.

Other users of public land go on their merry way of reserving land for their special needs, apparently under the illusion that no other use should be made of the land. Withdrawals for fishing access and other recreational use (hardly necessary under multiple use of land), military use, wilderness preservation, roadside strips, and the like continue at an accelerated pace. Proponents of these withdrawals should profit by the lessons learned by mining - recognize others or eventually suffer legislation and a hard road back into the good graces of public opinion. They should also learn from mining that it only takes a few offenders out of the responsible majority to do the damage.

The mining industry looks on the diminishing of land open to them for prospecting with a great deal of alarm. This is not a "sour grapes" attitude but one of grave concern for the future of this basic industry. It is axiomatic that the more land open to prospecting, the greater the possibility of finding a mineral deposit. Metals cannot continue to be indefinitely available if mining is restricted to presently known deposits. New discoveries have to be made in areas not now considered to be "mineralized" and in areas where lavas and sediments hide mineralization. This will be a big and difficult job but one the mineral industry is equal to if it has the opportunity. It is important, not only to mining but to the maintenance and advancement of the Nation's industrial development, that we cease restricting public land and put it to multiple use.

H.M.D.

PROGRESS REPORT OF
AREAS IN U. S. NATIONAL FORESTS APPROVED
FOR DETERMINATION OF SURFACE RIGHTS

no. 12

<u>Forest</u>	<u>Name of Area</u>	<u>Acres Nat'l Forest Land</u>	<u>Date of Field Examination</u>	<u>Date of First Publication</u>	<u>End of 150-day Period</u>
Deschutes	Ground	1,120			
Fremont	Chemult	8,500	July 1956	Feb. 27, 1957	July 29, 1957
Deschutes	Chemult	45,500	May, June 1956	Feb. 27, 1957	July 29, 1957
Deschutes	Tolo	9,750			
	Bend	29,760			
Malheur	Twin	55,200			
	Dixie	36,070			
	Baldy	47,830			
	Canyon	22,680			
Ochoco	Round	24,450	Oct.-Dec. 1956	Nov. 20, 1957	April 21, 1958
	Marks	30,170			
	Green Mountain	22,920			
Rogue River	Applegate	113,250			
	Elliot	49,260	Nov. 1956	June 19, 1957	Nov. 18, 1957
	Ashland	29,130			
Siskiyou	Wildhorse	53,000	July-Sept. 1956	Feb. 21, 1957	July 22, 1957
	Elk "A"	14,570	Oct.-Nov. 1956	Sept. 12, 1957	Feb. 9, 1958
	Elk "B"	123,650	Sept. 1957		
	Fuller	8,800	Sept.-Oct. 1956	Feb. 21, 1957	July 22, 1957
	Taylor	34,230	April-May 1957	Sept. 11, 1957	Feb. 12, 1958
	Illinois	45,350			
	Pistol	39,950			
Umatilla	John Day "A"	8,942	Nov.-Dec. 1956	Sept. 25, 1957	Feb. 23, 1958
Umpqua	Bohemia	157,460			
	Steamboat	24,000			
	Cow Creek	58,000			
Wallowa- Whitman	Dooley Mountain- Buffalo	44,000	June-July 1956	Feb. 27, 1957	July 29, 1957
	Pine	82,230	July-Aug. 1956	Feb. 27, 1957	July 29, 1957
	Woodley	35,250	July-Aug. 1956	Feb. 27, 1957	July 29, 1957
	Unity	37,500	Aug.-Sept. 1956	Feb. 27, 1957	July 29, 1957
	Baker	261,770			
	Bull Run	22,200			
	Whitney	37,700			
	Eagle	89,600			
	Limber Jim- Sheep Creek	39,780			
	Snake River	31,750	June-July 1957		
	Summit	35,720			
Willamette	Little North Fork	22,600	May-June 1956	Feb. 27, 1957	July 29, 1957
	Quartzville	28,000	May-June 1956	Nov. 1, 1956	April 1, 1957
	Blue	17,600	Sept. 1956	Sept. 25, 1957	Feb. 22, 1958
	Blue River	170,200			
	Cascadia	218,000			
	Detroit	281,950			

TOTAL. . . 2,549,392

RESUMÉ OF U.S. BUREAU OF LAND MANAGEMENT PUBLIC LAW 167 WORK

AREAS EXAMINED AND ADVERTISED

Josephine County
(Adv. Nov. 21, 1956, in
Grants Pass Courier)

