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ACTIVE MINES AND MILLS IN OREGON IN 1960

The following list of active mines, mills, and metallurgical plants in Oregon presents a concise view of the industry for 1960. As compared to the 1958 listing (The Ore.-Bin, August, 1958), the picture has changed in some respects due to the ever increasing demand for industrial minerals and processed materials. The mines and mills (see next page) are arranged alphabetically by name under each commodity, with the name and address of owner or manager in the left-hand column and the location of the operation in the right-hand column.

Oregon building stone quarries have increased in number in the past year in response to a persistent demand from out-of-state customers. At the present time 18 quarries are producing, and by the end of the year at least three more will have been opened. Originally all of the quarries were individually owned and operated, but now some of them are being consolidated under a single management, and many of the others are selling their stone to wholesalers rather than directly to the customer.

There has been little change in the lightweight aggregate field in the state for several years. Two companies produce expanded shale, and five others quarry pumice, scoria, and cinders. Large quantities of volcanic cinders are quarried by state, county, and federal agencies for road metal, but their operations have not been included as mining companies. One diatomite quarry continues steady production.

No sand and gravel operations are included in this list despite the fact that this commodity accounts for a large percentage of the state's total mineral production.

The number of limestone producers has remained almost static for many years in spite of steadily increasing production. Most of the state's limestone is mined by cement companies for their own use. The remainder is quarried for agricultural, metallurgical, and chemical use.

One new silica producer appears on this year's list, the first addition to this commodity in more than 20 years. Other additions to the list of miscellaneous nonmetallics include salines, crushed marble for roofing granules, and coal for possible use in a proposed steam hydroelectric power plant.

In the metals field, gold-mining activity has increased over the past few years, but total production is still very limited as compared to former times. With the exception of one eastern Oregon property, operations at lode mines consist chiefly of intermittent development work. Individual initiative still persists among the placer miners who operate seasonally along the creeks and high bars, which have been yielding gold continuously for over a century. Oregon, like many of the western mining states, would see a resurgence of mining activity if gold were recognized again as a necessary metal.

Mercury mines continue a test of survival against ing costs and a wavering price structure. During the past year several small prospects were explored and several small furnaces were installed. Mining and development work continue in uranium, copper, molybdenum, and nickel.

Metallurgical plants in Oregon are producing a wide variety of products. Raw materials are obtained from local deposits and from points located half way around the earth, and the products may in turn be used locally or flung out into orbit in a space vehicle.

LIST OF ACTIVE MINES AND MILLS IN OREGON IN 1960

NONMETALLICS

Building Stone

Banasco Quarry Joseph Banasco Plush, Oregon	Lake County Sec. 8 T. 37 S., R. 24 E.
A. O. Bartell (Scoria) Portland, Oregon	Lake County Quartz Mt. District
Carver Quarry A. Faoro & Sons Portland, Oregon	Clackamas County Sec. 18 T. 2 S., R. 3 E.
Cinder Hill Quarry (Cinders and scoria) Leroy E. Grote Prineville, Oregon	Deschutes County Sec. 33 T. 14 S., R. 13 E.
Hawaiian Travertine Quarry (Rhyolite) Melvin Parker Grants Pass, Oregon	Wasco County Sec. 20 T. 8 S., R. 13 E.
Moon Mesa Stone Quarry (Rhyolite) Anthony Brandenthaler Baker, Oregon	Baker County T. 11 S., R. 40 E.
Natural Stone Company (Sandstone) Mary Johnson Portland, Oregon	Malheur County T. 32 S., R. 41 E.
Northwestern Granite Co. (Monument stone) S. E. and Stanley Ingram Haines, Oregon	Baker County Sec. 27 T. 7 S., R. 39 E.
Ochoco Stone Quarry (Platy Lava) William Durfee Redmond, Oregon	Deschutes County Sec. 14 T. 15 S., R. 12 E.
Oregon Emerald Quarry (Tuff) Operator Oregon Quarries, Inc.	Crook County T. 14 S., R. 16 E.
Oregon Quarries, Inc. (Tuff) N. D. Kile The Dalles, Oregon	Operating following quarries (which see) Oregon Emerald Pacific States Cut Stn Rainbow Rock
Oregon Tuff Stone Co. Fred Franklin Sublimity, Oregon	Marion County Sec. 29 T. 8 S., R. 1 E.
Pacific States Cut Stone Co. (Tuff) Operator Oregon Quarries, Inc.	Jefferson County Sec. 9 T. 9 S., R. 15 E.
Rainbow Rock Quarry (Tuff) Operator Oregon Quarries, Inc.	Wasco County Sec. 11 T. 6 S., R. 11 E.
Red Rock Mine (Scoria) Roberts & Hurrle Portland, Oregon	Deschutes County Sec. 29 T. 14 S., R. 13 E.
Rocky Butte Quarry (Basalt) Joe Marston Portland, Oregon	Multnomah County Quarry at Rocky Butte
Sahara Tan Quarry (Tuff) William Durfee Redmond, Oregon	Deschutes County Sec. 21 T. 14 S., R. 13 E.
Snow Bird Quarry (Tuff) Duane Coble Roseburg, Oregon	Douglas County Sec. 24 T. 27 S., R. 1 E.
Stayton Flatrock Quarry Oliver Juel & Son Stayton, Oregon	Marion County Sec. 10 T. 9 S., R. 1 W.

