

STATE DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
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PROSPECTING FOR QUICKSILVER IN OREGON
By The Staff

Geology

Quicksilver occurrences are widely scattered over the State; however, mines which have shown significant production can be segregated into three large districts; the Western Cascades, Central Oregon, and Southeastern Oregon (see map). These districts are in regions of past widespread volcanic activity and, as in other quicksilver regions of the world, indicate a close association between volcanism and quicksilver deposition.

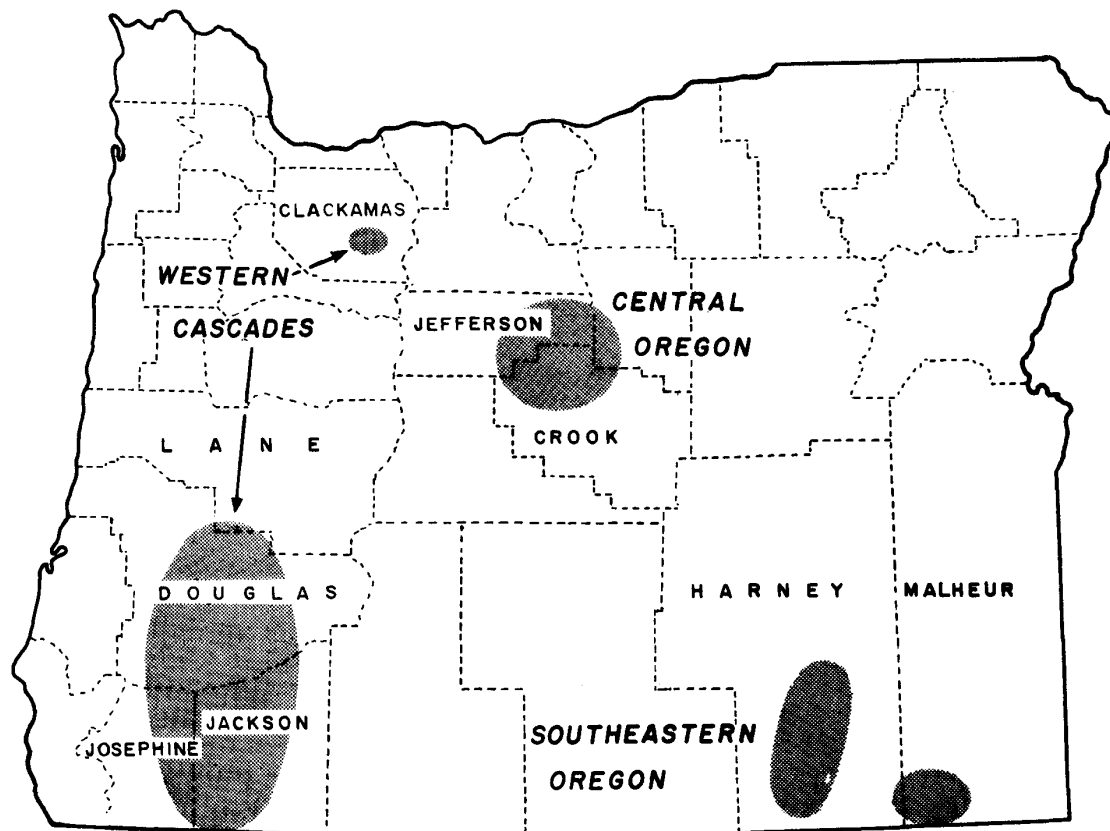
Quicksilver mineralization in Oregon occurred chiefly during the Tertiary period of the geologic time scale. It does not seem likely that the mineralization in all of the districts took place simultaneously; rather, mineralization was related to several periods of intrusion that occurred over many millions of years. Within limited portions of a district mineralization was somewhat contemporaneous as it resulted from a single intrusive episode.

Evidence obtained from study of quicksilver deposits (see bibliography) indicates that the deposits were formed at relatively shallow depths, from a few feet below the surface to about 4,000 feet. In some of the deposits downward percolating ground water may have been responsible for precipitation of the quicksilver contained in the rising mineralized hydrothermal solutions. It follows, then, that quicksilver deposits would be found in volcanic areas that have undergone relatively little erosion.

