

OREGON'S MINERAL INDUSTRY IN 1965

By Ralph S. Mason*

Oregon's mineral industry surged upwards to an all-time high in 1965, with a preliminary estimate by the U.S. Bureau of Mines of \$68,457,000. This is a 7-percent increase over the previous year. Of particular interest, at a time when price increases are common throughout industry, is the hold-the-line performance turned in by Oregon producers of lime, stone, and sand and gravel. These three commodities accounted for 70 percent of the total value of state mineral production and individually scored tonnage gains ranging from 7 to 15 percent. Not one of these three commodities increased in unit value, however, and two of them decreased somewhat.

The state's metallurgical industry continued strong and healthy. Plans were announced for a new steel mill; enlargements to an existing reactive metals plant; and increased productive capacity at a large mine and smelter.

Employment in the state's mining industry increased 13 percent over last year -- more than three times as much as in the booming construction industry. Mercury producers, reacting to skyrocketing world prices, were active at several mines scattered across the state.

Offshore oil exploration saw two deep-water rigs in action, with four deep tests completed. Hopes for offshore hard-minerals mining were snuffed by failure of the state to enact legislation at the last session of the legislature.

The Metals

Mercury

Interest in cinnabar deposits throughout the state increased predictably after the unprecedented rise in mercury prices. A detailed report on mercury activity in the state during 1965 follows this general summary.

Gold and silver

Big news in Oregon gold circles was the announcement late in the summer that the Buffalo mine in the Granite district of eastern Grant County

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Some of Oregon's Minerals at a Glance
Preliminary Figures for 1965
(in thousands of dollars)

	<u>1964</u>	<u>1965</u>
Clays	\$ 262	\$ 248
Gold	23	13
Lime	1,918	2,022
Sand and gravel	25,158	24,000
Stone	19,296	22,000
Misc. *	16,631	18,372
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Estimated total	\$64,269	\$68,457

* Cement, copper, diatomite, gem stones, lead, nickel, silver, zinc.

had been sold to the Union Pacific Railroad. James P. Jackson, Jr., owner-operator of the mine, will continue to direct operations. The new owners have announced that operations will be accelerated. The Buffalo has a record of production extending back to 1903. The 600 level, developing an additional 250 feet of ore below the lowest workings on the 400, was driven by Jackson several years ago. This last summer Union Pacific conducted a diamond drilling program to determine mineral-

ization beyond the present limits of the underground workings.

Oak Mine, Inc., of Grants Pass explored the Oak mine near Jumpoff Joe Creek in northern Josephine County. Reopening work was conducted by Lloyd Frizzell, Bob Shannon, Ernest McTimmonds, and Francis Adams. The main values are in copper, zinc, gold, and silver. The ore consists of sphalerite, pyrite, pyrrhotite, chalcopyrite, and some galena.

The Turner-Albright copper and gold mine southwest of Grants Pass in southern Josephine County was explored during the year by McPhar Geophysics, Ltd., of Toronto, Canada. Exploration consisted of drilling out an anomaly discovered last year with an induced polarity survey. Massive, brecciated sulfides were encountered between the north and south workings. Lloyd Frizzell, consulting geologist, supervised the drilling, which was done by Bob Shannon of Grants Pass.

Dave Vallandigham of Provolt completed construction of a gold mill on Powell Creek in southern Josephine County, and reworked ore from the old Dark Canyon mine dump. The mill circuit includes a primary jaw crusher, 25-ton ball mill, Clark Cone, sand classifier, a four-cell Denver flotation unit, and a 15-foot Wilfley table. Vallandigham plans to break new ore in the mine in the near future.

Juan Muñoz of Prineville retimbered the old Mayflower mine in Crook County and performed a detailed sampling of the workings. The Mayflower is an old gold-silver producer which was discovered about 1885.

Gerald Whitney of Athena re-activated his gold placer property in the Mormon Basin district of northern Malheur County. The property was operated prior to World War II but has been inactive since that time. Due to shortage of water, the placer can be worked only in the spring and early summer.

Old hard-rock gold mines sometimes never die. The Ashland mine

near the city of Ashland in southern Jackson County is being refurbished as a tourist attraction. The Ashland consists of more than two miles of tunnels and shafts and has a history of production reaching back before the turn of the century. Ben Gassaway and Norman Easley are planning to reopen the mine, using a narrow-gauge railroad to haul visitors to stations underground where typical mining equipment will be in operation.

The Oregon King mine in Jefferson County continued to explore and develop ore on several levels during the year. The mine is known for its high silver content, with relatively smaller amounts of gold.

Nickel

Hanna Mining Co. continued to mine and smelt nickel ore at its Riddle, Douglas County, installation. As a result of additional smelter capacity installed in 1964 and minor improvements in 1965, the labor force has been increased to about 500 men. The Hanna operation has been in continuous production since 1954.

Antimony

W. H. Holloway continued development at the Jay Bird mine in southern Jackson County. In Baker County, A. W. Brandenthaler explored the old Gray Eagle mine near Baker. A disseminated ore zone was struck on the 165-foot level late in the year.

Exploration projects

Federal Resources Corp. of Salt Lake City terminated its exploration work in the Bohemia district of Lane County in mid-year. The Bohemia district has long been known for its gold, silver, copper, lead, and zinc mineralization. At the Lucky Boy mine in the Blue River district of Lane County, a California group did some minor exploration for lead and zinc.

Industrial Minerals

Sand and gravel and stone

As the year 1965 came to a close, value of sand and gravel and stone totalled \$46,000,000 and represented 39,000,000 tons of products. The \$46,000,000 is the pit-price and the 39,000,000 tons rebuilt dikes, dams, reservoirs, and miles of roads and highways destroyed by the December, 1964 floods. Some of this vast tonnage of construction material went into new concrete buildings which formed the nucleus of the building boom that helped bring the state's economy to a fast boil.

Oregon producers of stone and sand and gravel also turned in a remarkable performance by holding down the selling price. The stone producers sold their product for a cent less per ton than they did a year ago, while sand and gravel actually declined from an average of \$1.38 per ton in 1964 to \$1.20 in 1965.

Industry's awareness of some of the problems arising from gravel-pit operation in areas adjacent to housing developments was indicated by an operator at Salem. Applications for zone changes to permit expansion of operations were coupled with long-range plans to convert the area into housing with a central lake occupying the abandoned pit.

Two Oregon products, native ingenuity and concrete, were combined by Paul Harmon, a Eugene contractor, to produce a long-overdue improvement to motoring. Harmon invented and is manufacturing a pre-cast, one-piece railroad crossing which is simply dropped into place across the highway. The rails fit into preformed slots.

Lightweight aggregates and pozzolan

Empire Building Materials Co. and Cloverleaf Mines, Inc., continued to mine and process expansible shale at their quarries in northern Washington County. In addition to producing lightweight concrete aggregate, Empire turned out pozzolan for use in concretes at the \$250,000 pozzolan mill erected at its Sunset Tunnel plant site. Empire announced plans to market dry-bagged masonry pozzolan-cement to replace the lime-cement mortars which have been used in construction for many decades. Ready-mix concretes using 25 percent pozzolan are specified for jobs using pumping equipment to place the concrete. Pozzolan reduces cost, improves workability of the mix, and reduces heat of hydration during the setting period.

Pozzolan was also produced at a plant in Gilliam County run by Permanente Cement Co. Raw material is a gray, finely divided volcanic ash. Some of the plant's output was used in the construction of the John Day Dam on the Columbia River.