Lightweight Aggregate

Cascade Pumice Corp. Ralph H. Young Bend, Oregon	Deschutes County Sec. 5, T. 18 S., R. 12 E., & Sec. 36, T. 16 S., R. 11 E.
Central Oregon Pumice Co. W. E. Miller Bend, Oregon	Deschutes County Sec. 7, T. 17 S., R. 12 E., & Sec. 7 T. 18 S., R. 12 E.
Cinder Hill Quarry (Cinders & Scoria) Leroy E. Grote Prineville, Oregon	Deschutes County Sec. 33 T. 14 S., R. 13 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.
Great Lakes Carbon Corp. (Diatomite) Dicalite Dept. Lower Bridge, Oregon	Deschutes County Sec. 16 T. 14 S., R. 12 E.
Harney Concrete Tile Co. (Pumice) Don Robbins Burns, Oregon	Harney County Sec. 3 T. 24 S., R. 30 E.
Northwest Aggregates, Inc. (Expanded shale) Portland, Oregon	Washington County Sec. 24 T. 3 N., R. 5 W.
Red Rock Mine (Cinders) Roberts & Hurrle Portland, Oregon	Deschutes County Sec. 29 T. 14 S., R. 13 E.
Smithwick Concrete Products Co. (Expanded shale) Portland, Oregon	Washington County Sec. 8 T. 3 N., R. 4 W.

Limestone

Chemical Lime Co. (Burnt lime) Baker, Oregon	Baker County Plant at Wingville
Dewitt's Polk County Lime Co. Dallas, Oregon	Polk County S. W. of Dallas
Ideal Cement Co. Gold Hill, Oregon (Quarry at Marble Mt.)	Josephine County Sec. 30 T. 37 S., R. 6 W.
Greely Lime Co. Portland, Oregon (Quarry near Enterprise)	Wallowa County Sec. 19 T. 2 S., R. 44 E.
Oregon Portland Cement Co. Portland, Oregon (Quarries at Lime, Nelson & Dallas; plants at Lime and Oswego)	Baker & 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
Big Quartz Mine (Silica) G. D. Rannells Aurora, Oregon	Douglas County Sec. 2 T. 28 S., R. 1 E.
Bristol Silica Company (Quartz) F. I. Bristol Rogue River, Oregon	Jackson County Sec. 30 T. 36 S., R. 3 W.
Eden Ridge Coal Pacific Power & Light Co. Portland, Oregon	Coos County T. 32 S., R. 11 W.
Gas-Ice Corporation (Dry ice) Portland, Oregon	Jackson County Sec. 7 T. 39 S., R. 2 E.
Leverett Marble (Granules) R. D. Johansen Grants Pass, Oregon	Josephine County Sec. 15 T. 38 S., R. 5 W.
Wilhoit Coal Mine T. G. Mandrones Portland, Oregon	Clackamas County Sec. 15 T. 6 S., R. 2 E.

METALS

Gold Lode Mines

Ashland Mine Van Curler Bros. Ashland, Oregon	Jackson County Sec. 7 T. 39 S., R. 1 E.
Buffalo Mine J. P. Jackson, Jr. Granite, Oregon	Grant County Sec. 14 T. 8 S., R. 35½ E.
Cobalt Gold Mine Cobalt Gold Mines, Inc. H. F. Stevens Boise, Idaho	Grant County Sec. 11 T. 12 S., R. 33 E.
Columbia North Pole Lode T. D. French & Assoc. Bourne, Oregon	Baker County Sec. 32, 33 T. 8 S., R. 37 E.
Ducharme No. 6 Willard Ducharme & O. P. Beekman Grants Pass, Oregon	Jackson County Sec. 13 T. 36 S., R. 4 W.
Greenback Mine Wes Pieren Grants Pass, Oregon	Josephine County Sec. 32 T. 33 S., R. 5 W.
Humdinger Mine Earle Young & Walter Lonnon Grants Pass, Oregon	Josephine County Secs. 21, 16 T. 38 S., R. 5 W.
M. C. Claim McTimmonds & Adams Grants Pass, Oregon	Curry County Sec. 1 T. 39 S., R. 10 W.
Oro Grande Les Hudson & Frank Kolkow Grants Pass, Oregon	Josephine County Sec. 28 T. 33 S., R. 5 W.
Reno Mine Quinton Stone Grants Pass, Oregon	Josephine County Sec. 34 T. 33 S., R. 8 W.
Snow Bird (Tip Top) George Slade Williams, Oregon	Josephine County Sec. 20 T. 38 S., R. 5 W.
Warner Mine Frank Gelhaus Rogue River, Oregon	Jackson County Sec. 4 T. 33 S., R. 4 W.

