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AUGER HOLE PROSPECTING

by

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The following description of drilling methods used by the Oregon Department of Geology and Mineral Industries in exploring ferruginous bauxite deposits in northern Washington County, Oregon, may be of interest to anyone who plans to do similar exploration.

During the fall of 1944, 22 holes were drilled having a total depth of 605 feet, an average of approximately 28 feet per hole. The deepest hole drilled was 45 feet. The area explored extended along a ridge approximately 2 miles in length. This ridge has fairly steep slopes on both sides although the ridge itself is for the most part flat-topped. The entire area was logged off 10 or 15 years ago, and the ground is now covered with brush and scrub growth as much as 15 or 20 feet high.

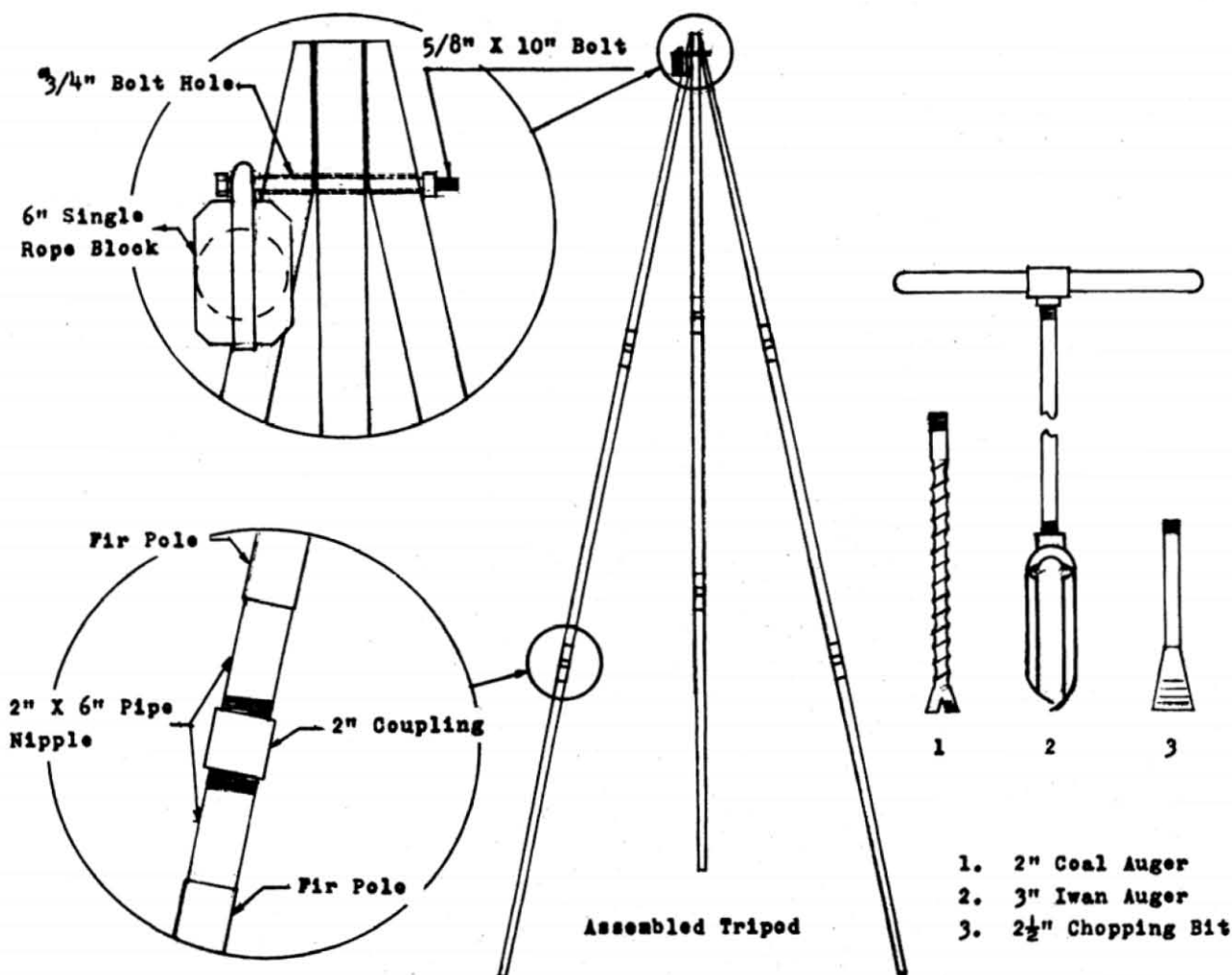
The ore occurs in a bedded deposit or deposits having a dip corresponding roughly to the surface of the top of the ridge and lying from 5 to 30 feet beneath the surface. Overburden consists for the most part of light-colored silts and clays which are easily penetrated with an auger. The ore is characteristically reddish in color and usually has a gritty texture, although both color and texture vary widely.