Two operators at Bend in central Oregon, Boise-Cascade and Central Oregon Pumice Co., continued production of natural lightweight aggregates. Both lump pumice and scoria are mined by the companies and crushed and blended into a variety of mixes.

Lightweight concretes were used increasingly in commercial and public construction, as architects turned more and more to pre-cast slabs and modules, many of them of intricate design and of considerable size.

Pacific Diatomite Co. mined and processed diatomite from its pits in northern Lake County. The company markets industrial absorbents and extenders, and is experimenting with insulation board and pipe and conduit coverings. Drilling at the deposit north of Silver Lake revealed a thickness of at least 40 feet.

Building stone

Quarrying operations were carried out at the Kah-nee-ta Stone quarry on the Warm Springs Indian Reservation in Wasco County by the Stone Center; at the Moon Mesa quarry on Dooley Mountain in Baker County by A.W. Brandenthaler; at the Willowdale quarry in northern Jefferson County by Ray Bohlman; at the Cinder Hill Co. quarry in Deschutes County; and at the Jones Marble quarry in Josephine County by W. H. Holloway. The Kah-nee-ta, Cinder Hill, and Jones Marble quarries produced various-sized pieces of rubble; Moon Mesa supplied either rubble or veneer; and Willowdale sawed blocks out of the solid in a variety of lengths.

Lime, limestone, and cement

Chemical Lime Co. quarried high-grade limestone during the snow-free months at its Baboon Creek quarry high in the Elkhorn Mountains of Baker County. The stone was burned at the company kilns near Baker and sold as either burnt or hydrated lime. Oregon Portland Cement Co. quarried stone at Lime, Baker County, and produced portland cement at its plant nearby on Burnt River. The Oswego plant in Clackamas County, also operated by OPC, used limestone barged from Texada Island, B.C. Ideal Cement Co. manufactured cement at its Gold Hill, Jackson County, plant, using limestone trucked from Marble Mountain in Josephine County. Ideal suffered considerable damage to its power-plant facilities on the Rogue River during the 1964 Christmas floods. Ash Grove Lime & Portland Cement Co. operated its highly automated lime plant at Portland with stone obtained from Texada Island. The same source of raw material was used by Pacific Carbide & Alloys Co., Portland, for the production of calcium carbide. Oregon Portland celebrated its 50th anniversary and also 50 years of operation at its Oswego plant during the year. The company's second plant at Lime was fired up in 1923. A historical review of the company's activities appeared in the February 1965 ORE BIN.

Bentonite

Central Oregon Bentonite Co. quarried crude bentonite at its Silver Wells deposit on Camp Creek in eastern Crook County. The company sold its product for stock pond and irrigation canal sealing.

Materials for Lunar Research

Rocks from five localities in the state, selected by the New York Academy of Science as Lunar Reference rocks, were collected by the Department of Geology and Mineral Industries and shipped to various space-age companies and lunar research organizations. The rocks include basalt,

welded tuff, obsidian, rhyolite, and serpentine. In addition, several large blocks of basalt were shipped to a Baltimore firm that is developing a drill for use on the moon. Pioneer Construction Co., Portland, supplied the five-ton boulders from its St. Helens Road quarry. The possibility of using certain areas of central Oregon for "hard" and "soft" simulated lunar landings with spacecraft was explored by industry representatives during the year. The Surveyor lava flow on the flanks of Newberry Crater and some of the pumice flats in the Bend area were selected as possible test sites.

Metallurgical Plants

The exotic-metals industry complex located at Albany continued in full operation during the year. The Electrodevelopment Laboratory of the U.S. Bureau of Mines pursued its investigation of various refractory metals by means of electrometallurgical testing. Wah Chang Corp. extracted zirconium, hafnium, columbium, and tantalum metal from their respective ores. Increased zirconium demand kept production facilities operating at capacity. Commercial production and fabrication of high-strength columbium alloys also increased. Finished mill products were fabricated from zirconium, hafnium, columbium, tantalum, titanium, molybdenum, and tungsten. Northwest Industries machined reactive metals to close tolerances for high-temperature and severe-corrosion applications. Oregon Metallurgical began the erection of a titanium sponge plant to round out its production and fabrication facilities for this space-age metal. OreMet has been obtaining its sponge from various sources, including England and the Soviet Union. The new sponge furnace is scheduled to go on the line early in 1966. Integration of production facilities was prompted by marked increases in titanium castings markets.

Cascade Steel Rolling Mills announced plans to erect a steel rolling mill in Portland that will have an annual capacity of 50,000 tons. Reynolds Metals Co. started construction of a 30,000-square-foot cast house at its Troutdale plant. Vertical direct-current casting units, plus two 90,000-pound holding furnaces, are also being installed.

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MORE LAND WITHDRAWALS FOR FUN AND GAMES

A study of the land withdrawals in Oregon requested by the U.S. Bureau of Land Management and the U.S. Forest Service during 1965 reveals that more than one third has been for recreation. The balance of the lands which are to be withdrawn will be used for various purposes, mainly the creation of reservoirs--which will have definite recreational possibilities. A total of 16,944 acres is involved in the federal withdrawals from mineral entry.

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QUICKSILVER IN OREGON IN 1965

By Howard C. Brooks*

Quicksilver prices climbed to all-time highs during the year. Starting from an average of \$182 per flask for the month of August 1963, the value reached \$709 in June 1965 (Figure 1). As a result of the price spiral, Oregon again resumed its role as an important producer of the liquid metal. Approximately 1,400 flasks were produced during 1965 in contrast to output of only four flasks in 1963.

Most of Oregon's 1965 output came from two mines: the Black Butte in Lane County and the Bretz in Malheur County. Both were reopened in 1964 and resumed production late in that year. A combined total of about 10 flasks was produced during 1965 from the Canyon Creek prospect in Grant County, the Glass Buttes mine in Lake County, the Mother Lode mine and Bear claims in Crook County, and the Elkhead mine in Douglas County. Elsewhere in the state there was much prospecting activity.