Gold Placers

Anderson Placer Tom Yarem Sunny Valley, Oregon	Jackson County Sec. 15 T. 33 S., R. 4 W.
Baker Flat Placer John E. White Grants Pass, Oregon	Jackson County Sec. 32 T. 33 S., R. 4 W.
Buddy Placer Jack Lewis Central Point, Oregon	Jackson County Sec. 15 T. 33 S., R. 4 W.
Bear Placer George Foster Kerby, Oregon	Josephine County Sec. 36 T. 38 S., R. 9 W.
Brown Placer Al Brown Holland, Oregon	Josephine County Sec. 28 T. 40 S., R. 7 W.
California Bar Thomas Bros. Cave Junction, Oregon	Josephine County Sec. 1 T. 40 S., R. 7 W.
Can Can Placer Victor Nordgreen Jacksonville, Oregon	Jackson County Sec. 25 T. 39 S., R. 2 W.
Coarse Gold Creek H. Thurber Roseburg, Oregon	Douglas County Sec. 20 T. 29 S., R. 7 W.
Crump Placer W. D. Crump Baker, Oregon	Baker County Sec. 23 T. 11 S., R. 38 E.
DeJanvier Placer Glenn DeJanvier Gold Hill, Oregon	Jackson County Sec. 1 T. 37 S., R. 4 W.
Edmonds Placer Joe and Lou Edmonds Cave Junction, Oregon	Josephine County Sec. 12 T. 40 S., R. 7 W.
Esterly Placer Journeys End, Inc. Cave Junction, Oregon	Josephine County Sec. 22 T. 40 S., R. 8 W.
Forest Queen Orville Snavely Grants Pass, Oregon	Josephine County Sec. 28 T. 35 S., R. 5 W.
Goff Placer Cantwell and Smith Sutherlin, Oregon	Josephine County Sec. 5 T. 34 S., R. 6 W.
Golden Bar Placer Bob Pancost Galice, Oregon	Josephine County Sec. 2 T. 35 S., R. 8 W.
Golden Lyon Placer Cole Grisel & Sons Grants Pass, Oregon	Josephine County Sec. 10 T. 35 S., R. 8 W.
Gold Nugget Placer Archie Rhoten Kerby, Oregon	Josephine County Sec. 30 T. 38 S., R. 8 W.
Hogum Creek A. A. Robbins Riddle, Oregon	Douglas County Sec. 21 T. 32 S., R. 4 W.
Johnson Placer Commers and Reinke Rogue River, Oregon	Jackson County Sec. 15 T. 34 S., R. 4 W.
King Placer Ted King Sunny Valley, Oregon	Jackson County Sec. 21 T. 33 S., R. 4 W.
Last Chance Placer James A. Burgen Galice, Oregon	Josephine County Sec. 26 T. 34 S., R. 8 W.
Lucky Strike Paul E. Jonas Merlin, Oregon	Josephine County Sec. 22 T. 34 S., R. 8 W.
Maloney Placer Bert Pankey Galice, Oregon	Josephine County Sec. 10 T. 35 S., R. 8 W.
Oregon Bar Placer Fritz Johnson Cave Junction, Oregon	Josephine County Sec. 31 T. 39 S., R. 6 W.
Rocky Gulch Placer N. L. Lewis Galice, Oregon	Josephine County Sec. 25 T. 34 S., R. 8 W.
Ruble Placer Fitzpatrick and Inman Canyonville, Grants Pass	Josephine County Sec. 30 T. 33 S., R. 5 W.
Schaffer Placer J. B. Schaffer Grants Pass, Oregon	Josephine County Sec. 22 T. 37 S., R. 5 W.
Shoemaker Placer Jack N. Shoemaker Gold Hill, Oregon	Jackson County Sec. 15 T. 37 S., R. 4 W.
Sterling Placer A. C. and Ivan Rock Jacksonville, Oregon	Jackson County Sec. 33 T. 38 S., R. 2 W.
Sutter Placer Graham and Peyton Klamath Falls, Oregon	Josephine County Sec. 36 T. 38 S., R. 9 W.
Upper Hogum Henry Speaker Wolf Creek, Oregon	Douglas County Sec. 28 T. 32 S., R. 4 W.

Mercury

Bonanza Mine Bonanza Oil & Mine Corp. Sutherlin, Oregon	Douglas County Sec. 16 T. 25 S., R. 4 W.
Bretz Mine Arentz-Comstock Mining Venture McDermitt, Nevada	Malheur County Sec. 3 T. 41 S., R. 41 E.
Maury Mountain Mine F.D. & H.W.Eickemeyer Prineville, Oregon	Crook County Secs. 10, 15 T. 17 S., R. 19 E.
Mother Lode Mine Werdenhoff Mining Co. Prineville, Oregon	Crook County Secs. 20, 29 T. 14 S., R. 20 E.
Towner Quicksilver Mine Frank Towner Post, Oregon	Crook County Sec. 10 T. 17 S., R. 19 E.
War Eagle Mine David Chase Medford, Oregon	Jackson County Sec. 17 T. 34 S., R. 2 W.

Miscellaneous Metals

Bear Creek Mining Company (Uranium) James Marier Idleyld, Oregon	Crook County Sec. 13 T. 18 S., R. 16 E.	Lakeview Mining Company (Uranium) Lakeview, Oregon	Lake County T. 37 S. Rs. 18, 19 E.	Standard Mine (Copper, cobalt) Ray Summers John Day, Oregon	Grant County Sec. 12 T. 12 S., R. 33 E.
Hanna Nickel Smelting Co. (Nickel) Riddle, Oregon	Douglas County Nickel Mountain T. 30 S., R. 6 W.	Sage Hollow Mine (Uranium) Forest J. Kennady Glide, Oregon	Crook County Sec. 13 T. 18 S., R. 16 E.	Twin Mountain Mining Co. (Molybdenum) Robert Hulin Baker, Oregon	Baker County Sec. 5 T. 8 S., R. 37 E.

METALLURGICAL 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	Reynolds Metals Co. (Aluminum) Troutdale, Oregon	Multnomah County
Harvey Aluminum Co. The Dalles, Oregon	Wasco County	Oregon Steel Mills 5200 N. W. Front Avenue Portland, Oregon	Multnomah County	Supreme Perlite N. Suttle Road Portland, Oregon	Multnomah County Plant in N. Portland
Industrial Processing Co. (Calcium hydrate) 5005 N. W. Front Ave. Portland, Oregon	Multnomah County	Owens-Illinois Glass Co. 5535 N. E. 101 Avenue Portland, Oregon	Multnomah County	Vermiculite-Northwest Inc. 2303 N. Harding Portland, Oregon	Multnomah County
National Metallurgical Corp. (Silicon) Springfield, Oregon	Lane County Springfield	Pacific Carbide & Alloys Co. (Carbide, vinyl acetate) N. Columbia Blvd. & Hurst Portland, Oregon	Multnomah County Plant in N. Portland	Wah Chang Corp. (Reactive metals) Albany, Oregon	Linn County Albany

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THE FOREST THAT MOVED*

This is the story of the forest that migrated. It is something new and original and somewhat startling. It came into the office of the state forester a few days ago in the shape of a requested change in a logging permit.