The first part of the drilling project consisted of putting down a few closely spaced holes in order to determine the attitude of the ore body. Once this was determined it was possible to locate additional holes at 1500-foot intervals along the ridge so that they would strike the ore most effectively. The project was planned to indicate extent of the deposit, not to prove exact tonnage.

In general all of the holes drilled required the use of either the 3-inch or 2-inch "Iwan" soil auger, the 3-inch auger being used to start all holes while the 2-inch was used when the ground became too hard to penetrate with the 3-inch drill, and had to be loosened with a 2-inch coal auger bit. Holes deeper than 30 feet were generally drilled with the 2-inch auger in order to reduce friction along the walls of the hole and also because of its lighter weight.

The 3-inch drill used had a 3/4-inch pipe-thread, and the drill pipe consisted of standard 3/4-inch galvanized iron pipe. The 2-inch auger had 1/2-inch threads, and a 1/2 by 2-inch nipple and 1/2 by 3/4-inch bushing were used to adapt it to the 3/4-inch pipe. The coal auger, similar to those used in coal mines, was a regular hand-twist drill with a 3/4-inch pipe coupling welded to the shank.

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Holes that were drilled deeper than 15 or 20 feet required the aid of a tripod to help pull the drill pipe and pod out of the hole. The tripod used on this project was the result of considerable experimentation on other similar projects of the Department, and was made up of portable joints or sections of fir poles $2\frac{1}{2}$ inches in diameter and 9 feet long.

Each leg of the tripod consisted of three sections joined together by turning down the ends of the poles and forcing 2-inch pipe nipples, 6 inches long, to a flush joint, and coupling the sections together with regular pipe couplings. Details of construction of the tripod are shown in the accompanying diagram. In order to conserve weight without making the tripod unduly limber, the middle section of each leg was made from a slightly thicker pole than the top and bottom sections which tapered toward the ends.

A $\frac{3}{4}$ -inch hole was drilled about 6 inches from the upper end of all three poles and a $\frac{5}{8}$ by 10-inch bolt was used to assemble the tripod. The hole in the "middle" leg was drilled at right angles to the length of the pole, and the other two holes were drilled at a slight angle to permit proper spreading of the legs. A 6-inch single block with a $\frac{5}{8}$ -inch rope 50 feet long was attached to the top of the tripod by means of the bolt connecting the legs.

Best results were obtained when the block at the apex of the tripod was attached as shown in the drawing. This arrangement permitted passage of the pipe above the block without interference from the closely spaced poles when holes were drilled deeper than 25 feet. The rope used in the block had a loop braided in one end large enough to slip over the drill handle. This loop was wound with wire to protect it from wear and to help keep it open for free passage of the pipe. The other end of this rope was equipped with a harness snap which was hooked to a large screw eye screwed into a tripod leg about 5 feet from the ground. The total weight of the assembled tripod, including rope and block, was approximately 130 pounds. Cost of the tripod hardware, rope, and block amounted to about \$17.00. The fir poles were cut and fitted in the field.