A Review of the Market

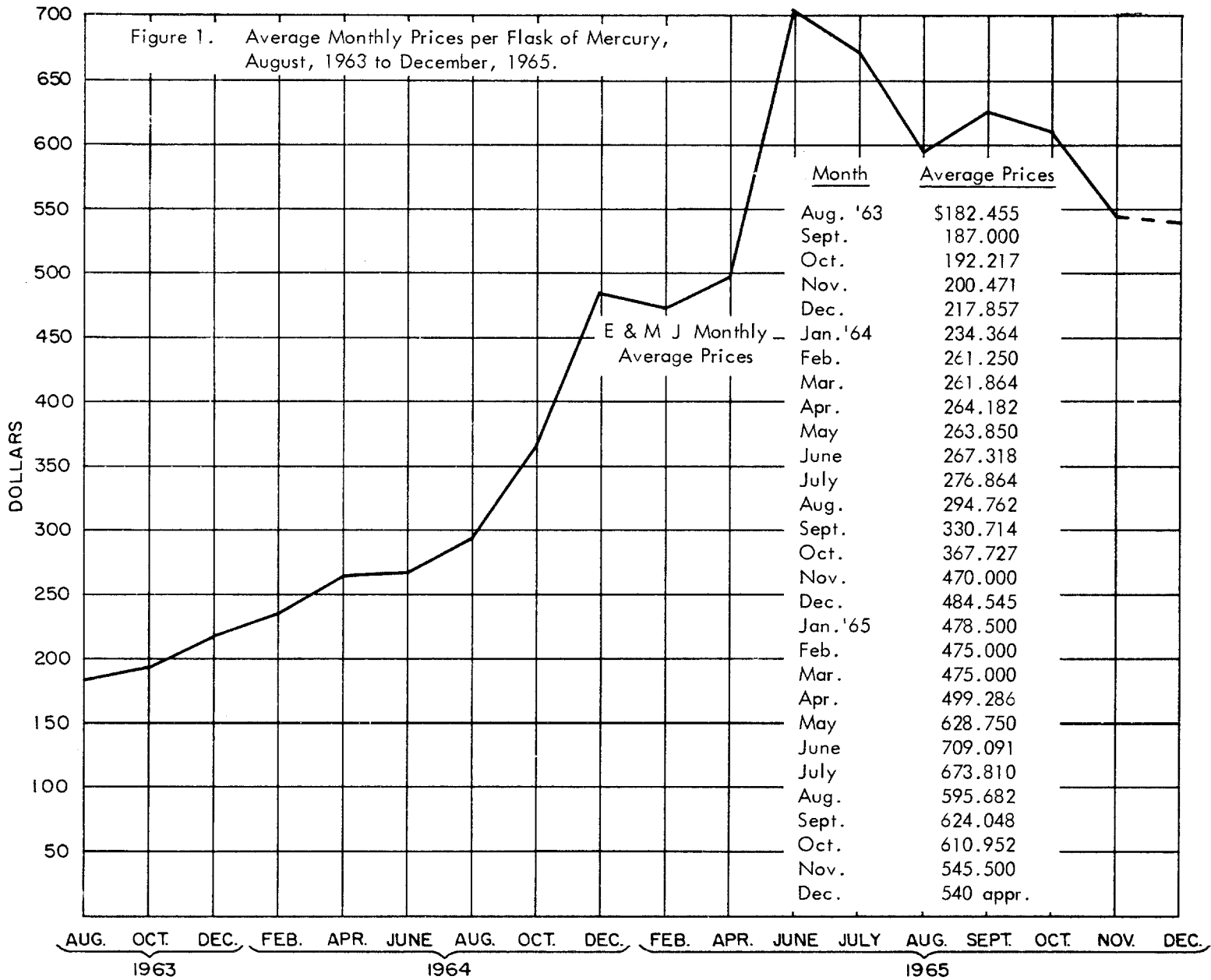
Market analysts agree generally that the cause of the 1963-1965 mercury price spiral was, very simply, lack of metal. Industrial consumption has been expanding greatly, while for several years mercury prices followed a downward trend that sharply curtailed mine output.

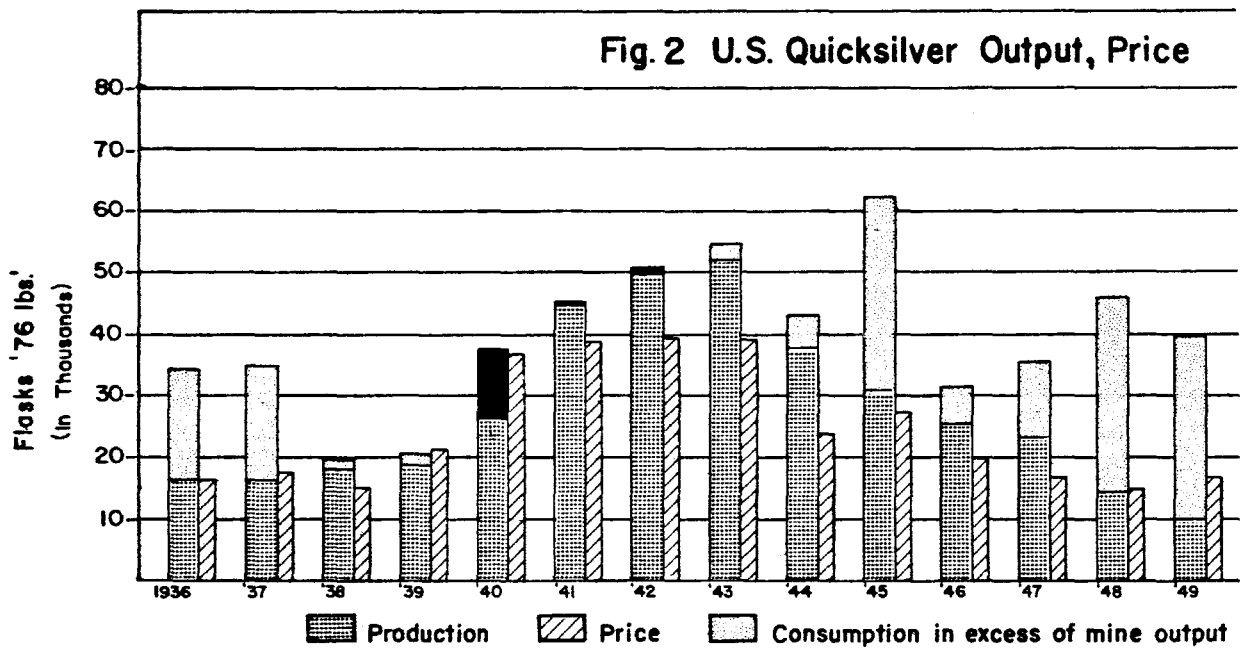
As shown in Figure 2, U.S. mercury consumption has been running a-long in excess of 50,000 flasks annually for 10 years. A sharp upward trend in consumption, beginning in 1961, reached an all-time high of 82,000 flasks in 1964. Despite this great demand, mercury prices dwindled steadily from an annual average of \$290 per flask in 1955 to \$189 in 1963. Mine output in 1958 was 38,067 flasks or about 72 percent of consumption. Production in 1964 was 14,142 flasks or only 17 percent of consumption.

The most important single factor in the supply pinch is the heavy demand for mercury for the expanding production of chlorine and caustic soda. These two basic big-tonnage chemicals are used in the manufacture of paper, plastics, textiles, rubber, glass, paints, pharmaceuticals, and a wide variety of other products. Consumption has also been rising sharply in such fields as the manufacture of mildew-proofing and anti-fouling paints, pharmaceuticals, dental preparations, and general laboratory use.

Figure 3 shows how United States production, plus imports, has lagged behind consumption since 1961. At the same time, world output fell from