T. 34 S., R. 5 W.
T. 34 S., R. 6 W.
T. 37 S., R. 5 W.
T. 38 S., R. 5 W.

(Adv. Mar. 20, 1957, in
Grants Pass Courier)

T. 38 S., R. 6 W.
T. 39 S., R. 5 W.
T. 39 S., R. 6 W.

(Adv. Sept. 25, 1957, in
Grants Pass Courier)

T. 36 S., R. 5 W.
T. 36 S., R. 6 W.
T. 36 S., R. 7 W.
T. 37 S., R. 6 W.
T. 37 S., R. 7 W.
T. 37 S., R. 8 W.
T. 38 S., R. 6 W.
T. 38 S., R. 7 W.
T. 38 S., R. 8 W.
T. 39 S., R. 8 W.
T. 40 S., R. 8 W.

Douglas County
(Adv. Mar. 20, 1957, in
Roseburg News Review)

T. 30 S., R. 2 W.

(Adv. Sept. 18, 1957, in
Roseburg News Review)

T. 19 S., R. 9 W.
T. 19 S., R. 8 W.
(8 secs.)

Grant County
(Adv. Sept. 18, 1957, in
Blue Mountain Eagle)

T. 13 S., R. 30 E.
T. 14 S., R. 30 E.
T. 13 S., R. 31 E.
T. 14 S., R. 31 E.
T. 12 S., R. 32 E.
T. 13 S., R. 32 E.
T. 14 S., R. 32 E.
T. 12 S., R. 33 E.
T. 13 S., R. 33 E.
T. 14 S., R. 33 E.
T. 12 S., R. 34 E.
T. 13 S., R. 34 E.
T. 13 S., R. 35 E.

Baker and Wallowa Counties
(Adv. Sept. 16, 1957, in
Democrat Herald)

T. 11 S., R. 37 E.
T. 12 S., R. 37 E.
T. 8 S., R. 38 E.
T. 11 S., R. 38 E.
T. 12 S., R. 38 E.
T. 11 S., R. 40 E.
T. 12 S., R. 40 E.
T. 9 S., R. 41 E.
T. 11 S., R. 41 E.
T. 12 S., R. 41 E.
T. 7 S., R. 42 E.
T. 7 S., R. 43 E.
T. 11 S., R. 44 E.
T. 11 S., R. 45 E.
T. 5 S., R. 48 E.
T. 6 S., R. 48 E.
T. 7 S., R. 48 E.

AREAS EXAMINED
BUT NOT ADVERTISED

Curry County
T. 31 S., R. 14 W.

Douglas County
T. 29 S., R. 2 W. (Part)
T. 31 S., R. 4 W. (Part)
T. 32 S., R. 3 W.
T. 32 S., R. 4 W.
T. 32 S., R. 5 W.

Josephine County
T. 33 S., R. 5 W.
T. 33 S., R. 8 W.
T. 34 S., R. 7 W.
T. 34 S., R. 8 W.
T. 35 S., R. 7 W.
T. 35 S., R. 8 W.
T. 39 S., R. 7 W.
T. 40 S., R. 7 W.
T. 41 S., R. 8 W.
T. 41 S., R. 9 W.

Jackson County
T. 38 S., R. 2 W.
T. 33 S., R. 1 W.
T. 33 S., R. 2 W.
T. 33 S., R. 3 W.
T. 33 S., R. 4 W.