Total cost of drilling equipment, which included one 3-inch auger, one 2-inch auger (each drill came supplied with a handle and 3 feet of 3/4-inch pipe), two pipe wrenches, and 39 feet of 3/4-inch pipe with couplings, amounted to approximately \$17.00. Since the drill rig would be used for various exploration projects in the future, and in areas that might be some distance from repair facilities, all of the pieces comprising the tripod hardware and drill pipe were either standard pipe fittings or hardware supplies obtainable at any plumbing shop or hardware store. The soil augers are likewise commonly stocked by hardware stores, as are also the pipe wrenches, rope, and rope block. The only item which might not be generally available would be the fir poles used in the tripod, but rough straight-grained lumber could possibly be substituted.

The drill crew consisted of a driller and sampler who at intervals usually switched duties. The actual drilling operation consisted of, first, preparation of the drill site. This required removal of any brush or logs, and the scraping of debris from the area surrounding the collar of the hole. When it was known beforehand that the hole would be deeper than 15 or 20 feet, the tripod was immediately set up and put in use after the first 9 feet had been drilled.

Usually the driller started the new hole while the sampler transferred and assembled the tripod. This effected a considerable saving of time, since normally no samples were taken for the first few feet and the drilling could be done easily by one man.

Assembling the three legs of the tripod (the sections of each leg were not unscrewed for short moves between holes) required less than 5 minutes. The legs were placed in position and bolted together with the block attached at one end of the bolt. The lower ends of the two "outside" legs were placed about 8 feet apart and about 6 feet from the hole collar. To erect the tripod, one man lifted the upper ends of the three legs where they were bolted together and the second man pushed in on the middle leg. Once raised to full height the tripod was moved slightly to bring the block directly over the hole.

On flat, even ground, the three legs were kept about 8 feet apart at the corners of an equilateral triangle. This spacing gave maximum height and structural strength.

As the hole was deepened, additional lengths of pipe 3 feet long were added to the drill. In order to reduce the number of couplings in the drill pipe, 6-foot lengths were substituted for the 3-foot pieces as the drilling progressed. The use of 9-foot pipe lengths would have proved advantageous, as a much smoother and straighter string of pipe would have resulted.

When the hole reached a depth of 9 feet, the rope and pulley were used to haul the drill pipe from the hole and to keep it suspended while the pod was unloaded. When the drill was ready to be returned to the bottom of the hole, the driller grasped the rope, using a gunny sack for protection against rope burns, and let the drill down into the hole as rapidly as possible. As most of the material drilled was more or less damp, it was somewhat difficult to remove from the pod. A corn knife proved to be a handy tool for this purpose. When holes deeper than 25 feet were drilled, it was necessary to lift

the string of pipe up beyond the block. First the pipe was pulled up with the rope until the loop entered the block, and then the rope was held by one man while the other lifted the string of pipe out of the hole. An improvement of this practice - which was exceedingly strenuous when holes 30 or 45 feet deep were drilled - would be to use a double block with a second rope equipped with a hook at one end. The hook would fit into a tee inserted in the string of pipe at the point where the pipe emerges from the ground when the handles have been raised up to the block by the first rope. The second rope would then be used to elevate the remaining pipe enough to clear the pod. This system has not yet been tried in the field but it probably would be a time and labor-saving device.

While the 3-inch and 2-inch Iwan-type soil augers penetrated most of the semi-solid soils and altered rocks, there were some hard ribs or strata encountered which could not be drilled with these augers. When such material was struck, the first step was to switch from either the 2-inch or 3-inch auger to the 2-inch coal auger mentioned above. This coal auger was usually able to penetrate consolidated material provided the material was not too hard. The usual practice was to twist this auger down as far as possible with frequent unwindings. The auger was then removed without attempting to bring any loosened material out, and the soil auger was put back on the string of pipe. This procedure had to be repeated many times in hard oolitic material, but with practice the change from one drill to the other was made in 10 seconds or less.

Care was exercised when using the coal auger in material being sampled as it mixed up several inches of material at the bottom of the hole, and, if there were a sudden change in the composition of the bed, some "salting" would occur. For material that was too hard to be drilled with the coal auger, a light forged chisel bit was used occasionally. This bit was alternately lifted and dropped while being slowly rotated and was generally able to break up fairly solid material.

