

STATE OF OREGON  
DEPARTMENT OF GEOLOGY & MINERAL INDUSTRIES  
329 S.W. OAK ST.  
PORTLAND, OREGON

# THE ORE.-BIN

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This is the first issue (vol. 1, no. 1, January 1939) of THE ORE.-BIN. It will be released the early part of each month, and takes the place of the PRESS BULLETIN which has been released by this Department in the past.

The State Department of Geology and Mineral Industries will use THE ORE.-BIN to advise the public of the work of the Department, and of new and interesting developments in mining, metallurgy, and geology. This policy is similar to that employed with the PRESS BULLETIN.

Newspapers are encouraged to use any of the material contained in THE ORE.-BIN. It is designed primarily for such use. A credit-line of acknowledgement is requested.

Your comments and criticisms will be appreciated. It is our desire to make THE ORE. BIN an effective medium for "telling the world" about Oregon, its mineral resources and mining possibilities.

Earl K. Nixon,  
Director.

## OREGON MINERAL PRODUCTION

The State Department of Geology and Mineral Industries, Earl K. Nixon, director, has completed a statistical survey of Oregon non-metallic mineral production for the year 1937; and the following table shows the value of the different materials produced. The value of the non-metallic production is added to the value of the metallic production, as reported by the U. S. Bureau of Mines Mineral Yearbook, in order to get the total 1937 production. This total represents a 6.7 percent increase over the 1936 production.

An estimate of the 1938 production is also given, and this latter total is a 16.7 percent increase over the 1937 production.

## OREGON MINERAL PRODUCTION FOR 1937.

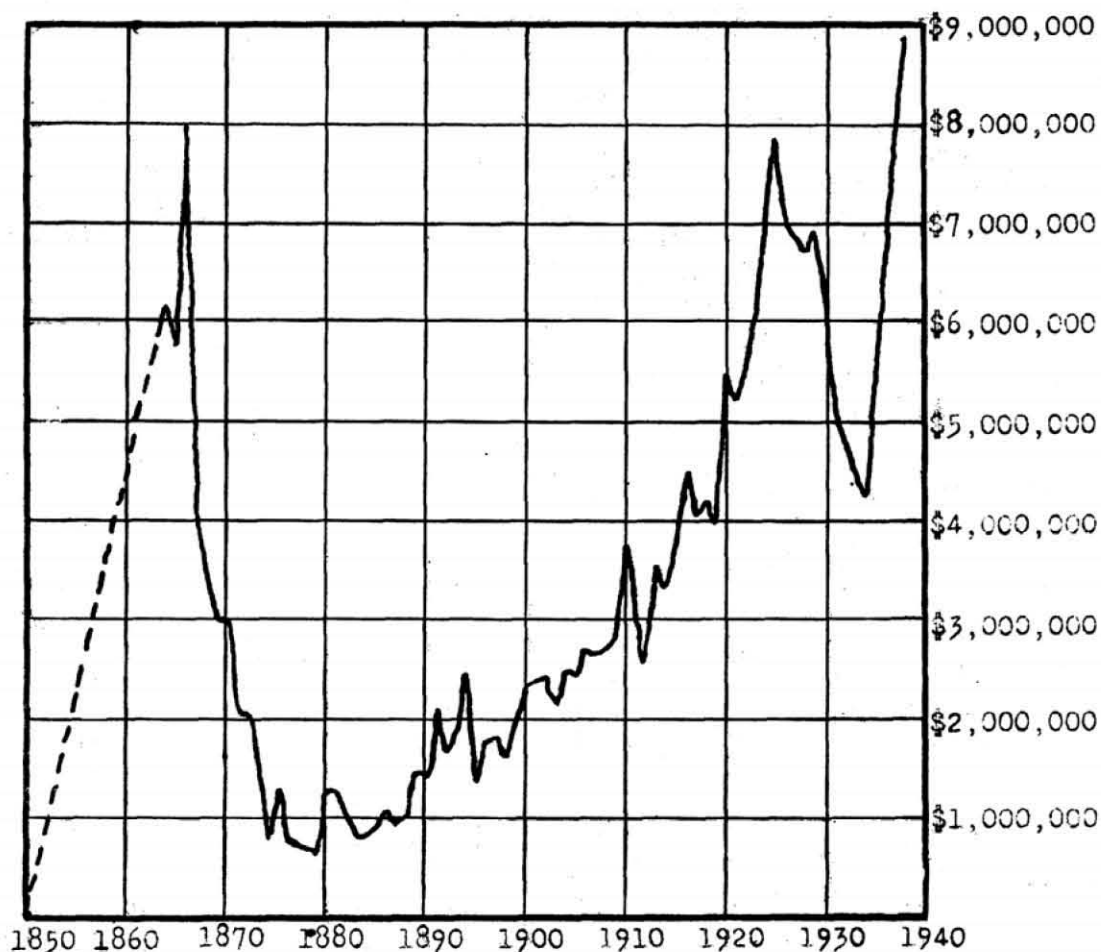
Sand, gravel and crushed rock	\$3,715,069.	
Dimensional stone	36,279.	
Limestone for various uses (except cement)	58,577.	
Coal	34,156.	
	<u>\$3,844,081.</u>	
Miscellaneous (inc. cement, clay products, abrasives, mineral water)	1,390,695.	
	<u>\$5,234,776.</u>	
Metals	2,392,133.	(from Minerals Yearbook)
TOTAL	<u>\$7,626,909.</u>	