It was from the Snellstrom Lumber company of Eugene. It simply asked that the $NW\frac{1}{4}NW\frac{1}{4}$ Section 24, Township 20 South, Range 9 West be included in the logging permit which had been issued the company in January of this year.

Then the writer of the letter had added the simple notation that the reason for the request was the fact that a huge landslide had moved the timber over to this 40-acre tract.

This land is located on a tributary of Twin Sister creek which runs into Smith river down in western Douglas county near the Lane county line. The country is exceedingly rough and underlaid with sandstone. It is given to landslides during wet weather.

*Reprinted from The Forest Log, July, 1960

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CHROMITE ORES TESTED BY BUREAU OF MINES

"Flotation of Pacific Northwest chromite ores" by G. V. Sullivan and W. A. Stickney has just been published by the U. S. Bureau of Mines as Report of Investigations 5646. The report describes experiments by the Bureau of Mines at Albany, Oregon, on chromite ores from three areas in the Pacific Northwest, namely the John Day area of Grant County, Oregon, the Twin Sisters area in Washington, and the Mouat deposits in Montana. Results of the tests proved that flotation can be used to recover chromite from most fine-grained disseminated chromite ores without prior desliming of the ground pulp.

Report of Investigations 5646 may be obtained free of charge from: Publications Distribution Section, U. S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa.

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EXPLORATION COSTS OF SMALL MINES*

By
H. E. Krumlauf**

This information is for small mine operators and those who might become interested in small mines. At the outset it must be realized that seldom will cost figures, as given, fit exactly a given mine; they are presented to help the potential operator make reasonable estimates of the capital needs and the operating expenses involved in exploration and development of small mines.

For discussion purposes let us assume that the prospector has found a promising outcrop, mineralized zone, or geological structure, indicating the possibility of an ore deposit; and that he has properly located and recorded a claim or claims to cover the area. Also, that the prospector has sampled the outcrop or zone by taking samples from trenches or test pits that have been dug into the solid rock of the outcrop or zone of mineralization.

If the samples show that ore has been found a development program can be planned; and, if capital is available, this plan can be put into operation.

At this point many prospectors make a serious error by believing that the material found is ore. The United States Geological Survey defines ore as follows: "Ore is a natural aggregation of one or more minerals from which useful metals may be profitably extracted". It requires considerable mining and metallurgical experience to determine if the valuable minerals found can be "profitably extracted" and if the material is actually "ore".

The wise prospector, before he proceeds further, will obtain the services of a competent mining engineer or mining geologist. While the cost of obtaining such professional services may seem high, the advice given the operator in most cases will save many times the cost of the service.

When the preliminary work they recommend has been completed, such as trench sampling, test pitting, and minor drilling, the information obtained must be carefully appraised. If the drilling has shown that no valuable minerals are likely to be found, the claims should be abandoned. Only when the results indicate ore should the next step be planned.

The accompanying table gives a rough estimate of the "break even" grade of material for small mines. If the exploration indicates material of better grade for any single metal than is shown in the table, the mine might be profitable.

"Break Even" Ore Values for Small Mines

Type of Ore	Grade %	Total Value	Return to Shipper*
Gold-Silver		$22.00	$ 16.00**
Copper (at 32c/lb.)	4	25.60	16.00
Lead (at 12c/lb.)	15	36.00	16.00
Zinc (at 13c/lb.)	25	65.00	16.00

*Freight paid by smelter.
**Mining cost at $12.00 per ton plus miscellaneous costs at $4.00 per ton.

Small Mine Pay Scale

Worker	Base Pay	Actual Cost *
Miner	$ 15.00	$ 18.69
Mucker	14.00	17.44
Foreman	16.00	19.93

*Cost to the mine operator is figured as follows:

Miner's base pay		15.00
Add 1/6 of weekly overtime		1.25
Payroll wage per day		$ 16.25
Social Security (3%)	$0.49	
Unemployment (3%)	0.49	
Industrial ins. (9%)	1.46	2.44
Actual cost per shift		$ 18.69

The "break even" grade of ore for the small mine operator, as shown in the above table, must return $12 per ton to cover direct mining costs; $1.60 for royalty at 10 per cent of the smelter or ore buyer's return; approximately $1.50 for trucking from mine to railroad; and a balance of $0.90 out of the total of $16.00 may be used for taxes, insurance, exploration, legal costs, and surveying.

Under very favorable conditions, a small mine operator may be able to produce and ship for less than $16 per ton, whereas the cost of other operations having less favorable conditions may exceed $16.00 per ton. The final cost figure will depend upon such items as width of vein, strength of the ore and wall rocks, cost of transportation, royalty, ability of the mine operator, type of labor, and cost of supplies. The values given above are for estimating purposes only. An ore buyer or smelter representative should be consulted for detailed information.

* Reprinted from August, 1960, issue of PAY DIRT, official publication of the Arizona Small Mine Operators Assoc., Phoenix, Arizona.

** Professor of Mining Engineering, College of Mines, University of Arizona, Tucson. From a talk before the Tucson Council, Arizona Small Mine Operators Association.

If, however, the gross value of the material discovered by the exploration thus far is equal to or greater than shown in the above table (after adjusting for changes in market value) the next step can be planned and executed. That is, a general plan for underground exploration.

The base pay of mine employes is only part of the cost of labor to the operator. Substantial amounts in the form of insurance and taxes must be added to the base pay. These include:

1. Overtime at the rate of 1.5 times the base pay for the sixth day. This overtime, for accounting purposes, is distributed equally to each of the six days to obtain the so-called "payroll wage". All insurance and taxes are computed from the payroll wage and not the base pay.