Ross (1942) has termed quicksilver a "lone wolf" among the metals as "No district that has been prominent in the quicksilver industry has had any large production of other metals and few are close to mining districts of other kinds." This holds true in Oregon, although some of the mines were located by prospectors following a gold "trace" in panning up a stream. Some gold has been found in the quicksilver mines of the Central Oregon district, but in no case has any quicksilver mine produced more than a very minor amount of metal other than quicksilver. The base metal mining area closest to any of the large quicksilver mines is the Bohemia mining district. It is approximately 15 miles east of the Black Butte quicksilver mine in Lane County.

If, as suggested above, quicksilver is deposited at shallow depths and is not associated with other metals, it may be inferred that the ascending mineralized hydrothermal solutions carrying the quicksilver are end-products resulting after any other metallic constituents have been precipitated. The solutions thus represent the last residues of a crystallizing magma beneath the area and are consequently of relatively low temperature and under low pressure. Transmission of the solutions from the magma surfaceward are necessarily through rather large pre-existing channelways (open faults, fissures and fractured zones) and precipitation is caused by any condition that halts the solutions or changes their pressure, temperature, or composition. At the Opalite mine in southeastern Oregon, Yates (1942) proposed transmission through open fault fissures and precipitation due to the downward movement of ground water. In the Horse Heaven area of central Oregon, Waters and others (1951) considered the control for transmission to be fractures in or near volcanic plugs and stated that "... individual ore shoots owe their position and richness to a complex combination of minor structural features." They stated that the most important factor for formation of a deposit was the presence of permeable rocks, which generally were the shattered portions of plugs and dikes and breccia zones along faults that cut the plugs or adjacent wall rocks. Locally rich ore was commonly found in breccias just beneath cappings of clay or other impermeable rock. In the Bonanza-Nonpareil area of the Western Cascades, Brown and Waters (1951) determined that the primary transmission of the ore solutions was upward along sheared zones. They stated that "Deposition of cinnabar was controlled to a large degree by the original

permeability of the beds (sandstones) and by the induced permeability brought about by shearing within certain well-defined zones." An additional controlling factor at the Bonanza mine was an impervious shale overlying the country rock of sandstone while at the Nonpareil, cross faults cutting the shear zones contributed to localizing the solutions. What role carbonaceous and bituminous substances play in the deposition of quicksilver is not clearly understood, but gilsonite and similar material are rather plentiful in the ores of the Central Oregon district and cinnabar in coal is found in the War Eagle mine of Jackson County in the Western Cascade district.



PRINCIPAL QUICKSILVER DISTRICTS

Principal Quicksilver Producers^{1/}

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

^{1/} Having total production in excess of 50 flasks. (Information from "Oregon Quicksilver Localities Map," 1945.)

As in most other quicksilver producing areas of the world, Oregon's principal ore of quicksilver is cinnabar, the monosulphide of the metal. It is easily identified because of its carmine red color and streak, its comparative high specific gravity (8.0 - 8.2) and its hardness (2 - 2.5). It will "hang back" in the pan but because it is soft and fairly brittle it usually will be found only as small fragments. In the "opalite" ore of southeastern Oregon the cinnabar blackens when exposed to sunlight and its characteristic red color is hidden. Freshly broken surfaces of the opalite ore will be red, however. It was this characteristic of the ore to blacken that probably delayed the discovery of the Opalite mine. In most deposits some native quicksilver and the black sulphide, metacinnabarite, are found but are not economically important.