## ESTIMATE OF OREGON MINERAL PRODUCTION FOR 1938.

Gold	\$2,900,000.
Silver	82,000.
Quicksilver	400,000.
Platinum	3,000.
Copper )	
Lead )	15,000.
Zinc )	
	<u>\$3,400,000.</u>
Non-metals	5,500,000.
TOTAL	<u>\$8,900,000.</u>

The accompanying graphs show the yearly recorded production of mineral products in the state since 1850. The records of production in the early years of the state's mining history are far from complete, as it was not until 1866 that a Government agency undertook the task of obtaining mine production statistics in the western states. For example, estimates of Oregon's gold production in 1866 varied all the way from two million dollars to twenty million dollars.

# VALUE OF OREGON MINERAL PRODUCTION TO AND INCLUDING 1938



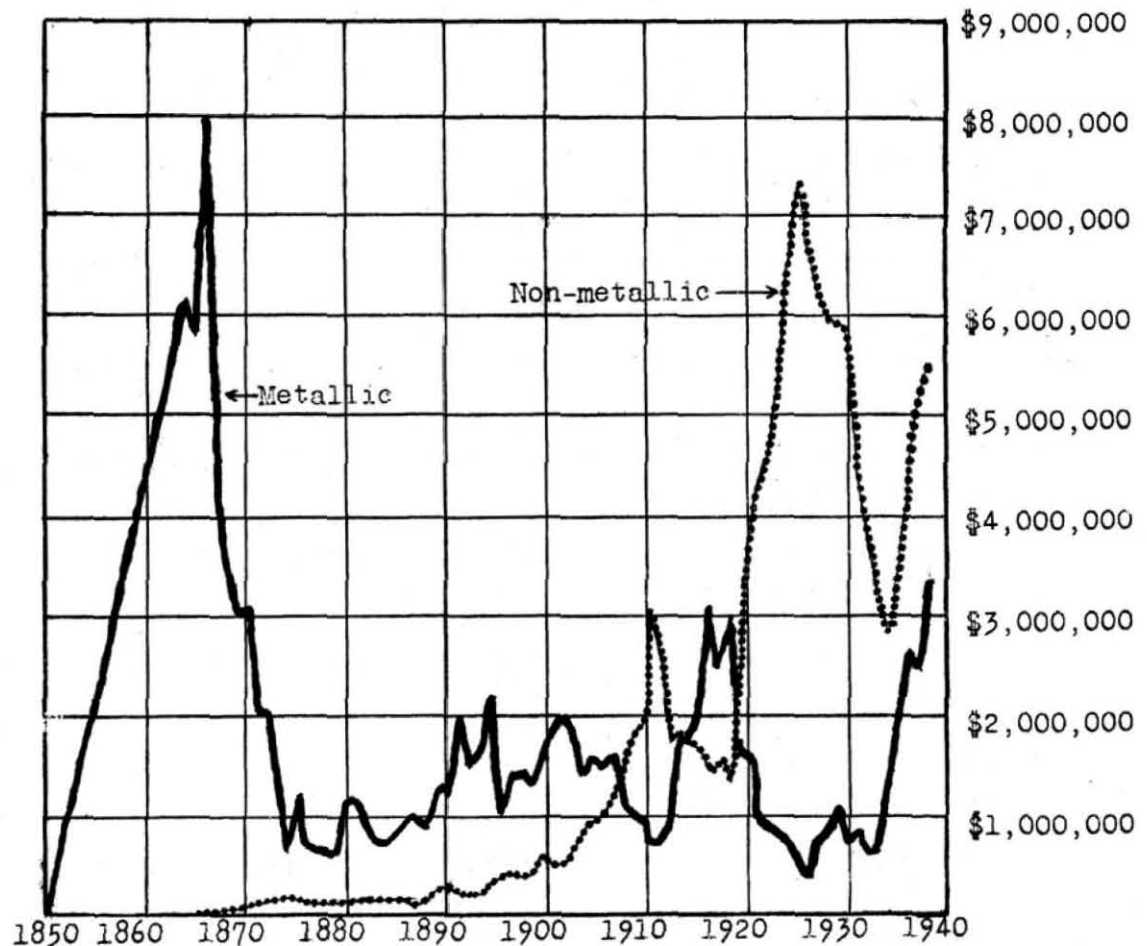
Total value of Production of Metals	\$132,000,000
Total value of Production of Non-Metals	<u>118,000,000</u>
Total of all Oregon Mineral Products	\$250,000,000

The peak of production at 1865-1866 was due to the high output of gold from hydraulic mining in South-western Oregon.

The peak around 1925 was due mainly to increased output of non-metallics.

Since 1933 the increase is due equally to non-metallic and to quicksilver and gold productions, - the latter being encouraged by a higher price for the metal.

VALUE OF OREGON METALLIC AND NON-METALLIC MINERAL PRODUCTION  
to and including 1938.



The value of metallic production is estimated at \$2,392,133 for 1937; \$3,400,000 for 1938.

Value of the non-metallic production is estimated at \$5,234,776 for 1937; \$5,500,000 for 1938.

The percentage of increase for all mineral production in Oregon from 1937 to 1938 is 16  $\frac{2}{3}$ %.