In wet, plastic clay considerable difficulty was experienced when the soil auger was pulled out owing to the suction created. The best practice was to avoid overloading the auger, and to rotate the drill slowly while lifting it. For several reasons it is not good practice to fill the pod of the auger too full. First, when the pod is tightly packed with material the sides of the pod might be pushed outwards slightly and might bind along the walls of the hole when being removed; second, material might be forced out of the top of the pod and might either be lost on the way out of the hole or be smeared along the walls, thus possibly contaminating subsequent samples; third, tightly packed material was often difficult to remove from the auger; and fourth, careful measurements of the advance per revolution of the auger revealed that an excessive amount of effort had to be expended to advance the drill once the pod was full. In general, the pod was filled and cleaned three or four times in making 1 foot of hole.

Sampling of the material removed from the drill hole required careful attention. First, the exact depth of the pod was determined for each sample taken. This was done by measuring the length of pipe, starting at the tip of the pod and marking the distance on the pipe with keel.

The thickness of the samples varied somewhat. In some cases where the material being sampled showed little change in texture, color, and moisture content, samples representing 3 or 4 feet in thickness were taken. Samples of this thickness were generally restricted to zones which were not thought to contain ore and were taken merely for checking. In the ore zone proper, most samples were taken every 2 feet and in some cases every foot. Whenever any distinct change occurred in the appearance of the ore, a new sample was started regardless of the thickness of the preceding sample. The sampling interval was purposely restricted to narrow limits in order to delimit accurately the ore body.

When the filled drill pod was brought to the surface, the material was immediately removed and placed in a glass jar with a moisture-tight seal.

The most satisfactory method of labeling the jars was to use a list of field numbers which had been previously typed in columns on a sheet of paper. Numbers were cut from the sheet and attached to the top of the jar by means of cellulose tape. This system saves much writing in the field, and the jars can be labeled in advance or during some free time on the job.

A complete log of the hole was kept on mimeographed 8½ by 11-inch sheets prepared for this purpose. These forms provided space for the location of the hole, elevation of the collar, depth to the top of the bed, depth of the hole, elevation of the water table, and the material in which the hole was bottomed. Spaces were also provided for the sample interval, the depth at which the sample was taken, the sample number, and a description of the material sampled. As an adequate description of the material sampled was helpful in determining the nature of the ore body and the overburden, and as this required a considerable amount of writing, a sample key listing the common colors, textures, and compositions was drawn up. Each of the terms listed in the key was given either a letter or a number, and these letters and numbers were then used on the log instead of writing out the entire description in longhand. This saved a great deal of time, and permitted a complete description of the material in the small space allotted.

The rate of drilling varied widely from hole to hole and was largely governed by the nature of the material drilled. In addition the rate of drilling varies inversely with the depth of the hole. The following figures summarize the cost of drilling and sampling on the project. The first set of figures includes one hour travel time while the second includes only actual time spent on the ground.

<u>Interval</u>	<u>Drilling & sampling time, hr.</u>	<u>Distance drilled, ft.</u>	<u>Advance per hr., ft.</u>	<u>Feet per man hr.</u>	<u>Total cost drilling & sampling, ft.</u>
All holes, 8 hrs. (elapsed time)	155.00	605.5	3.906	2.604	\$ 0.512
All holes, 7 hrs. (actual drilling time)	135.62	605.5	4.464	2.976	\$ 0.448

In addition to the above costs a slight depreciation charge should be made for equipment worn out on the job. Little apparent wear occurred on the 3-inch auger after drilling more than 500 feet of hole, but the 2-inch auger showed considerable wear after a much shorter footage and had to be replaced when it broke into two pieces while drilling. This increased wear on the 2-inch auger was largely due to the fact that it was used only in either hard ground which could not be drilled by the 3-inch auger alone or in very deep holes where the weight of the string of pipe was considerable. Breakage of pipe and pipe-fittings was negligible, and wear and tear on wrenches, rope, and tripod hardware was also inconsequential.