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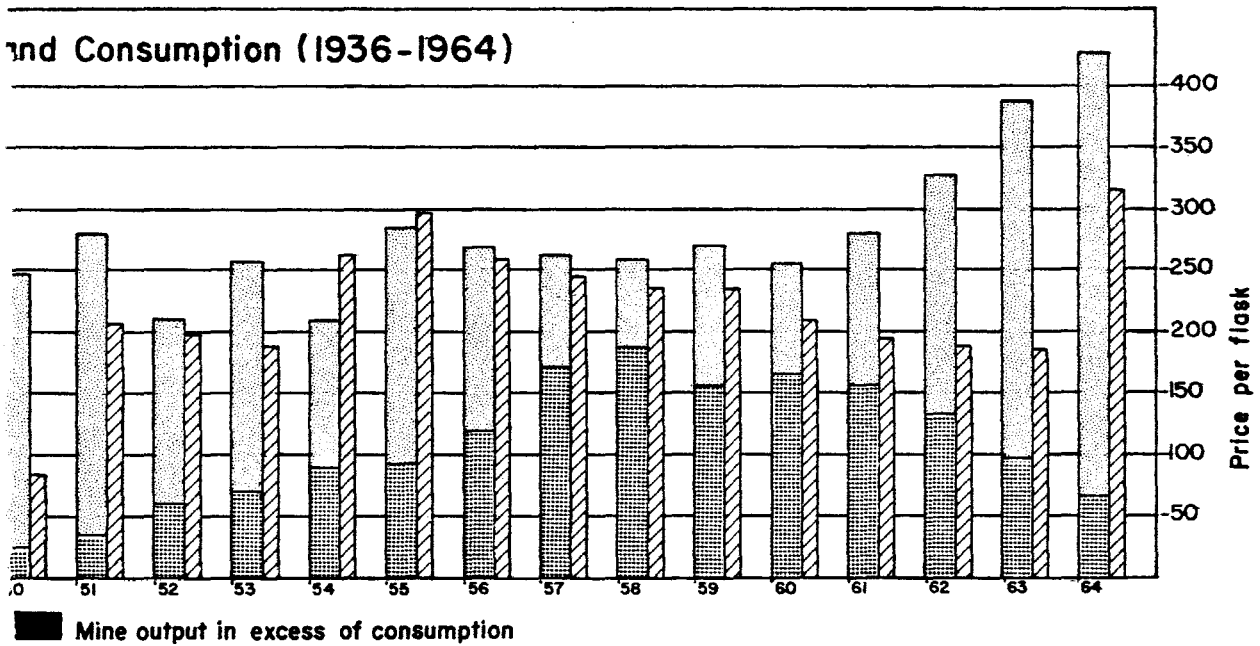


242,000 flasks in 1960 to 239,000 in 1963. Also, in 1963 Russia and China began importing quicksilver for industrial use, whereas formerly they exported it.

The bulk of the world's output of quicksilver comes from 7 countries which, in the order of their productivity in recent years, are: Italy, Spain, the United States, Russia, China, Mexico, and Yugoslavia. Spanish and Italian production accounted for 40 to 50 percent of world output in recent years, while United States producers accounted for only 10 or 12 percent. This means that Spain and Italy normally control the world market price of quicksilver. American producers have neither a large enough share of the market nor the financial strength to absorb the short-range loss necessary to firm a depressed market, and therefore must dance to whatever tune Spain and Italy choose to play. Most domestic producers can operate only when prices are high. In 1964 domestic output came mainly from three mines: Cordero in Nevada and New Idria and Buena Vista in California. Almost certainly these mines would have closed before now if the price break had not come when it did.

The price escalation began in September 1963 when Monte Amiata, Italy's largest producer, stopped selling and announced that it wanted more money for its product. A few weeks later, Spain temporarily withdrew from the market because of lack of supplies. Encouraged by these events, United States producers became reluctant to part with their product and prices rose steadily upward. United States brokers and consumers then became fearful and began attempting to fill their larders against future needs before prices

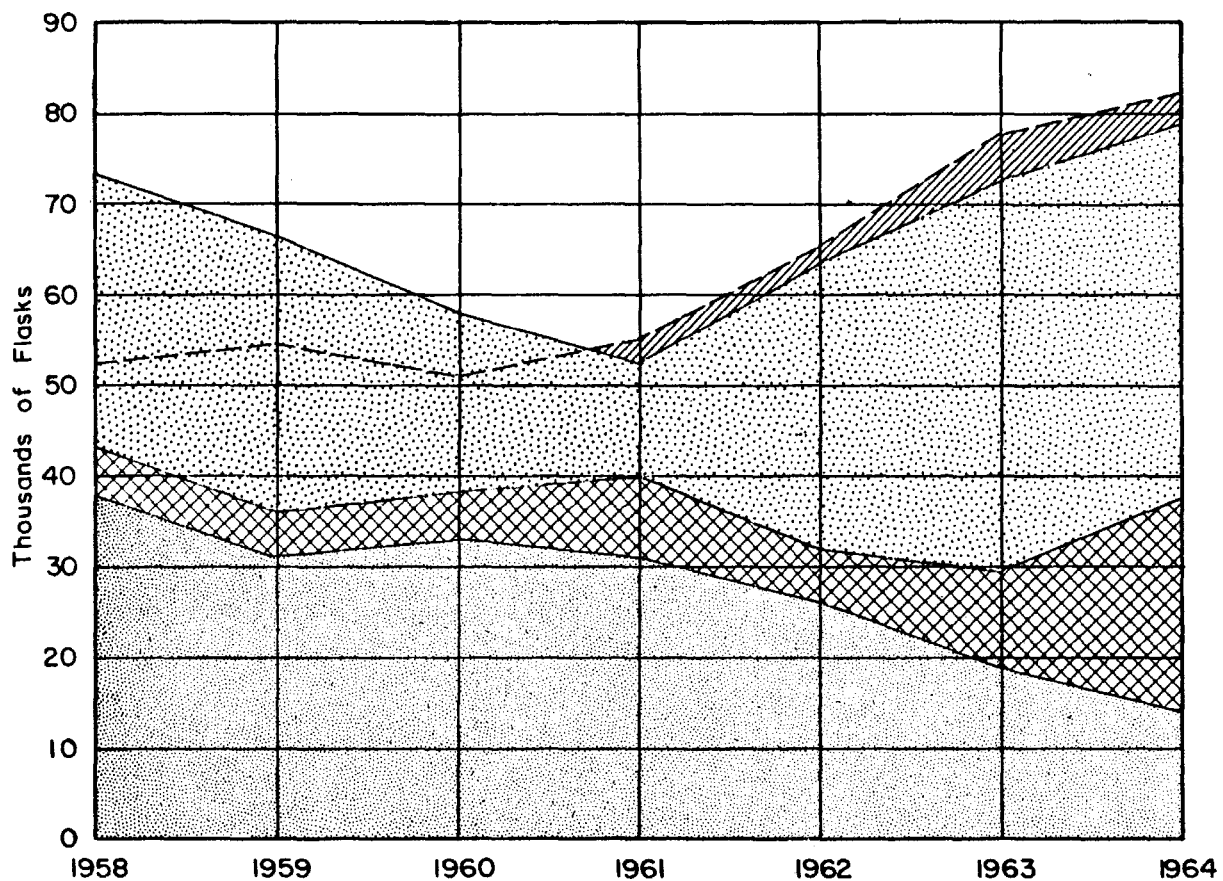
and Consumption (1936-1964)



should get out of hand. With this added burden on the market came the realization that the world's mercury cupboard was getting bare. Prices then rocketed from a \$267 average in June 1964 to \$505 on November 20. The average selling price for December was \$484. Prices settled back slightly to around a \$475 average for the first three months of 1965; then in April they took off again, reaching the all-time monthly average high of \$709 per flask in June. From this peak, prices have declined to an estimated average of \$540 for December.

Prices might yet be in the \$600 to \$700 range were it not for the intervention of the United States Government. In March 1964 the Atomic Energy Commission released as excess to its needs some 72,500 flasks of the metal. Of this 55,000 flasks were made available for public sale through the General Services Administration. Great concern was voiced by American producers, and Government-industry hearings were held to discuss disposal plans. At the time very few people realized just how scarce mercury really was, but everyone involved could readily predict that 55,000 flasks dumped on the market would wipe out the domestic industry, already nearly defunct because of the long price depression. However, when domestic consumer needs became urgent, emergency offerings were called for and sales began in February 1965. More than 30,000 flasks were sold by year's end -- most of it considerably below existing market prices. In October an additional 38,000 flasks of AEC surplus stock was turned over to GSA for future sale.