2. Federal Insurance Contributions ACT (F.I.C.A.), commonly called Social Security, at the rate of 3 per cent..

3. Industrial Insurance (industrial accident and occupational disease insurance) at the rate of 9 per cent.

4. Unemployment compensation - state and federal - which adds another 3 per cent.

Other possible benefits could include paid vacations and holidays, shift differentials, group insurance, etc., all of which would increase the actual cost from the figures shown above.

At this point, plans must be made for the mine surface-plant. The type and size of this plant will vary somewhat. For example, if the headframe to be built is for sinking and exploring with a sinking bucket, it would cost less than one designed for a vertical or inclined shaft with a skip. However, this latter type of headframe can be used more efficiently for production.

The cost of a semi-permanent installation which can be used, with some additions, for production is estimated at $3,490. A temporary plant could be installed at a lower cost but must be replaced if the mine produces. Also, the cost of roads for access and other purposes must be added to the total. Distribution of the costs for a mine surface plant are shown in the following table. The estimates provide for a hoist, shop and storage shed to be a 12-foot by 30-foot building, costing $4.00 per square foot.

MINE SURFACE PLANT

Headframe	$ 800.00
Buildings:	
Ore bin (15 tons)	600.00
Hoist, shop & Storage shed	1,440.00
Compressor shed	150.00
Powder house, etc.	150.00
Leveling ground, installing hoist, track and pipe	350.00
Total	$ 3,490.00

SHAFT SINKING

Labor	Cost Per Shift
1 Working Foreman	$ 19.93
1 Miner	18.69
1 Mucker	17.44
1 Topman (Hoisting, etc.)	18.69
Labor Cost Per Shift	$ 74.75
Miscellaneous Costs	49.83
Total Cost Per Shift	$ 124.58

The next step in the exploration program is the sinking of an exploration shaft to examine the mineralized area at depth. This shaft should be put down in the ore body or mineralized zone wherever possible. A satisfactory small mine shaft, whether vertical or inclined, is 6 feet by 9 feet in rock cross section, giving two compartments 4 feet by 4½ feet and 3 feet by 4½ feet, inside timbers. Costs for this job may be figured as shown in the table to the right above.

The figure of $49.83 for miscellaneous costs is based on experience which indicates that for small mines the labor cost will average 60 per cent of the total and miscellaneous costs will average 40 per cent of the total cost. Therefore, $74.75 divided by 60 times 40 equals $49.83.

The cost of sinking a 100-foot shaft will depend upon the advance possible per shift, and for the four-man crew would vary as shown below. For a small mine, the usual size of a drift is 5 feet wide by 7 feet high. This will allow for a track with 18-inch gage, a ditch, and pipes for air, water, and ventillation. However, when working in bad ground the drift should be driven 6 feet by 8 feet in rock section to allow for timbers.

COST OF SHAFT SINKING

Advance Per Shift	Cost Per Foot*	Total Cost 100-Foot Shaft
1.0 ft.	$124.58	$12,500.00
1.5	82.98	8,300.00
2.0	62.29	6,200.00

*Includes all operating costs: labor, supplies, etc.

DRIFTING IN GOOD GROUND

Crew	Heading	Advance Per Shift	Cost Per Foot
4	1	4 ft.	$ 31.15
5	2	5 ft.	24.92

DRIFTING IN BAD GROUND

4	1	3 ft.	$ 41.53

These costs include the laying of track and pipe, etc.

Equipment to Be Purchased
Used

	Estimated Cost
3 mine cars (18 cu. ft.)	$ 300.00
1 pump (air driven duplex)	100.00
1 truck (1 ton)	1,500.00
1 mine fan (10" gas engine drive)	300.00
Auxiliary hoisting equipment - skip, sheave, cable, etc.	400.00
Total	$ 2,600.00

Equipment to be Rented

Item	Cost New	Rent Per Month
Hoist for skip or bucket		
2600 lb. rope pull	$ 1,662.00	$ 120.00
1000 lb. rope pull	1,000.00	80.00
Compressor - rotary		
125 c. f. m. gas	4,900.00	210.00
250 c. f. m. gas	8,900.00	300.00
365 c. f. m. Diesel	14,360.00	575.00
Drilling Machines		
2 - 45 lb. Airleg (Each)	1,080.00	83.00
1 - 100 lb. Stoper	1,250.00	75.50
Air Receiver	Installed	200.00

Supplies

Miscellaneous Supplies	Estimated Cost
Track:	
2 tons 12-lb. rails, used	$ 360.00
Ties, Plates, Spikes, etc.	150.00
Pipe	
500 feet 2½ inch black iron at 98 cents per foot (new) for compressed air line	490.00
500 feet 1 inch galvanized at 32 cents per foot (new) for water pipe	160.00
Fittings, valves, unions, etc.	200.00
Ventilation:	
450 feet 10-inch galvanized sheet metal pipe	675.00
Pipe fittings	60.00
Drilling:	
2 - 50-foot lengths of 1-inch air hose and fittings	75.00
2 - 50-foot lengths ½-inch water hose and fittings	55.00
2 - Line oilers	50.00
General Tools:	
Shovels, picks, saws, wrenches, anvil, forge, etc.	500.00
Miscellaneous:	
Surveying, assaying, etc.	300.00
TOTAL	$ 3,075.00

Summarizing the above outline of costs gives the following:

Summary of Costs

Item	Estimated Cost
Surface Plant	$ 3,490.00
Shaft	
100 feet at $82.98	8,300.00
Drifts	
300 feet at $31.15	9,350.00
Equipment Purchases	2,600.00
Miscellaneous supplies	3,075.00
TOTAL	$ 26,815.00

For drifting and crosscutting, the basic costs for labor with a four-man crew will be identical with the costs in shaft-sinking i.e., $74.75 per shift for labor, and $49.83 for supplies, etc., for a total cost per shift of $124.58. When working in good rock with two headings open, an extra mucker at $17.44 per shift may be used to advantage, thereby lowering the cost per foot of advance.