OREGON MINING ASSOCIATION

The annual meeting of the Oregon Mining Association was held in Portland on December 1, and the following officers were elected: President, S. H. Williston; Vice-president and Secretary, Irving Rand; Directors, Worthen Bradley, D. Ford McCormick, and F. Whalley Watson. The office of the association is at 1105 Public Service Bldg., Portland, Oregon.

MINING LAWS IN O & C BILL

Mining laws were made applicable to the Oregon-California revested grant lands under an amendment added by Representative White (D-Idaho) to the O & C authority bill.

The public lands committee approved White's amendment to the bill adding a mining provision similar to that contained in the Taylor Grazing act. It reads:

"Nothing herein contained shall restrict prospecting, locating, development of mining, entering, leasing, or patenting mining reservations under laws applicable thereto."

The bill itself would transfer the administration of revested forest lands, now handled by the forest service, to the O & C administration. It has been placed on the House calendar with favorable committee recommendation.

Grants Pass Courier

Grants Pass, Oregon, Dec. 5, 1944.

ANNUAL MINING INSTITUTE AT THE UNIVERSITY OF WASHINGTON, SEATTLE

The 18th Annual Mining Institute of the College of Mines, University of Washington, will be held on Wednesday, January 24, 1945. The program beginning in Mines Laboratory at 10:00 a.m. will include among others the following speakers: John J. Curzon, manager of Howe Sound Company's Holden mine, who will outline and illustrate the "Changing Mining Methods at Holden," and Glenville A. Collins, president of North American Gold Fields, Ltd., who will describe and show motion pictures of "Drag-Line Gold Dredging in the Cariboo, B.C."; views of similar operations in California and of travel in the North will be included.

The luncheon will be in charge of the West Coast Mineral Association. In the afternoon a 225-ton press and other new equipment of the College of Mines and the Northwest Experiment Station will be demonstrated, along with exhibits of new machinery from the manufacturers. Bureau of Mines sound films on "Magnesium - Metal from the Sea" and "Airplanes - Their Metals, Fuels, and Lubricants" will be shown. At 6:00 p.m. a joint dinner will be held at the Faculty Club with the North Pacific Section of A.I.M.E. At 8:00 p.m. Russell Spry, ore-dressing engineer of Vancouver, B.C., will give an illustrated address on "Mill Planning for New Properties."

DECLARATION OF POLICY

of

Northwest Mining Association

Golden Anniversary Meeting

December 1944

The Northwest Mining Association, in its 50th Annual Meeting, looks back over half a century of unparalleled progress under the American system of competitive free enterprise, and looks forward to another fifty years which must see the restoration and improvement of this time honored system after the present emergency.

The Mining Industry has been called upon to supply in unprecedented amounts the basic minerals vital to Victory. We pledge our continued cooperation to the prosecution of the war, recognizing that until the day of ultimate Victory few steps can be taken toward a return to normal conditions.

Free Enterprise

Free enterprise, by whatever name it may be called, is the basis of the American way of life. It has brought to America the world's maximum industrial production and highest standard of living.

Free enterprise requires the highest degree of personal freedom attainable under just laws impartially enforced - freedom to save, invest and venture as we wish - absence of arbitrary controls by government - preservation of property rights under a system of government by law and not by men.

Trade Policy

We emphatically reject the viewpoint that our nation has become a have-not in minerals. Our known and indicated ore reserves are substantially as great as at any previous time and improved operating efficiency has compensated for any decline in grade. Nevertheless, we do not resist a moderate increase in mineral imports commensurate with the recent expansion in national industrial capacity, provided that foreign trade policies do not discriminate against domestic mining. We insist that the stability of domestic economy is a fundamental necessity, and that the government should stockpile any mineral imports in excess of the amounts our national economy can absorb without dislocation.

Premium-Quota Plan

The premium-quota plan was adopted as a wartime measure to obtain necessary production under ceiling prices. However, costs have risen under the premium system to an extent that would jeopardize normal production if premiums were removed and present price ceilings continued. Therefore, we urge retention of the premium-quota system until control of prices is abandoned and until operators who have made investments for war production have had a chance to recover these investments.