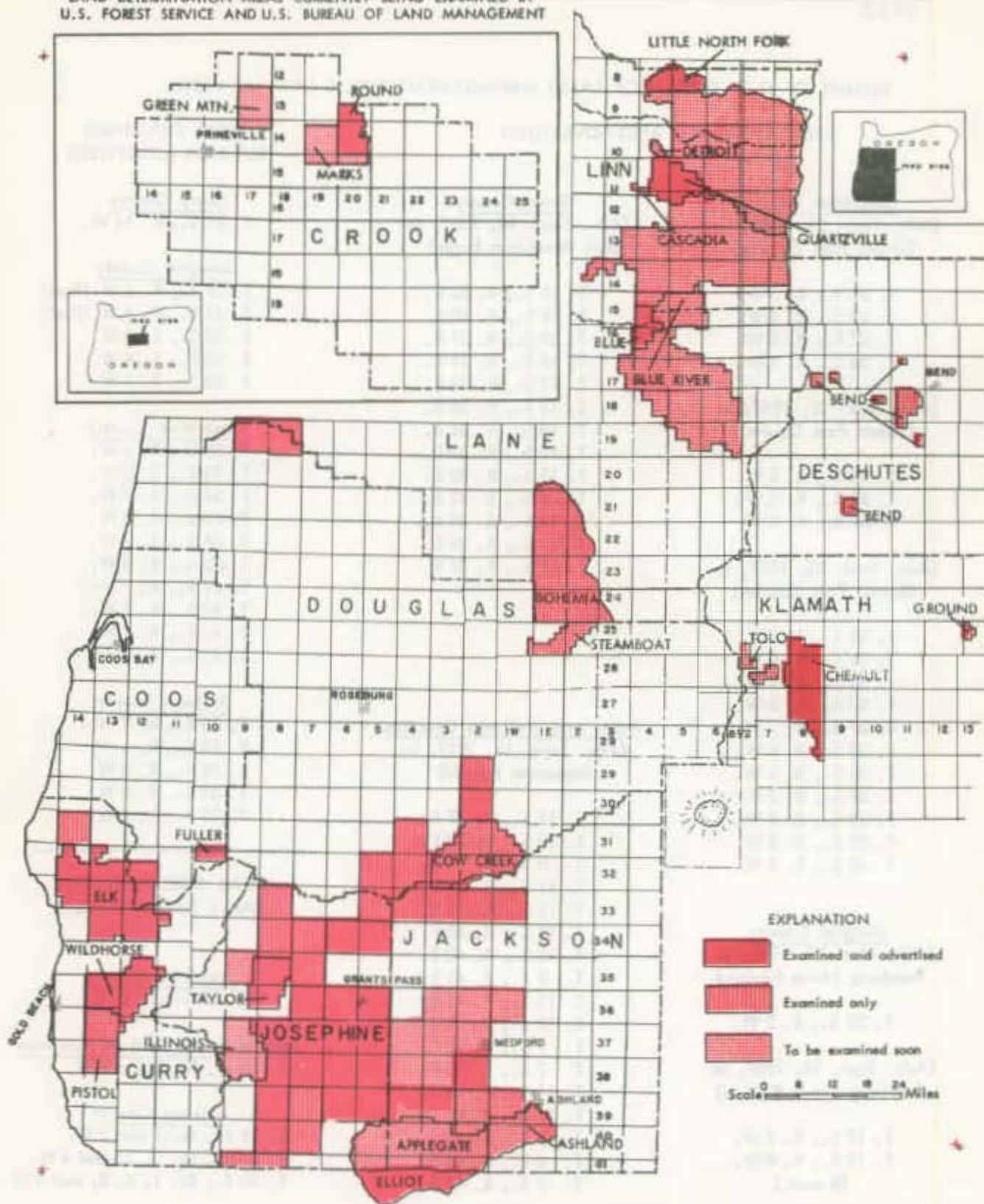
AREAS SCHEDULED FOR
EARLY EXAMINATION

Josephine County
T. 35 S., R. 9 W.