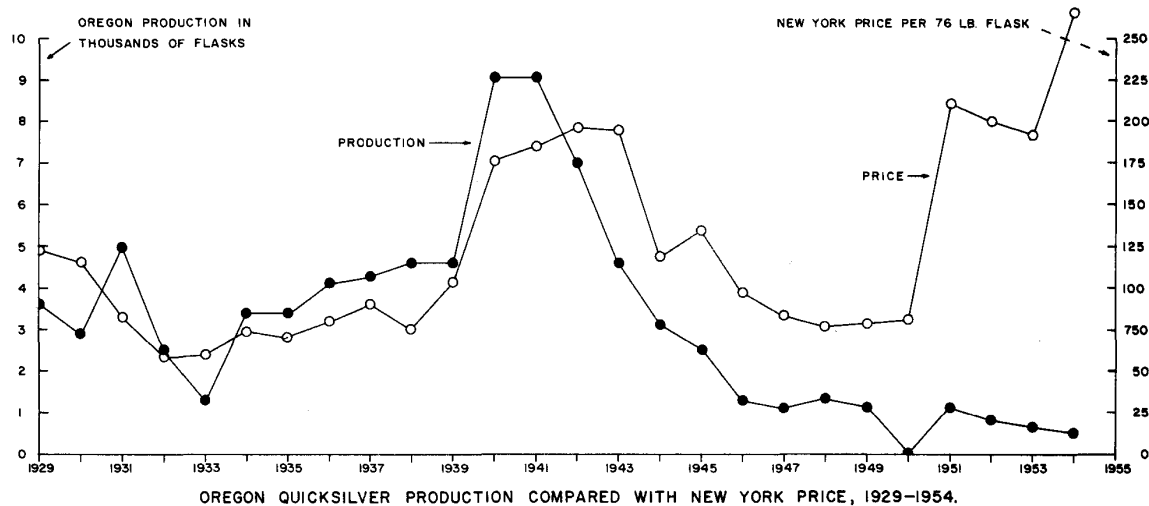
Prospecting guides

Certain generalizations can be made about the areas of the quicksilver deposits in Oregon that may be of help to those interested in prospecting. The broadest of these generalizations is that all deposits that have had any quantity of production are in or adjacent to areas of Tertiary volcanism. Generally, all sizeable deposits have been found within a fairly large (sometimes up to a mile in largest dimension) zone of alteration where the original appearance of the rocks has been almost entirely changed. Within the mineralized zones formed from the hydrothermal solutions, clay is the most common product of alteration. Carbonates (calcite, siderite, ankerite) and silica (quartz, chalcedony, opal) are frequently abundant and widespread. The sulphides of iron (pyrite and marcasite) may be plentiful and occasionally the red and orange sulphides of arsenic (realgar and orpiment) are found. Stibnite (antimony sulphide) is not uncommon and the hydrous sulphate of iron (melanterite) may be present.

In areas of "opalite" rocks, zones of silification, especially near faults, should be looked for carefully. The "opalite" rocks are dense, fine grained, brittle, and have a waxy lustre. These rocks may crop out as low knobs or they may be exposed in stream channels with lake beds or alluvium covering them. Within the silicified areas, zones of brecciation should be searched for. It must be remembered that in southeastern Oregon the cinnabar of such deposits is not bright red on the weathered surfaces so it is necessary to chip the outcrops when prospecting. Panning of unsilicified tuffs and lake beds that are contorted or have steep dips is also a good idea for the steep dips may reflect faulting at depth.

According to Waters and others (1951), all deposits of quicksilver ore thus far found in the Horse Heaven mine area of central Oregon lie within or adjacent to intrusive masses. Plugs of biotite rhyolite and augite andesite appear to be the most likely intrusions in which to prospect. Mineralizing solutions alter and soften the rocks making them more subject to weathering and erosion than the unaltered barren plugs. Therefore topographic lows or depressions should be investigated. Areas of fracturing in the plugs and permeable zones formed by faults in or adjacent to the plugs also offer good prospecting. Where plugs cut through red soil zones of early Tertiary age there is always the possibility that the impermeable clay soil has formed a trap for solutions carrying quicksilver.

In southwestern Oregon, Wells and Waters (1934) have noted that "In many places adjacent to the principal ore bodies the rocks over areas of more than a square mile have been bleached and softened. At most localities the altered rocks are intersected by numerous small, relatively hard silica-carbonate veinlets that stand out on the surface as prominent ribs and strengthen and support the mass. Owing to the fact that these veinlets commonly contain much siderite and in some places a little pyrite, oxidation at or near the surface has stained them a dark, rich brown, causing them to stand out conspicuously against the light-colored matrix. These brown resistant veinlets are known to the miners as 'iron ribs' and are perhaps the most reliable surface indication of an altered or mineralized zone. Because of their resistance to solution the ribs accumulate on the surface of the altered zone as a dark-brown rubble."



Retorts for prospects

At quicksilver prospects the retort is still being used as a reduction plant. Since the firing is indirect, more fuel per ton is needed than in a large scale furnace; and the small tonnage makes the labor cost per ton much higher than in furnace plants. Still, one or two men can cut their own fuel, tend their retort, mine their ore, and make a nice profit on sorted high-grade ore with only a small capital expenditure for plant.