A new uptrend in domestic production has begun. Old mines are being reopened and prospectors are heading for the hills in large numbers.



--- Consumption
 ▨ Consumption in excess of supplies
 ▩ Imports
 ▧ Secondary
 ▫ Mine output

Year	Mine output	Secondary	Imports	Total supplies	Consumption
1958	38,067	5,400	30,196	73,663	52,617
1959	31,256	4,950	30,260	66,466	54,895
1960	33,223	5,350	19,515	58,088	51,167
1961	31,662	8,360	12,527	55,549	55,763
1962	26,277	5,800	31,516	63,593	65,301
1963	19,100	10,520	43,126	72,746	77,963
1964	14,142	23,780	41,107	79,029	82,608

Figure 3. United States quicksilver consumption versus supplies, 1958 to 1964. (From U.S. Bureau of Mines statistics.)

How long the boom will last is debatable, but past performances of the market indicate that present high prices will bring about eventual over-supply of mercury and a subsequent depression in prices. This has happened four times since World War I. Unless United States' mineral policies are changed there is little reason to expect that it will not happen again. For many years industry leaders have been pleading with the Government to establish a policy that would stop the yo-yo-type existence of the mercury producers. As a matter of fact, all that industry has received from Government is harassment. For example, the 110,500 flasks declared surplus by Government in 1964-65 represented almost as much quicksilver as domestic mines produced in the past 5 years. One can only marvel at the tenacity of the quicksilver miner and wonder what sort of "helping hand" Government will offer next. The really distressing factor is that without a healthy domestic industry the United States is almost totally dependent on foreign sources of supply that could be cut off in time of war.

Oregon's Quicksilver Industry

Quicksilver occurrences are widely scattered throughout Oregon. More than 250 deposits have been prospected over the years and quicksilver has been produced from at least 70 of them. Most of the productive ones in the past have been in the southwestern, central, and southeastern parts of the state.

Oregon quicksilver mines have produced a total of about 105,000 flasks valued at 15 million dollars. More than 90 percent of past production has been contributed by 5 mines: Bonanza in Douglas County, Black Butte in Lane, Horse Heaven in Jefferson, and Bretz and Opalite in southern Malheur. The Bonanza is the largest producer with an output of 39,488 flasks. Yield from the other 4 ranges from 12,000 to 17,500 flasks each.

Since 1927, when continuous production began, trends in output have closely followed the cycles of United States production. The yearly average output from 1927 through 1945 was 4,265 flasks, with a peak of more than 9,000 flasks in both 1940 and 1941.

Following the cancellation of purchase contracts late in World War II and the acquisition of large stocks of foreign quicksilver by the United States Government, prices began a decline which resulted in closure of nearly all domestic quicksilver mines. Oregon's production in 1950 was 5 flasks valued at \$81.26 per flask.

High prices brought about by the Korean conflict and Government support programs during the 1950's saw partial revitalization of Oregon's quicksilver industry, and 3,993 flasks were produced from 8 mines in 1957. From this, Oregon output dwindled to 4 flasks from a single property in 1963. A detailed account of Oregon's quicksilver industry and descriptions of the mines and prospects are given in the Department's Bulletin 55, "Quicksilver in Oregon," published in 1963.

As a result of the price rise in 1964, the Black Butte and Bretz mines were reopened to produce most of the 126-flask output for the state that year, as well as most of the 1,400 flasks for 1965. Prospects are good for continued operations at these and some of the other mines, assuming continued strength of the market. Figure 4 shows the location of mines and prospects that were active during 1965.

Quicksilver Developments During 1965

Black Butte mine

The Black Butte mine in southern Lane County lies near the head of the Coast Fork of the Willamette River 17 miles south of Cottage Grove. The deposit was discovered in 1890. Output from several different periods of operation totaled about 16,500 flasks. The period of greatest productivity was from 1927 to 1943, when 13,571 flasks were produced by the Quicksilver Syndicate, which still owns the property.

Except for a short time during 1956-57, the mine lay idle from 1943 until present operations were begun by the American Mercury Corp., lessees, in 1964. The furnace, a 4-foot by 60-foot rotary kiln, installed in 1956 but little used, was revamped and production began in November. The furnace has a capacity of 80 tpd and is oil fired. Present output is at the rate of about 70 flasks per month from ore averaging $2\frac{1}{2}$ to 3 pounds per ton. Recovery averages 97.5 percent.

Thirty people, including office and supervisory personnel, are employed at the mine. Ten to twelve miners work on each of two shifts, and four men operate the furnace plant on staggered shifts. Burt Avery, formerly of the Bonanza mine, is superintendent. The mine foreman is Ralph Emerson. Mining by the present operators has thus far been confined to the 1,100 and 900 levels with the 1,100-level adit being the main access and haulageway. The ore is trucked from there to the furnace plant, less than half a mile away. Small bunches of ore left from previous operations are being exploited and new ore is being developed as the 1,100 level is driven to the southeast.

A new adit level 125 feet below the 1,100 level is being driven in the search for ore. Plans call for drifting southeastward along the main ore zone with close-interval long-hole drilling. Very little exploratory work has been done between the 1,100 level and the 1,600 or Dennis Creek level 500 feet below.

Bretz mine

The Bretz mine lies in the Opalite mining district of southern Malheur County, Oregon and northern Humboldt County, Nevada. The district is centered about 15 miles west of McDermitt.

Mining began at the Bretz in 1931. Production during three different periods of operation, 1931-36, 1940-44, and 1956-61, totaled 16,000 flasks. Six more or less distinct ore bodies scattered over a linear distance of 3,000 feet have been worked by open pit.

The present operations conducted by the Bretz Mining Co. involve an agreement between Samuel S. Arentz of Salt Lake City and Minerals & Chemicals Philip Corp. of New Jersey. Work to reopen the mine began in July, 1964. Production began in November and is now at a peak for the year of 120 to 150 flasks a month. Twenty-five men are employed.

During 1965 a large quantity of low-grade material stockpiled from previous operations was treated, and low-grade ore was mined from the edges of old ore bodies. Much exploration drilling was done, some to considerable depth. Prospects for continued operation are good, providing market prices remain strong. Underground mining is being considered for the future.

Ore treatment at Bretz differs from that at most mines. Instead of being furnaced directly, the ore is concentrated by flotation and the concentrates are then roasted in a small Herrshoff furnace. The float plant has a daily capacity of about 150 tons. Over-all tonnage of ore treated is much greater than this, however, since much waste rock is previously removed by a new scrubber unit which was added to the mill circuit in 1964.

Baker County

Old workings of the Paramount prospect near Greenhorn were reopened and examined by Tony Brandenthaler of Baker. Work ceased in late summer. Surface trenching and sampling was also done by Mr. Brandenthaler at the White Wonder prospect near Whitney.

Early in the year Robert Hulin and Fred Williams erected a one-tube, wood-fired retort on their Cave Creek property in the Burnt River Canyon area. Available surface ore proved too low grade for successful operation on so small a scale. Little or no new development work was done.

Crook County

National Minerals Corp. leased the old Mother Lode and Blue Ridge mines in the Johnson Creek district and the Bear claims in the Marks Creek district. Ore from the Mother Lode was trucked to Black Butte for treatment. Seventy dry tons of this ore yielded 243 pounds of quicksilver. Some additional surface trenching was done on the other two properties, but the company had financial difficulties and work ceased in October. Owners Dick Tooley, Shirley Quant, and Ed Brewer resumed development of the Bear claims and before shutting down for the winter produced a little more than a flask of quicksilver from high-grade ore, using a small retort at the Blue Ridge mine.