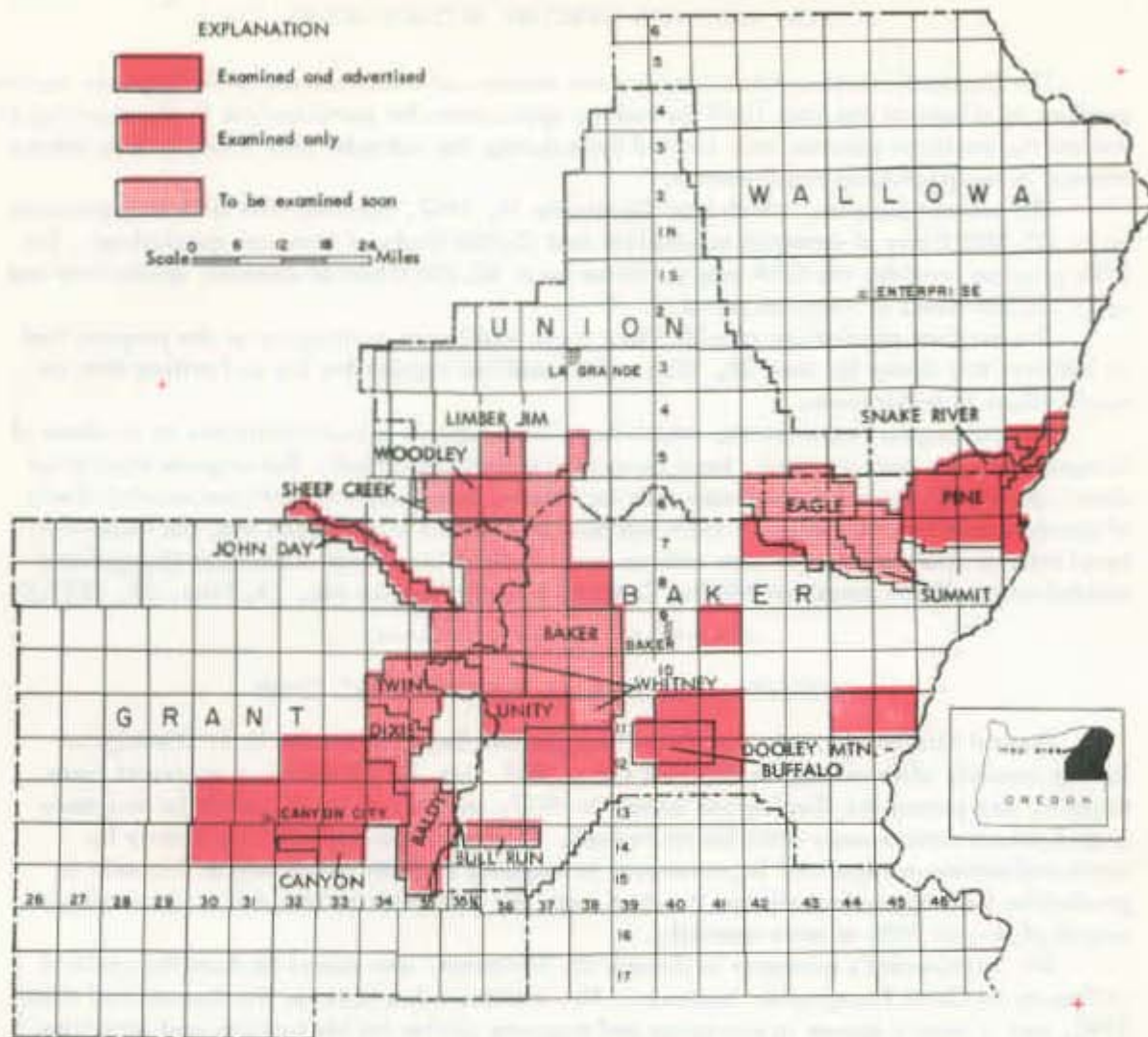
Josephine and Jackson Counties
T. 38 S., Rs. 3 and 4 W.

Jackson County
T. 39 S., Rs. 1 and 2 W.
T. 37 S., Rs. 2, 3, and 4 W.
T. 36 S., Rs. 1, 2, 3, and 4 W.

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



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



Information about Public Law 167 and its management is given in the following Ore.-Bin articles, which may be obtained free-of-charge by writing to the Department of Geology and Mineral Industries, 1069 State Office Building, Portland 1, Oregon:

1. "Basic Mining Law Amended" (explains Public Law 167) - August 1955.
2. "Mining Claim Holders Take Note" (gives procedures under which the U. S. Forest Service is conducting land determinations and discusses rights of claim holders) - April 1956.
3. "The Multiple-Use Mining Law - Success or Failure" (shows purpose of PL 167 and includes maps of land determination areas) - October 1956.

In addition, the Department, upon request, will send free forms to any mining claimant who wishes to be notified by the Government that his claim has been examined and wants to file a "Verified Statement" of its validity.

GSA MODIFIES MERCURY REQUIREMENTS

The General Services Administration has announced modifications of the mercury purchase program to eliminate the time limit for making application for participation in the program; to extend the purchase program on a limited basis during the calendar year 1958, and to make a change in the packaging requirements.

The present program, which ends December 31, 1957, provides that GSA may purchase up to 125,000 flasks of domestic quicksilver and 75,000 flasks of Mexican quicksilver. The 1958 program provides the GSA may purchase up to 30,000 flasks of domestic quicksilver and up to 20,000 flasks of Mexican metal.

The original regulations provided that those wishing to participate in the program had to indicate this desire by June 30, 1956. The modified regulations fix no limiting date on applications to participate.

The packaging requirements, which have been subject to much criticism by members of Congress and the mercury trade, have been only slightly modified. The original regulation drawn up in 1954 provided the flasks must be "clean, seamless, wrought-iron or steel flasks of standard quality and design." GSA has now interpreted this to mean that the flasks must be of tubular steel or wrought iron with no longitudinal seams and crimped or plugged and welded ends. (From American Mining Congress Bulletin Service No. 24, Nov. 29, 1957.)