In reasonably good ground, the crew of four should advance 4 feet per shift. In ground requiring timbering, the advance for the four-man crew would be 3 feet or less. However, if two drifts are being advanced, a mucking crew of two men can be working in one drift, while the miner, with the foreman's help if needed, can be drilling in the other drift. These various conditions would give the above costs.

The amount of drifting needed to prove or disprove the value of the property will vary greatly. In some instances it will be necessary only to check diamond drilling results; in case of small but high-grade ore shoots, considerable drifting may be required. Unless a definite amount of drifting can be determined in the beginning of the underground exploration, about 300 feet tentatively may be planned.

Raising is usually done while other phases of mining are being carried on. Thus the cost per foot is materially reduced, since supervision and hoisting are available without much additional cost. In good ground a two-man crew should advance a 4-foot by 7-foot raise 3 feet per day. The total cost would be approximately $60 per day, or $20 per foot. Chute raises, 12 feet long, will cost upwards of $15.00 per foot, not including cost of the chute.

The major equipment items for small mines may be rented or purchased. During the exploration stage it is advisable to rent this equipment and thereby materially reduce the initial capital outlay. Furthermore, equipment may be obtained on a rental-purchase agreement in which 75 per cent of the rent may be applied to the purchase price.

The accompanying tables list the equipment which may be rented and that which should be purchased, together with the cost of each.

Supplies that are consumed during the operation, such as powder, fuse, detonators, bits, drill rods, and timber, were included in the cost of shaft sinking, drifting and raising, as presented in the preceding computations. The supplies which are part of the capital expenditures, and have not been included in the previous costs, are given in the table headed "Supplies".

Under good supervision and favorable conditions, the total costs may be reduced substantially. However, under poor supervision or adverse conditions, the costs will be considerably higher. These cost figures are given only as guides to the small mine operator or the investor in small mine exploration. No two explorations are exactly alike, and no two operators have identical costs; therefore, the above cost figures, although derived in part from actual small mine operations, will correspond to a given exploration only by chance.

Many good small mines fail because there is not enough capital available for development, equipment, payroll, and supplies. This capital must be sufficient to meet the costs outlined above, plus a working capital of at least $5,000.00 additional, to permit the mine to carry through the early stages to the period of profitable returns. This means that adequate financing should be assured before exploration or mining starts.

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PORTLAND HARBOR HANDLES LARGE TONNAGE OF MINERALS

Portland has long been noted as one of the United States' leading bulk cargo ports. Tremendous amounts of import and export bulks pass through the harbor annually, strengthening the port's hold on the number one spot as the leading dry-cargo seaport on the entire Pacific Coast of the United States.

The leading cargoes handled via Portland are ores and ore concentrates, approximately 200,000 tons of which were imported in 1959. Portland has invested millions of dollars in the construction of specially designed facilities for handling these cargoes and effecting their rapid transshipment to their final destination. These special facilities, together with favorable overland freight rates to the interior and efficient, low-cost handling, have more than tripled the amounts of ores being imported through Portland in the past few years.

Most of the ores moving through Portland are destined for large smelters in Idaho and Montana. Alumina, the greatest single bulk imported, moves primarily to Harvey Aluminum near The Dalles, Oregon. This cargo is handled at a specially built floating dock owned by Harvey. The alumina, arriving from Japan, is vacuumed from the ships' holds at the rate of several hundred tons per hour, automatically weighed, and dropped directly into rail cars for transshipment.

Lead and silver ore from Bolivia, lead and zinc concentrates from Peru and other South American countries and from Australia, are other large-volume mineral imports. A copious amount of other minerals, such as fertilizers, salts, and petroleum products also move through Portland's harbor. One of the port's greatest coast-wise cargoes is petroleum, moving both in and out of this area. Approximately 34,000,000 barrels of petroleum products were received at Portland during 1959. Nearly all of the fuels and oils used in this vicinity are imported by water and almost all major oil companies maintain docks in the harbor, both for handling inbound and outbound products and for providing bunkers for ocean-going vessels.

Portland's docks are a major terminus for barges plying the Columbia and Willamette rivers, loaded with petroleum and other mineral products. Barges carrying sulphur to nearby paper mills, fertilizer to Pasco and other upper-Columbia-River ports, and salts to Portland chemical plants constitute a great amount of the traffic moving to special commodity docks throughout the area.

Imports of these materials have a direct and tremendous impact not only upon the economy of Portland and of Oregon as a whole, but upon consumers of the finished manufactured materials made from them. Low-cost handling means lower costs to the final consumer. Portland is ranked high on the list of economy-minded ports ready to handle great quantities of raw materials such as ores and minerals. Oregon's manufacturing plants, including some smelters, rely heavily upon Portland's harbor for the import of their raw materials and likewise for the export of their finished products.

The Dock Commission's Terminal No. 4 is geared for handling these commodities. The largest and most diversified of the port's marine facilities, Terminal No. 4 is the site of the nation's largest tidewater grain elevator west of the Mississippi, a dependable, efficient bulk outloading pier (which, in 1957, made Portland the country's third ranking coal-export port), and open storage area for holding dry bulks, such as ores.

Now under construction at this terminal is a giant bulk unloading pier, destined for completion in early 1961. When put into service, this pier will be the most modern and efficient on the Pacific Coast. A giant travelling bulk unloading tower, costing in the neighborhood of $4,000,000 and constructed by Pittsburg's Dravo Corporation, will scoop up dry bulks from the holds of ships and deposit them into rail gondolas, trucks, or open stockpile at the rate of 900 tons per hour.