The Independent prospect adjacent to the Mother Lode mine was leased

to Juan Muñoz. Soil sampling and drilling was done and will be continued next spring.

At the Maury Mountain mines five miles south of Post, Oregon Pacific Industries Corp. leased the Lost Cinnabar No. 1 claim owned by Selby Towner. Some of the old workings were rehabilitated during the year. An extensive exploration program is reportedly planned for 1966. The adjoining Eickemeyer property is now owned by C. F. Taylor.

Curry County

Vern Shangle and Ed Pease of Medford took a short option on the Red Devil cinnabar prospect. The Red Devil, discovered in 1963 by Everett McTimmonds of Grants Pass, is near the head of Diamond Creek in secs. 8 and 9, T. 41S., R. 10W., just north of the California border. Bulldozer trenching and shallow drilling is said to show low-grade cinnabar mineralization over a considerable area.

Douglas County

Floyd Morin and Bill Holley formed the Alcona Mining Co. to operate the Elkhead mine. The old rotary furnace plant was completely rebuilt and enlarged. A small output was made late in the year. Ore was mined from the upper edges of the old glory holes by power shovel and trucked to the furnace.

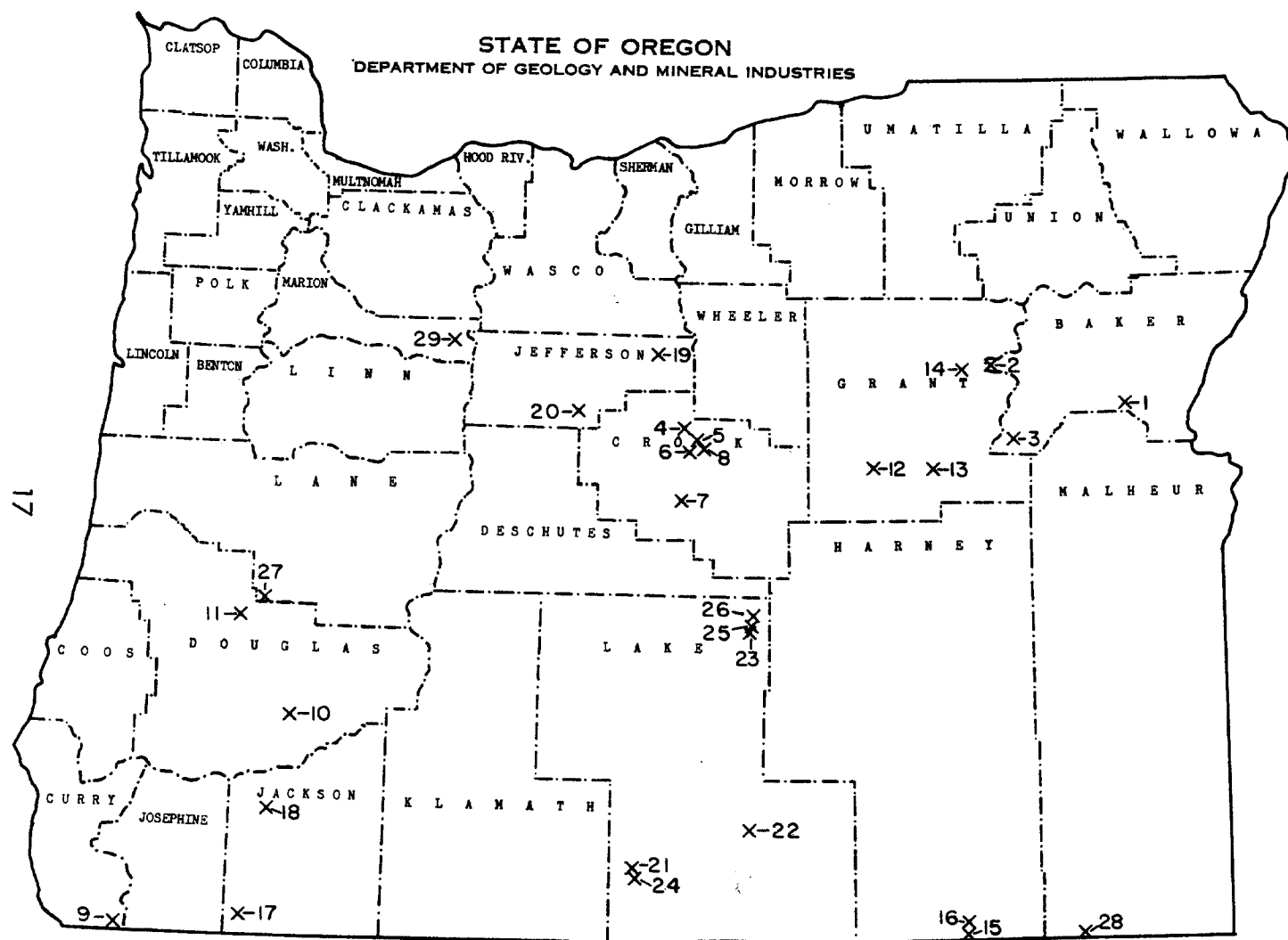
Charles Jackson and Vernon Lerwill located a new prospect in the Tiller-Drew area in sec. 17, T. 29S., R. 1W., and did surface prospecting and dozer trenching during the summer. Cinnabar at this occurrence is associated with a fault breccia zone in the Western Cascades volcanic series of Tertiary age.

Grant County

Cordero Mining Co. dropped its exploration sub-lease on the Canyon Creek prospect in early spring after completing contemplated tunneling and long-hole drilling. The prospect is near the south fork of Canyon Creek 12 miles south of Canyon City. Lessees Lawrence Roba and Banday Sintay resumed efforts to develop the mine but were financially unable to continue work beyond mid-summer. They plan work for 1966.

Production from this prospect, which was discovered in 1963, has been about 24 flasks, 20 in 1964 and 4 in 1965. Cinnabar occurs along a fault zone in upper Triassic graywackes and shales.

Broadway Minerals, Inc., was organized and leased the Broadway prospect in the Murderers Creek area southwest of Canyon City. The prospect is owned by Homer York of Prineville and Cecil Rannels of Canyon City. A 20-ton per day rotary furnace, formerly employed at Glass Buttes, was



Mine or Prospect	County
1. Cave Creek	Baker
2. Paramount	Baker
3. White Wonder	Baker
4. Bear*	Crook
5. Blue Ridge	Crook
6. Independent	Crook
7. Lost Cinnabar No. 1	Crook
8. Mother Lode*	Crook
9. Red Devil	Curry
10. Jackson and Lerwill	Douglas
11. Elkhead*	Douglas
12. Broadway	Grant
13. Canyon Creek*	Grant
14. Long Walk	Grant
15. Double Link	Harney
16. Hiveley	Harney
17. Doodlebug	Jackson
18. War Eagle	Jackson
19. Ashwood	Jefferson
20. Gray Butte	Jefferson
21. Angel Peak	Lake
22. Gray	Lake
23. Glass Ridge	Lake
24. Manzanita	Lake
25. McManmon-Justron Gp.*	Lake
26. Ryan Group	Lake
27. Black Butte*	Lane
28. Bretz*	Malheur
29. Breitenbush	Marion

Figure 4. Quicksilver mines and prospects that were active during 1965.