FITZGERALD RETIRES AS TOPOGRAPHIC CHIEF

Gerald FitzGerald retired as Chief Topographic Engineer for the U.S. Geological Survey recently after serving in this post since 1947. Mr. FitzGerald is a native of Burns, Oregon, and joined the Geological Survey in 1917, with which organization he was associated almost continuously until his retirement. During his service with the Survey he instituted numerous important improvements in mapping methods which saw an increase in production from approximately one hundred maps per year prior to World War II to today's output of around 1800 or more annually.

Mr. FitzGerald's successor is George D. Whitmore, who moves up from the position of Deputy to Chief Topographic Engineer. Mr. Whitmore has been on the Survey staff since 1945, and is widely known in surveying and mapping circles for his writings and activities in professional societies. He is the author of several texts on surveying.

DOMESTIC METAL PRICES

From E&MJ Metal and Mineral Markets, December 19, 1957

Copper - 26.140 cents per pound f.o.b. refinery (domestic average)	Nickel - per pound electrolytic cathodes f.o.b. Port Colborne, Ontario, 74 cents duty included
Lead - 13 cents per pound New York	Osmium - per ounce troy \$80-100
Zinc - 10 cents per pound East St. Louis	Palladium - per ounce troy \$21-22½
Quicksilver - \$225-230 per 76-pound flask New York	Platinum - per ounce troy \$77-80; average, \$78
Silver - (foreign) 89.625 cents per ounce New York; (domestic) 90½ cents government price	Selenium - per pound, commercial grade, \$7.50; high purity, \$10.50
Antimony - 99½ percent grade, domestic, bulk, f.o.b. shipping point 33 cents per pound	Titanium - per pound, grade A-1, 99.3+ percent, maximum .3 percent iron, \$2.25
Bismuth - \$2.25 per pound in ton lots	Titanium ore - per gross ton, ilmenite 59.5 percent TiO ₂ f.o.b. cars Atlantic ports \$26.25 - 30.00; rutile, short tons, minimum 94 percent, \$120-125
Cobalt ore - per pound of cobalt contained f.o.b. shipping point, free market, 10 percent grade, 60 cents; 12 percent, 80 cents.	Tungsten - per pound 98.8 percent, 1,000-pound lots, \$3.15
Iridium - per ounce troy \$100-110	Zirconium - per pound, sponge, powder, platelets: \$5 - 10 commercial
Lithium - per pound 98 percent \$11-14	

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- Aeromagnetic profiles of Western Oregon available (19,11:98)
- Assessment time nears (19,5:45)
- Bend quadrangle and Central High Cascades, Geologic maps of, published (19,10:88)
- Bill introduced in U.S. Senate (National Wilderness Preservation System) (19,3:28)
- Bingham, Mason L., reappointed to Board (19,4:35)
- Black sand potential investigated (19,2:17)
- Cascades, Central High and Bend quadrangle geologic maps published (19,10:88)
- Child, Lester R., appointed member of Board (19,7:63)
- Chromite
 - Eastern Oregon production (19,2:16-17)
 - Hearings scheduled (19,7:65)
 - New operation (19,9:81)
 - Ore receipts told (19,6:54)
 - Russian, reaches United States markets (19,10:91)
 - Geology of the Lower Illinois River Chromite District, by Len Ramp (19,4:29-34)
 - World production by countries (19,11:100)
- Coos Bay
 - Ground-water exploration near, continues (19,9:82) (19,3:27-28)
 - Sand dunes, Fresh water available in (19,3:27-28) (19,9:82)
- DMEA reduces participation (19,11:99)
- Department field activities (19,7:63)
- Diatomite explored in Lake County (19,10:91)
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- Expanded shale industry takes step forward (19,8:74)
- FitzGerald retires as topographic chief (19,12:106)
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- Fossil localities of the Sunset Highway area, Oregon, by Margaret L. Steere (19,5:37-44)
- Gamma-ray logging unit acquired by Department (19,11:97)
- Geologic maps
 - Lower Illinois River Chromite District, Geology of, by Len Ramp (19,4:29-34)
 - Marcota, Leaburg, and Lowell quadrangles, Oregon, Geology of, by H.G. Schlicker and H.M. Dole (19,7:57-62)
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