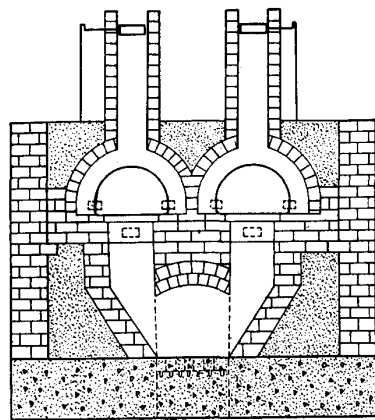
Retorts are generally round or D-shaped castings (see opposite page). Round pipes are usually about 1 foot in inside diameter and 6 to 7 feet long while D-retorts are 15 inches by 24 inches and 10 or 12 feet long. D-retorts are used singly or in sets of 2 and 3 with a common fire box. Pipe retorts are set up in benches of from 2 to 12 pipes.

Two things are important in setting up retorts. First, the bottom of the retort pipe must be protected from direct contact with the flames by one thickness of firebrick or tile. If this is not done the pipes burn out rapidly. Second, the condenser pipe which is fitted to the retort with cement must not be bricked in tight where it passes through the outer wall of the retort setting. The retort expands on being heated and if the condenser pipe is bricked in solidly the joint between them breaks and the quicksilver vapors leak out. Retorts should always be tested for tightness before being used by attaching a manometer to the plugged end of the condenser pipe or by covering this end with thin (toy balloon) rubber and then heating the closed retort to see if pressure is developed from the expanding air in it. If no pressure develops the retort leaks, and the leak must be found and repaired before being used.

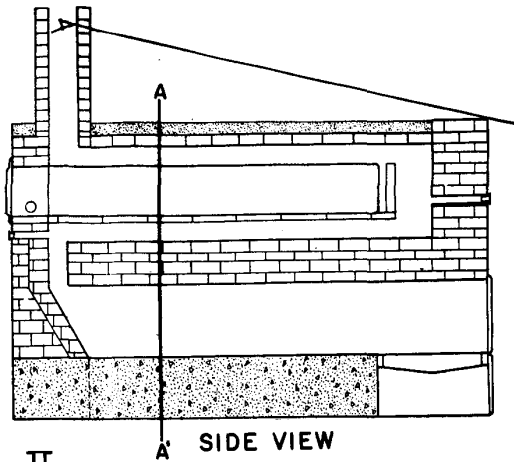
Lime should be used with the ore charged to the retort to prevent the iron of the retort from being attacked by the sulfur vapor.

Since the charging and discharging of a retort is accompanied by some danger to the operator of being poisoned by hot quicksilver vapors, the retort should be set up in such a position that the prevailing wind blows quarteringly across the front of it. Also, the ore should be charged in black iron pans so that charging and discharging can be done rapidly. An extra cover should be at hand already mudded and ready to be slapped on when the retort is opened for discharging and charging again.

Safety measures at retorts: Quicksilver poisoning is always a hazard when retorting and every precaution should be taken to guard against it. If a few rules for personal cleanliness are observed and if care is taken when charging and discharging the retort, the chances for poisoning will be practically eliminated. Washing up before meals, brushing of teeth before eating on the job, using an astringent mouthwash, and being careful not to roll cigarettes or

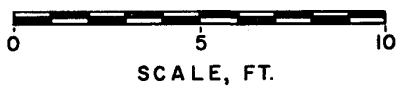


END VIEW

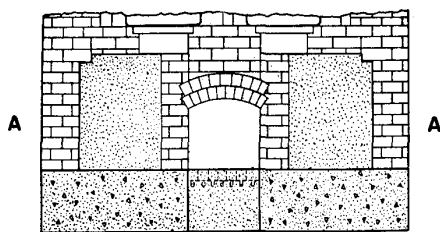


SIDE VIEW

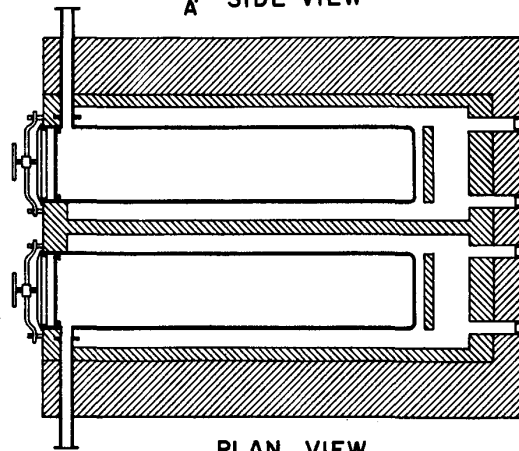
TYPICAL D RETORTS



SCALE, FT.