* Production in 1965.

moved to the property in mid-summer. No production was made. The old shaft was deepened to 50 feet and about 15 feet of drifting was done from the 40-foot level. Results were discouraging and work was stopped in mid-December.

Art Moothart, Jim Davis, and Harland Jones prospected a new discovery called the Long Walk in the Susanville area (sec. 14, T. 10S., R. 33E.). Several dozer trenches were cut during the summer, one of which exposed thin, widely spaced seams of cinnabar in sandstones and shales.

Harney County

Exploratory work, including drilling, was done by lessees on the Double Link prospect in the Pueblo Mountains east of Denio. Owners Woodley and Tiller report that construction of a treatment plant is planned.

Delbert Hiveley of North Bend reported discovery of a new prospect near Spring Creek in section 12, T. 40S., R. 34E., also in the Pueblo Mountains.

Jackson County

Joe Inman and Joe Fitzpatrick, veteran placer miners, teamed up with Chauncey Florey of Medford and are working the Doodlebug quicksilver prospect (old Palmer Creek prospect) at the head of Bailey Gulch off Palmer Creek. They have extended one of the old adits to more than 250 feet in length. A two-tube batch-type retort has been constructed and development ore is being stockpiled.

The portal of the "coal adit" at the War Eagle mine was reopened by Ben Baker and Dick Costello for owner Jack Bullock of Vancouver, Wash. Nothing further was done.

Jefferson County

Messrs. Rodman, Womack, Chandless, and Lyons of Culver, Oregon installed a small rotary furnace at their Gray Butte prospect east of Culver. The furnace has been used very little to date. Development of the prospect is continuing.

The Ashwood prospect, a quarter of a mile east of Ashwood, was leased for a short time during the summer to National Minerals Corp. An old open cut was enlarged and a short adit was driven.

Lake County

At Glass Buttes, exploratory work was done by three different companies. Jackson Mountain Mining Co. began surface exploration of the Ryan Group of claims in April and continued through December. Numerous

dozer trenches were cut and a small amount of rotary drilling was done. A large tonnage of low-grade opalite ore is said to have been developed and plans for construction of a treatment plant are being considered. The McManmon-Justrom claims were leased to a group headed by A. G. Mackenzie and Vincent Ryan. Some diamond drilling was done but, according to McManmon, attempts to reach the projected main ore zone at a depth of about 500 feet were unsuccessful because of badly fractured ground. Equipment was removed in November. McManmon produced a small amount of quicksilver from ore high-graded from the property and treated in a retort at his home near Bend. Glass Ridge Mining Co. continued development, mainly bulldozer work, of its claims in the southern part of the area.

Homestake Mining Co. began a preliminary study of the Manzanita prospect in the Quartz Mountain area 30 miles west of Lakeview. The property is owned by Don Tracey, Ross Foster, Dean Lange, and R. A. Briggs and sons.

In July the Angel Peak mine, also in the Quartz Mountain area, was leased to Raynold Johnson and an associate of Reno, Nev. Much bulldozer work was done but the results are said to have been discouraging. The furnace has been removed from the property. Johnson also leased the Gray prospect north of Plush late in the year.

C. H. Gillmore of Lakeview reported finding cinnabar near Cox Flat in the Thomas Creek area.

Marion County

At Breitenbush Hot Springs, where cinnabar was discovered in 1963, Earl Smith, John Hennamon, and associates have erected a 3-tube Rossi retort. No production has been reported.

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MINERAL EXPLORATION PROJECTS IN 1965

The Department initiated a long-range study of the Kalmiopsis Wild Area in Curry County in 1965, to map the geology and make an inventory of all mineral occurrences. The area contains at least 50 mines and prospects for gold, silver, copper, chromite, and iron. The Department's geochemical exploration program continued its testing for copper, molybdenum, zinc, and mercury in southwestern Oregon during the 1965 field season. Another Department field investigation during the year involved the use of electrical resistivity to extend known areas of ferruginous bauxite in northwestern Oregon. In a cooperative undertaking with the University of Pittsburgh, the Department obtained diamond-drill cores of Cenozoic lavas to be studied at Pittsburgh for variations in paleomagnetism.

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OIL AND GAS EXPLORATION IN 1965

By V. C. Newton, Jr.*

A new phase of offshore exploration was initiated in Oregon in April, 1965 when two oil company groups began drilling on federal shelf lands. Extensive seismic studies made between the years 1961 and 1965 indicated substantial thicknesses of sedimentary rocks under the continental shelf region bordering Oregon and Washington. Besides the favorable thicknesses of sedimentary rocks, folds and faults were defined which could provide traps for oil and gas accumulations. The next step in exploration, then, was to drill into the offshore rocks to see if they contained hydrocarbons.

Before deep drilling could be done on the State and Federal submerged lands, it was necessary for the oil companies to obtain leases. This they did by competitive bidding in October and December, 1964.

Four deep testholes were drilled off the Oregon coast in 1965; all were on Federal lands. Nine firms participated in the operations. It is fairly certain that no commercial amounts of oil or gas were found in these holes, but the companies have not released any details on the findings as yet. Comments by some of the oil company representatives suggest that drilling has closely verified seismic results; this is at least a favorable indication.

Exploration work onshore in Oregon last year was at a standstill. Gulf Oil Corp. abandoned the last onshore hole in February 1964. Gulf's "Porter 1" was located 14 miles southeast of Corvallis. This terminated operations in the Willamette Valley where, in 1962-1963, four deep wildcats were drilled within an 18-month period and more than 600,000 acres of land were under lease. Results of the Willamette Valley drilling were discouraging.

During the past 20 years of search for oil and gas in Oregon, 23 exploratory wells have been drilled deeper than 5,000 feet. More than half of these were in western Oregon. Figure 1 shows rock sections encountered in six of these deep drillings. It is evident from these logs that volcanic rocks played a prominent part in the Tertiary history of the State; however, sedimentary rocks attained considerable thicknesses in marine and continental basins. At least 15,000 feet of Tertiary marine sedimentary rock is exposed in western Oregon. Thick sections of Tertiary lake beds occur in continental basins of southeastern Oregon. In central Oregon, several thousand feet of unmetamorphosed pre-Tertiary marine rocks are exposed in