Tax Reforms

We favor drastic alteration of Federal Tax laws in order to promote development of new mines, and in order to permit operation of existing mines at good rates of production, thus insuring a healthy mining industry and full employment of labor.

We favor a change in the Federal Income Tax law to permit taxpayers to make reasonable deductions from net income for money expended in grubstakes or primary investments in the development of natural resources.

Venture Capital

We recommend that the Securities & Exchange Commission modify its restrictive rules and regulations so that more venture capital may be made available for all business purposes.

Mineral Land Policies

We support the principle of discovery and location as embodied in the Federal Mining Act, and in the administration of this act we urge that discovery be presumed wherever the claim owner performs in good faith the required location and assessment work, and where his possession of the claim is primarily for mining purposes. We oppose any attempt to bring about the Federal recording of mining claims, and favor the continuation of the present system of recording under State laws.

We oppose the adoption or expansion of a leasing system for mineral resources on public lands, on the ground that it restricts and discourages mineral development.

Indian Reservations

We condemn the creation of Indian Reservations except by specific act of Congress, after full congressional hearing in which all interested parties are represented. We advocate repeal of the Wheeler-Howard Act conferring such authority on the Secretary of the Interior, and reconsideration by Congress of all Indian Reservations created in Alaska under that authority.

Re-opening of Gold Mines

We recommend that W.P.B. Order L-208, shutting down gold mines, be rescinded immediately, and that

United States gold producers be permitted to sell newly mined gold in any world market.

Monetary Policy

We favor a currency with a metallic base, using gold and silver. We endorse the continued purchase and coinage of domestic gold and silver, as provided by law, and urge the repeal of the prohibitions on free circulation of gold.

Employee Relationships

We support all efforts to be made by either labor or management that are designed to improve employer-employee relationships. We believe that those relationships can be improved by a limitation of three months on retroactive pay orders imposed by any federal tribunal.

MERCURY IN OCTOBER 1944

According to the U.S. Bureau of Mines monthly mercury report released December 5, 1944, consumption of mercury in October 1944 was again substantially above domestic production, making the third successive month in which the disparity has been noteworthy. As a result, industry stocks were 41 percent below those held January 31, when they were at their highest levels since the Bureau of Mines monthly surveys began in September 1939, and for an indefinite period before that. Stocks at the end of October were the smallest reported in the period covered by the monthly reports. The metal on hand was sufficient for about two and one-half months' needs at the increased rate of consumption in August-October, but supplies were not evenly distributed. The conditions outlined were accompanied, as was to be expected, by a further stiffening of prices during October and by a strong price at the month-end. In order to ease the situation, the War Production Board announced December 1 that it would make releases from the Government stockpile for essential war uses.

Salient statistics on mercury in the United States in 1939-43 and in January-October 1944, in flasks of 76 pounds each.

Period	Production	Consumption	Stocks at end of period		Price per flask at New York
			Consumers and dealers 1/	Producers 2/	
	Average Monthly				
1939. . . .	1,553	3/ 1,742	12,600	376	\$ 103.94
1940. . . .	3,148	2,233	14,100	607	176.87
1941. . . .	3,743	3,733	12,400	439	185.02
1942. . . .	4,237	4,142	10,700	1,377	196.35
1943. . . .	4/ 4,327	4,542	13,200	3,457	195.21
	Monthly				
1944:					
January .	4,400	3,400	11,300	5,459	151.60
February.	3,800	3,700	9,400	5,450	130.00
March . .	3,800	3,600	9,900	5,011	130.00
April . .	3,700	3,200	9,700	5,604	128.20
May . . .	3,400	3,100	8,900	6,171	115.54
June. . .	3,000	3,400	9,000	5,757	101.69
July. . .	2,700	3,000	9,300	4,025	100.56
August. .	2,500	3,900	9,100	2,252	104.04
September	2,500	3,900	8,400	1,936	104.28
October .	2,700	3,900	7,400	2,550	109.20

1/Largely excludes redistilled metal. 2/Held by reporting companies. 3/Apparent consumption. 4/Based on final figures.