No complete record of Oregon's iron ore production, which began in 1867 and continued until near the end of the century, is available.

Concerning non-metallics, a material amount was produced chiefly in clay products for several years before any production records were kept.

It is worthy of note that the production curve shows rather a sharp rise beginning in 1934, indicating that by 1940 the total production will exceed the ten million dollar mark. This is in line with the Department's calculations based on its understanding of mining conditions.

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#### FISSURE ERUPTIONS NEAR BEND

The area south and southeast of Bend, Oregon, covered by the Newberry Crater topographic quadrangle, has had a geologic history and produced features that rival the famous Idaho "Craters of the Moon". Erupting volcanoes spewed forth lava flows so fresh that it is difficult to believe it happened hundreds of years ago instead of yesterday. These flows engulfed whole forests and the resultant lava tree casts and molds are worth going miles to see.

Nichols and Stearns\* recently reported on a fissure 20 miles long, that extends from a point north of Lava Butte in a southeast direction to Devil's Horn, four miles south of East Lake. Four distinct lava flows issued from this fracture and ran into dense forests. Part of this area has been set aside by the U. S. Forest Service as the Lava Cast Forest, and thus preserved for future generations. Many of the trees were engulfed while standing, and one may see the cast or mold of the lower portion of the tree trunk as a hollow cylinder surrounded by a broken mass of rough lava. Other trees were knocked down and rafted so close together that the molds remind one of a log jam in a river.