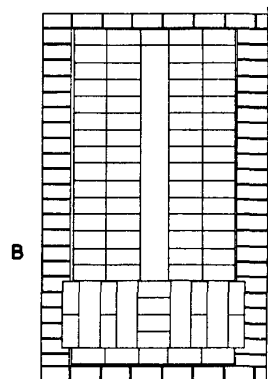
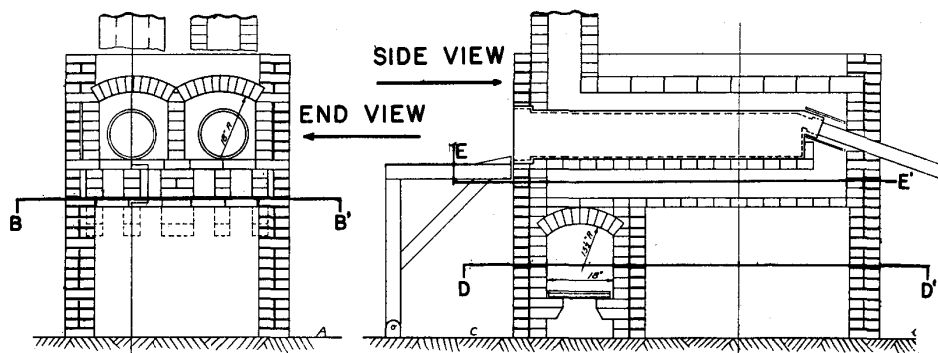


SECTION THRU A-A'



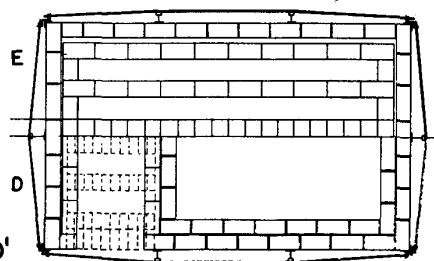
PLAN VIEW

TYPICAL PIPE RETORTS



SECTION THRU B-B'

SECTION THRU E-E'



SECTION THRU D-D'

stuff pipes with fingers that are dirty with ore, soot, or metallic quicksilver, are some of the common sense habits that should be developed. Periodic medical examinations are always a good health inventory, no matter what the occupation.

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

* Out of print. May be consulted at Department library and public libraries.

** Free on application to Publications Distribution Section, U.S. Bureau of Mines, 4800 Forbes Street, Pittsburgh 13, Pennsylvania.

NEW DRILLING PERMIT ISSUED

Drilling permit no. 7 was issued February 21, 1955, to Oroco Oil and Gas Company, Ontario, Oregon. The application to drill stated that the test will be known as Bolles No. 1. The drilling site was given as the NW $\frac{1}{4}$ sec. 15, T. 17 S., R. 47 E., Malheur County. Mr. H. K. Riddle is the President of Oroco Oil and Gas Company.

AUSTIN DUNN REAPPOINTED

Austin Dunn has been reappointed by Governor Paul L. Patterson as a member of the Governing Board of the State Department of Geology and Mineral Industries. The appointment has been confirmed by the State Senate. Mr. Dunn was originally appointed to this position in August 1, 1953, at which time he replaced Mr. H. E. Hendryx who resigned because of ill health. Mr. Dunn is an attorney in Baker and a former State Senator.

RADIOASSAYER INSTALLED AT BAKER OFFICE

A duplicate of the radioassayer which was installed by the Atomic Energy Commission in the Portland office of the Department has been placed on loan by the Commission in the Baker field office. The radioassayer is a type of geiger counter designed to be used in a laboratory and to handle crushed samples. The instrument does not record the amount of uranium in the sample; only a chemical analysis will do this. It does, however, measure the amount of radioactivity. This is registered on a dial in percent of U₃O₈ equivalent (the amount of uranium that would be present if no other radioactive materials were there and if the uranium were in equilibrium with its disintegration products). The instrument is calibrated to measure U₃O₈ equivalent in three ranges as follows: less than 0.05 percent; 0.05 to 0.10 percent; and 0.10 to 0.15 percent.