At present, ore imports are handled at Terminal No. 4 with the use of two large gantry cranes located on Pier No. 2. These cranes operate at a peak efficiency of about 150 tons per hour in unloading and loading directly onto trucks or rail cars. The Pier No. 4 unloading tower, designed to more than triple their unloading ability, will free these cranes for the loading of increasing amounts of outbound scrap metal and other exports.

Each ton of ores and ore concentrates that passes through Portland brings into the city $3. At this rate, 1959 saw a total of $600,000 derived from the import of this commodity alone. Increasing needs for foreign ores and minerals place great demands upon the maritime industry to keep abreast of new technological changes in handling concepts. Portland's harbor has undergone great change to meet these new needs in recent years, and currently plans a new program of construction and modernization that will place the port in an even better position for handling this cargo. Included in a planned improvement program is a new bulk loader to handle outbound cargoes.

A list of the major 1959 imports of ores and other dry bulks reflects the importance of Portland's harbor to the economy of the region:

Alumina	116,000 tons
Bauxite	3,700 tons
Lead ore	7,539 tons
Lead & silver ore	3,771 tons
Lead concentrate	34,017 tons
Zinc concentrate	29,258 tons
Crude salts	35,607 tons
Sand, zircon	2,192 tons

A portion of the minerals that were exported to foreign countries through Portland in 1959 includes:

Infusorial earth	1,252 tons
Fertilizers	15,532 tons
Ores	1,000 tons

Future prospects for Portland's harbor show a predicted 60 percent increase in overall tonnage handling by the year 1980. A large measure of this increase is in raw materials such as ores. Portland's facilities will be ready to handle them, and to handle them at greater savings than at any other Pacific Coast port, passing on the benefits to the entire region served by this city.

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E. B. MacNAUGHTON

Mr. E. B. MacNaughton, noted civic leader and former member of the department's governing board, died on August 23 at the age of 79. During his 56 years as a Portlander, Mr. MacNaughton held many positions. He was president and board chairman of The First National Bank, interim president at Reed College, director of The Oregonian Publishing Company, and president of various civic organizations concerning civil liberties. He was also the recipient of a number of honorary awards.

In 1937, when the Department of Geology and Mineral Industries was organized, Mr. MacNaughton was appointed to its governing board by Governor Martin. He resigned in 1943, but was reappointed by Governor Snell in 1946 and remained with the board until 1949. During the years he served the department, he devoted much attention to promoting the development of Oregon's mineral resources.

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MINED-OUT LAND BROUGHT BACK TO LIFE*

"Strip mining kills the land!" All too often in history this has been true. But experiments by a group of Hawaiian scientists, led by Dr. G. Donald Sherman of the University of Hawaii, have proved that this need not be so; that, in fact, the land can be brought to greater fertility than it had before it was mined.

Through a careful program of revegetation, including the use of fertilizers, the scientists have been able to grow over 10 times as much grass as before on land from which bauxite had been strip-mined. From their researches, the State of Hawaii has drafted a strip-mining law which will allow development of the islands' mineral resources without ruining their precious resources of land.

Hawaii's bauxite deposits are not commercial now, because they are too low in grade and are far from processing plants. But they do represent a large potential resource for the United States, and the basis of a possible alumina industry in the future.

Deposits containing over 500-million tons of alumina extend over 330 sq miles of high-rainfall land on Kauai, Maui and Hawaii; occurring in surface formations, they range in depth from 10 to 30 ft. But average ore grade is only 20-40% Al_2O_3. Still, the deposits have been interesting enough that several aluminum mining companies have explored them.

Looking toward the future, the Hawaiian government foresaw the possibility of a bauxite mining industry; it also foresaw the possibility of damage to the land. Land, to Hawaiians, represents their most precious resource. Wanting above all to preserve it, but at the same time to encourage a mining industry if possible, the Legislature made a $50,000 grant to the Agricultural Experiment Station of the University of Hawaii to study the problem of reclamation of land after bauxite mining.

The site selected for the experiment was $5\frac{1}{2}$ acres, situated in the Wailua game refuge on Kauai. A bauxite mining company had designated the bauxite in the area as good commercial ore. The average composition was 0.7% silica, 40% alumina, and the balance chiefly iron oxide and water.

First, the surface foot of soil was removed and stockpiled. Then the ore was stripped off down to the subsoil, which consisted of weathered basalt boulders. The lower boundary of ore was determined by rapid tests for kaolin clay. Eighty-six thousand short tons of ore containing 35,000 short tons of alumina were removed, to an average depth of 11 feet. The exposed subsoil surface was then plowed and disked to give a friable seed bed. One-half of it was covered with topsoil, to its original depth of about a foot. The other half was left bare.

The ore was considered non-commercial where the silica content was higher than 6% and the alkali-soluble alumina fell below 30%. The cut-off point of the commercial ore was obvious even to the laymen by the appearance and frequency of certain types of weathered basalt boulders.

The tests, which lasted one year, showed that it was necessary to add fertilizer to get any crop yield at all. Nitrogen, phosphorus, potassium and magnesium were the essential ingredients of the fertilizers. Their cost came to $155 per acre on the land which had been re-covered with topsoil, and $245 on the directly-exposed subsoil.

But once the soil had been fertilized, it produced much more vigorously than the original land had done. Within 90 days after mining had finished, all areas were completely revegetated. Some took as little as 30 days. Much more grass grew from the fertilized soils than had grown before. The land originally had been poor grazing land, much like that of other bauxite areas; it would carry about one head of cattle per 10 acres, and produce from 10 to 30 lb of beef per acre per year. The most productive "new" land yielded enough grass to produce from 500 to 600 lb of

* Reprinted from Engineering and Mining Journal, August, 1960, by permission.

beef per acre-year. That's a whole one-third of a cow, in place of two or three fair-sized roasts.