- Activated carbon from Texas lignite (VI:7;51-52)
Alumina, Northwest source of vital (VI:10;65-67)
Aluminum (VI:4;23)
 Dust treatment for silicosis (VI:9;63-64)
Annual Mining Institute at the University of Washington, Seattle (VI:12;82)
Another Tall Tale of a Sourdough (VI:3;20)
Antimony (VI:4;23)
 Oregon (VI:10;70)
Auger hole prospecting (VI:12;77-81)

Bismuth (VI:3;15-20)
Blast hole diamond drilling (VI:5;36)

Carbon, activated, from Texas lignite (VI:7;51-52)
Chrome
 Chemicals discussed (VI:8;57-58)
 Mining activity (VI:6;43)
Chromite (VI:4;22)
Clearing House (VI:1;5) (VI:2;14) (VI:11;76)
Coal
 Coming era (VI:4;25-28)
 Shortage (VI:6;44)
Coming coal era (VI:4;25-28)
Copper (VI:4;23)
Critical materials (VI:4;28)
Cyclone Gap property (VI:6;43)

Declaration of policy of Northwest Mining Association (VI:12;82)
Department notes (VI:10;70)
Diamonds (VI:1;1-5)
Doe Yak (VI:8;58)
Domestic mineral reserves (VI:4;21-25)
Don't you believe it! (VI:4;21-25)
Dry ice industry in the Pacific Northwest, The (VI:11;71-76)

Fluorspar (VI:6;37-43)

Geologic report on high-alumina clay deposit near Molalla, Oregon (VI:10;70)
Glaze, What's in a? (VI:2;7-12)
Gold, Bearing on ownership of our "useless" stocks at Fort Knox (VI:9;62-63)
Grant County, Oregon, mining news from (VI:7;52)
Grey Eagle chrome mill (VI:6;43)

Harrison commissioned in Navy (VI:5;36)
High-alumina clay deposit near Molalla, Oregon, geologic report on (VI:10;70)

Illinois chrome mine (VI:6;43)
In appreciation (VI:2;12-14)
Iron (VI:4;23)

Lead (VI:4;23)

Magnesium (VI:4;23)
Manganese (VI:4;22)
Mercury (VI:4;22)
 Production in the United States in 1943 (VI:1;6) (VI:6;44)
 In July 1944 (VI:9;64)
 In May 1944 (VI:7;46)
 In October 1944 (VI:12;84)
 In September 1944 (VI:11;76)

Microchemistry in research and industry (VI:5;29-36)

Minerals needed (VI:10;68)

Mining Association, Oregon (VI:12;81)

Mining news from Grant County, Oregon (VI:7;52)

Molybdenum (VI:4;22)

Nickel (VI:4;22)

Nixon, Earl K., joins Freeport Sulphur Company (VI:4;28)

Northwest Mining Association, declaration of policy (VI:12;82)

Northwest Source of Alumina Vital (VI:10;65-67)

Oregon antimony (VI:10;70)

Oregon mineral production (VI:10;67)

O and C Lands

Bill, Mining laws in (VI:12;82)

Mineral discovery hamstrung in western Oregon (VI:8;53-54)

Mineral leasing bill (VI:7;48-51)

Mineral rights in revested Oregon lands (VI:7;45-46)

S. 1982 (VI:8;54-55)

Pioneers, The (VI:10;69)

Quicksilver production (VI:10;68)

Shortages (VI:8;55-56)

Silicosis, aluminum dust treatment for (VI:9;63-64)

Sourdough chrome mine (VI:6;43)

Strategic notes (VI:8;55-57)

Synthetic rubber (VI:8;56-57)

Tin (VI:4;21)

Tungsten (VI:4;22)

"Useless" gold stocks at Fort Knox, Bearing on ownership of our (VI:9;62-63)

Vanadium (VI:4;22)

Western States Mining Conference (VI:9;59-62)

What's in a glaze? (VI:2;7-12)

Zinc (VI:4;23)