Radioassayers have been supplied by the Atomic Energy Commission to a number of assay offices and mills throughout the United States as a routine check on all incoming ores. The Department has been using one of these instruments in its Portland office for the past year.

NEW CHROME DEPOSIT

Bill J. Evitt, Jay C. Evitt, John F. Evitt, and P. G. Symens, owners of the Nickel Ridge Group claims on Rough and Ready Mountain, Josephine County, have started shipment of high-grade chromite from a small deposit on their Nickel Ridge No. 1 claim in sec. 31, T. 40 S., R. 9 W. The ore assays about 52 percent Cr₂O₃ with 2.4 to 1 chrome-iron ratio.

A minor amount of quartz boxwork and nickel laterite on the surface and some garnierite along fractures in the peridotite have been found in that area.

OREGON DRYING UP?

In its Water Resources Review for February 1955, the U.S. Geological Survey reports that deficient runoff, which has been characteristic of the Southwest for several years, has now spread northward into Oregon. Flow of the Columbia River near The Dalles, Oregon, was only 84 percent of normal for February. Streamflow for the John Day River was the lowest in February since 1937, and on the Grande Ronde River near La Grande it was the lowest for February in 45 years. Water stored in major reservoirs increased seasonally but remained well below normal, the Survey reports. Water levels in all key wells declined and a record-low level for February was measured in the key well near Burns.

STATE MAPPING REQUESTED

A request to have 9000 square miles of the State mapped topographically has been submitted to the U.S. Geological Survey by the State Mapping Advisory Committee. The principal area covered by the request extends from the California line north to Crater Lake and from the vicinity of Klamath Falls to Hart Mountain, east of Lakeview. At present no topographic maps are available for this region.

The U.S. Geological Survey has been mapping the United States since 1882, but only 30 percent of Oregon has been mapped and progress is slow. It has been estimated that at the current rate it would take until the year 2008 to map the State completely.

In addition to relief of the surface by contour lines, topographic maps show roads, railroads, streams, section and township lines, cities, towns, and even individual buildings in rural areas. Maps of the type requested by the committee are published with a scale of one inch equals one mile on sheets measuring approximately 16 by 20 inches. Such maps are essential for nearly all types of engineering planning, geological mapping, forest and range management, soil conservation, highway planning, and taxation assessment purposes. Tourists and recreationalists are using topographic maps in steadily increasing numbers.

PROGRESS OF MINING INDUSTRY BILLS IN LEGISLATURE

House Bill No. 158, designed to prevent silting of streams and defining such silting as pollution, was taken off the table for public hearings before the House Committee on Forestry and Mining on March 16 and 17. House Bill No. 159, which would require restoration of the surface after surface mining operations, was also taken off the table at the March 17 hearing. Testimony by proponents of the bills was given at both hearings and by opponents at the March 17 hearing. Amendments to both bills were proposed by those favoring the measures which would seem to confine their application to mining of precious metals. No definite action on these bills has been reported (March 23) as a result of these hearings.

A hearing on House Bill No. 295, which would impose a severance tax on all mineral products including oil and gas, was held before the House Taxation Committee in Salem on March 8. Opponents of the measure presented testimony. No action by the Committee has been reported (March 23).

Senate Bill No. 151 would repeal the Rogue River Coordination Board law in toto. It passed the State Senate on February 3 and is now (March 23) in the House Committee on Judiciary. (Probably tabled in House Committee)

OREGON PORTLAND CEMENT COMPANY MAY ENLARGE FACILITIES

According to a news item in the Baker Record Courier of March 17, the directors of the Oregon Portland Cement Company have authorized study of a plan to add a kiln at its Lime, Oregon, plant in the event the proposed Snake River hydro-electric development is authorized. The news story indicated that such an addition would approximately double the capacity of the plant. The 1954 payroll at Lime and Oswego, where OPC also has a cement plant, was reported to be \$1,642,346.

NOTICE TO SUBSCRIBERS OF THE ORE.-BIN

A number of complaints have been received by the Department from subscribers who have not been receiving the Ore.-Bin. The reason, in most instances, is that these people have moved and have not notified us of their change of address. The Ore.-Bin is sent by second-class mail which cannot be forwarded by the post office. Therefore, if you move, be sure to send us your new address so that you will not miss any issues.