The directly-exposed subsoil produced higher yields than did the removed-and-replaced topsoil. A great variety of plants could be grown in the mined-out-and-fertilized soils. The best was a grass-legume mixture; pineapples and sugar cane grew satisfactorily; so did sweet potatoes, guava, passion fruit and corn. Vigorously-growing eucalyptus trees achieved as much as a foot a month. The success of the re-vegetation allayed two fears of the Hawaiians: soil erosion and loss of watershed.

If the bauxite ores were to be up-graded by wet screening, the rejected fines would have a high content of kaolin minerals. On plots containing rejected fines from upgrading tests, sudan grass grew copiously. The layering in the fines produced by settling in ponds did not prevent plant roots from penetrating.

One year's study thus yielded valuable conclusions. Land denuded by bauxite stripping can be quickly brought back to life; it may in fact become much more valuable land than it was before mining. Hawaii is ready for a bauxite mining industry, knowing that it will not hurt the valuable land.

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PORTLAND AREA GEOLOGY EXTENDED BY SURVEY REPORT

"Geology and ground-water resources of Clark County, Washington, with a description of a major alluvial aquifer along the Columbia River", by M. J. Mundorff, has been issued as an open-file report of limited distribution by the U. S. Geological Survey. The report, dated August, 1959, includes a discussion of the geology and ground-water resources of the area, well logs, and a geologic map. Geologic formations of the Portland area are shown to extend northward into Clark County, which is underlain by Eocene to Miocene volcanics and sediments of the Western Cascades, Piocene Troutdale and Boring formations, Pleistocene glacial deposits, and Recent alluvium. A copy of the open-file report is available for inspection at the department's office in Portland.

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DEPARTMENT RECEIVES DRILLING RIG

The department was given a model drilling rig recently by Manning Barber of Portland. The model and base are about 48 inches tall. In the base beneath the rig, a cutaway diagram shows what geologic conditions might be encountered in drilling for gas and oil. The model rig, purchased a few years ago from the American Petroleum Institute by Mr. Barber for use in his business, will be on display at the department's office in Portland, and will be available for loan to school exhibits.

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GROUND WATER FOUND IN FLORENCE DUNE SAND

The U. S. Geological Survey has just made available an open-file report entitled "Ground water in the dune-sand area near Florence, Oregon". The author is E. R. Hampton, geologist with the survey's ground water division in Portland. The open-file report may be consulted in Oregon at the survey's office at 1001 N. E. Lloyd Boulevard in Portland or at the office of the State Engineer, 251 Finance Building, in Salem.

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CANADA LIKES GOLD AND GOLD MINING

Canada's attitude toward gold mining, as shown by the following news notes, contrasts sharply with the attitude toward mining of the United States government over the past 20 years. Although the news notes refer only to direct subsidy of gold mining, it might be added that Canada also grants even greater incentives to mining through a realistic tax schedule that recognizes costs of exploration and development and the need for early amortization.

"This office has received the annual reports of four Canadian gold mining companies which show the amount of money they received under the 'Emergency Gold Mining Assistance Act'.

	1959	1958
Lakeshore Mines, Ltd.	$ 394,400	$ 407,000
Wright-Hargreaves Mines, Ltd.	318,158	306,245
East Malartic Mines, Ltd.	251,238	386,189
Barnat Mines, Ltd.	343,087	429,601

"The amounts received from sales of bullion, with no credit for the bonus or subsidy, were:

	1959	1960
Lakeshore Mines, Ltd.	$2,232,978	$2,376,534
Wright-Hargreaves Mines, Ltd.	2,309,827	2,299,526
East Malartic Mines, Ltd.	3,711,452	3,660,275
Barnat Mines, Ltd.	1,275,578	1,459,230

"The amounts paid to the above four of Canada's many gold producers indicate that the Dominion feels that gold, and its continued production, is important and necessary to its economy." (Nevada Mining Association News Letter, August 15, 1960)

"The amount paid by the Dominion of Canada as a subsidy to gold producers, to preserve the gold mining industry and to increase the production of gold, totaled $131,063,000 up to March 31st of this year. 55% of the gold produced in Canada in 1959 came from mines eligible for assistance under the Gold Mining Act." (Nevada Mining Association News Letter, September 15, 1960.

"The gold mining industry in Canada has been receiving assistance from the federal government since 1948. We now have fifty lode gold mines, responsible for a pretty steady annual output of 4½ million ounces. Of these fifty mines, forty are eligible to receive assistance from the federal government, which pays out about $10 million a year to compensate them, in part, for the increased costs of operation. Without that assistance, at least half, if not two-thirds, of our gold mines would simply fold up and vanish. Even more serious perhaps, there would vanish with them large communities, some of them with twenty or twenty-five thousand people, entirely dependent on the continued operation of the gold mines." (Excerpt from statement by V. C. Wansbrough, Managing Director, Canadian Metal Mining Association, at Gold Session, AIME Northwest Metals and Minerals Conference, Portland, Oregon, April 29, 1960.)

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BRISTOL NAMED CHAIRMAN

Governor Mark O. Hatfield named Fayette I. Bristol, Grants Pass, as chairman of the Governor's Mining Advisory Committee on September 28. The appointee, president of the Bristol Silica Company of Rogue River, has been a member of the committee and an active participant since 1955.

A meeting of the Western Governors Mining Advisory Council will be held in Las Vegas on Monday, October 10, at the time of the American Mining Congress mining show. New officers of the council will be elected and a review of past accomplishments and proposals for future action will be discussed.

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