Newberry Craters were reported by Howell Williams\*\* a short time ago. The ancient mountain rivaled Mt. Mazama, the former Crater Lake mountain, in size and like it, disappeared by having its top engulfed by the hot, molten lava of the crater. Today, the crater is five miles in diameter, and is featured by beautiful Paulina and East Lakes. The surface elevation of the latter is 40 feet higher than that of Paulina Lake and there is no surface connection between the two.

Here may be found natural attractions, within an easy day's drive of any part of Oregon, that rival the greatly advertised Parks of the West. Our Oregon is truly a wonderful State in which to live.

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\* Nichols, Richard L., and Stearns, Charles E., "Fissure Eruptions Near Bend, Oregon": Geol. Soc. Am., Bull. no. 49, no. 12, pt. 2, p. 1894, Dec. 1938.

\*\*Williams, Howell, "Newberry Volcano of Central Oregon": Geol. Soc. of Am., Bull., vol. 46, pp. 253-304, February 1935.

## ROCKS THAT FLOAT

### A NEW METALLURGICAL PROCESS

The expression, "-- a country where the rocks float and the logs sink", is often used to describe a region that contains pumice. Pumice will float if placed on water, while some kinds of logs sink. Pumice is a rock, and, if it had had cooled under different conditions, might have become granite. It is so filled with air pockets that it is actually lighter in weight than an equivalent volume of water; therefore this rock floats.

If a steel ball-bearing is placed in a liquid, will it sink or float? That depends upon the liquid. If the liquid is water, the ball-bearing will sink; if mercury, the ball-bearing will float.

For example, a cubic foot of ice weighs 56.16 pounds or 0.9 as much as a cubic foot of water, which weighs  $62\frac{1}{2}$  pounds. Therefore, the ice will float in water, with 0.9 submerged and 0.1 above water. Ice will remain stationary wherever placed in the water.

As the ice weighs 0.9 as much as an equal volume of water, it is said to have a specific gravity of 0.9 because pure water is taken as a standard with a specific gravity of 1.0. Quartz weighs 2.65 times as much as an equal volume of water so it has a specific gravity of 2.65. Iron has a specific gravity of 7.5, the same as lead ore (galena); mercury has a specific gravity of 13.6, all referred to water as a standard. However, it will be noticed that iron is lighter than mercury and will therefore float on mercury.

This phenomenon is the basis for one of the oldest methods of separating minerals. Suppose that we have a lead ore in a gangue (waste rock) of quartz. The lead ore weighs 7.5 times as much as an equal volume of water, and the quartz weighs 2.65 times as much as an equal volume of water. If this crushed ore were dumped into a liquid that weighed three times as much as an equal volume of water, the lead ore would sink and the quartz would float. The gangue could then be drawn from the surface of the liquid, and the separation of ore from gangue would be accomplished.

It would seem, therefore, that mineral separation could be accomplished with ease by merely obtaining liquid that is lighter than one constituent of a crushed rock, and heavier than another portion. Early experimenters with this method ran into so many difficulties that commercial applications were abandoned. Recently, the idea of "Sink-and-Float" has received new impetus as a result of studies by the du Pont chemical laboratories. The difficulties have been surmounted and the process has proved its worth by actual use under commercial conditions. "Sink-and-Float" has, of course, been used for many years for strictly test purposes on coal.

### Sink-and-Float

#### A New Metallurgical Process

E. I. du Pont de Nemours & Company, of Wilmington, Delaware, announce the perfection of their SINK-AND-FLOAT process for separation and beneficiation of



minerals and coal. A copy of the report has been received from F. M. MEigs of the Minerals Separation Division of the du Pont Company. The report contains an account of the first successful installation of a plant of this kind for the treatment of anthracite coal on a commercial basis.

The Director of the Oregon Department of Geology and Mineral Industries is particularly interested in this new development because in 1932 he worked on a coal research problem in the anthracite field. He was associated with R. S. Walker, Charles Lotz and Ed Worthington, who at the same time were trying to devise a method of applying "sink and float" to the commercial treatment of anthracite coal.

These same technicians worked in collaboration with the Delaware Chemical Engineering Company (laboratories of Francis and Alfred I. du Pont) and built the first commercial sink-and-float plant. The plant was mechanically sound and made a premium quality product, but was discontinued because there were excessive losses of the "heavy liquid", and the escaping vapors were hazardous to workmen.

The du Pont technicians continued the experiments and made discoveries that overcame the former difficulties. The present plant treats 100 tons of anthracite coal per hour and is about the size of an eight-room house. It does the work of an anthracite breaker 25 times larger than the "sink and float" plant.

Fundamentally, the process is quite simple. Coarsely crushed coal is fed onto a "table" where it is washed with water and an active agent, then drained, and dumped into a tank containing heavy, "parting liquid", covered by a layer of water. The coal floats on top of the heavy "parting liquid" (at the bottom of the water layer) and the bone, slate, and rock sink to the bottom of the tank. Each product - coal and waste - is removed by conveyors and washed to recover the valuable "parting liquid". The coal is now ready for shipment and the waste goes to the dump.

It is obvious that the heavy "parting liquid" must be immiscible (won't mix) with water, or it could not be recovered from the washing process. A vapor seal is maintained at all points to prevent the escape of vapors from the "parting liquid", as these vapors are poisonous.

#### Metallurgical Possibilities of the Process

The liquids used by the Du Pont technicians are halogenated hydrocarbons - tetrabromethane, pentachlorethane, and trichlorethylene. The specific gravity of these ranges from 1.4 to 2.9. Common minerals such as asbestos, gypsum, quartz, feldspar, calcite, mica, etc., have specific gravities less than 3, and therefore will float on certain of these heavy liquids. The heavier minerals, such as native metals, metallic sulfides, and most metallic oxides, have specific gravities greater than 3 and therefore will sink. It would seem then, that here is a panacea for minerals separation problems, but this is not the case.

As a matter of fact there are certain limitations to the process. It is applicable to coal and to some other minerals which can be freed from their undesirable constituents by crushing. So far, it appears that finely divided material cannot be treated successfully with the "sink and float" process because there



are excessive losses of the "parting liquid". The material should be sized to plus 8-mesh Tyler standard screen scale, or plus one-quarter inch mesh.

One possible application of the "Sink-or-Float" process is in the treatment of coarser sizes of metallic ores. The primary crushed ore (plus one-quarter inch mesh) would be treated to eliminate gangue, in order to save the amount of feed to be finely ground for flotation. Another application might be in replacing the picking belt in certain operations. Careful experimental work will be necessary before any successful application to particular ores can be made.

The specific gravity of the parting liquid remains constant during the operation, and it is possible to make very sharp separation. It is said that quartz (specific gravity 2.65) can be separated successfully from calcite (specific gravity 2.71) by this "Sink-and-Float" process. What may be done eventually with this newly perfected process, is an interesting speculation.

Three cost estimates are given in the du Pont report:

Concentration of manganese ore (pyrolusite) - 300 tons per 24 hours - feed minus 1", plus 1/8 inch, estimated cost, \$1.05 per ton of concentrate when working 300 days per year.

Concentration of silver-bearing lead ore - quartz gangue - 2,500 tons per 24 hours - 90 percent recovery of lead with 8:1 concentration ratio. Cost estimate, 30¢ per ton of mill feed when operating 300 days per year.

Concentration of iron ore - siliceous gangue - 14,100 tons mill feed per 24 hours - sink and float production per 24 hours, 6,000 tons - ground to minus 3/4 inch, plus 3/16 inch mesh. Estimate cost, 24.2¢ per ton of feed when working 300 days per year.

The above costs include power, water, steam, all labor, supervision, maintenance, reagents, incidentals, and plant depreciation at 10 percent per year.