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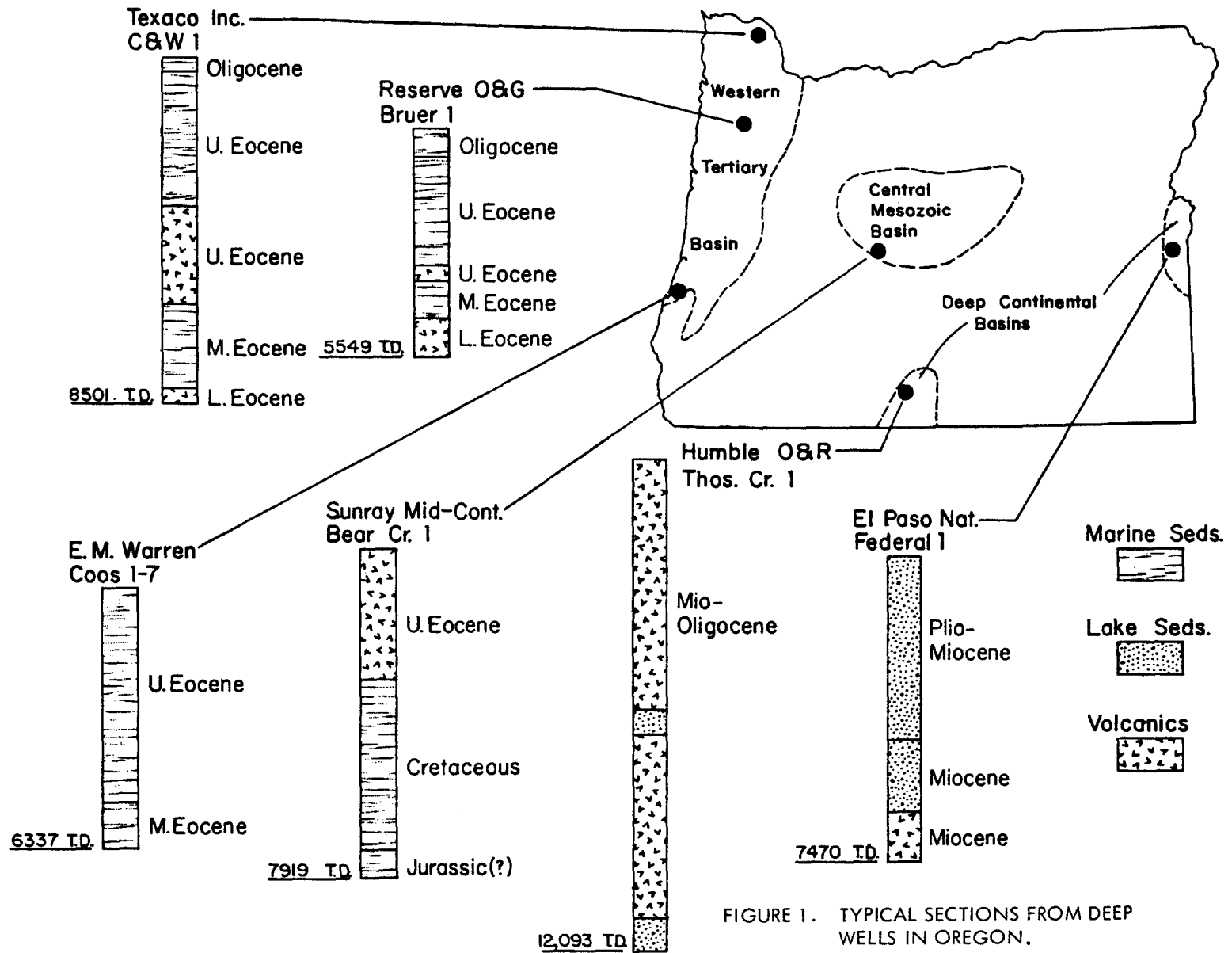


FIGURE 1. TYPICAL SECTIONS FROM DEEP WELLS IN OREGON.

windows of Tertiary volcanics.

Onshore Activity

The Department did not issue any new drilling permits in 1965; however, three permits were active, as follows:

<u>Permit</u>	<u>Company</u>	<u>Well</u>	<u>Location</u>	<u>Depth</u>	<u>Status</u>
18	Riddle Gas&Oil Producers, Inc.	Wollenberg 1	Sec. 28 T.30S., R.6W. Douglas County	1,100'	Plugged and abandoned 11-21-65.
52 PB*	Marvin Lewis	Crossley-Jennings 1	Sec. 31 T.6S., R.4W. Polk County	5,549'	Plugged and abandoned 8-27-65.
54	J. T. Miller	Ray Adams 2	Sec. 11 T.8S., R.5W. Polk County	622'	Abandonment pending 12-31-65.

* Originally drilled by Reserve Oil & Gas Co. under Permit 38.

The Department released the following well records after holding them confidential for the two-year period required by law:

<u>Permit</u>	<u>Company</u>	<u>Well</u>	<u>Location</u>	<u>Depth</u>	<u>Records</u>
51	E. M. Warren	Coos 1-7	Sec. 7, T.27S., R.13W. Coos County	6,337'	Sonic log Electric log Mud log Cuttings

Fewer oil and gas leases were in effect in Oregon last year than for any one-year period since 1950. An estimated total of 75,000 acres was under lease for hydrocarbon minerals on December 31, 1965. Private lands comprised approximately 56,500 acres of the total, Federal lands 17,300 acres, and State lands 1,200 acres.

Offshore Activity

Oil companies had to overcome many technological obstacles involving operations in deep water when they drilled four test holes to depths below 5,000 feet off the Oregon coast in 1965. In addition to mechanical problems, weather along the Oregon shore was found to be inclement even in the summer months and caused many delays in the work.

Standard Oil Co. of California and Union Oil Co. continued exploring



Figure 2. Western Offshore Drilling & Exploration Co. Barge No. III; it was converted from a World War II Navy tanker by Puget Sound Bridge & Dry Dock Co. at Seattle in 1964.

offshore in the Northwest as partners. The two firms jointly leased 167,000 acres of Federal outer continental shelflands in 1964. Wodeco III (Western Offshore Drilling & Exploration Co. Barge No. 3), a large, center-well drilling barge, was contracted for by Union and Standard for the drilling work (see figure 2). Drilling was begun on OCS (outer continental shelf) Tract 74 by the two companies on April 20, 1965, 11 miles off the coast from Lincoln Beach.

Rough seas thwarted the first two attempts to drill to 1,000 feet and set conductor pipe. During this time the ship's heavy crane was severely damaged while casing was being loaded, and Wodeco III had to be towed into Astoria for repairs. Despite several discouraging delays, a third test hole was drilled to 12,628 feet in 13 weeks. The hole was abandoned as a dry test.

Wodeco III was next moved 25 miles southward to Tract 57, 16 miles offshore from Seal Rock. Hard bottom at the new site would not allow

anchors to hold, so a core ship was ordered from Long Beach, Calif., to sink anchor posts. After eight weeks of drilling, which included delays caused by a troublesome heaving shale, the crews reached a depth of 5,600 feet. The drilling was suspended at that depth, because October storms made it increasingly difficult to hold the ship on location. Union and Standard indicated that the drilling on Tract 57 would be continued in 1966.

OCS Tract 57 is under lease to Pan American Petroleum Corp. and Atlantic Refining Co., but the fact that these two companies were unable to contract offshore equipment for drilling their Northwest leases in 1965 no doubt prompted them to give Union and Standard an interest in Tract 57 for the drilling of a test hole. Besides obtaining an interest in this tract, Union and Standard were able to evaluate a nearby site (Tract 55) which is under lease to them.

The drilling agreement allows both Pan American and its partners to obtain geologic data before another year passes. Geologic information is vitally important, since the Federal leases are valid for only five years unless production is found within that time.

Pan American and Atlantic Refining reportedly share interests in their 155,000 acres of Oregon and Washington OCS leases with Superior Oil Co., Canadian Superior, Sinclair Oil & Gas, and drilling contractor J. Ray McDermott.

Summary of offshore drilling in 1965.

<u>OCS Tract</u>	<u>Company</u>	<u>Well</u>	<u>Oregon Lambert coordinates</u>	<u>Depth Drilled</u>	<u>Water Depth</u>	<u>Status</u>
18	Shell	ET No. 1	X = 985,000' Y = 893,000'	5,600'	470'	Drilling
43	Shell	ET No. 1	X = 958,516' Y = 227,419'	3,348'	320'	Abandoned
43	Shell	ET No. 2	X = 959,642' Y = 227,714'	8,306'	325'	Abandoned
57	Union-Standard	Grebe No. 1	X = 978,950' Y = 327,200'	5,603'	195'	Suspended
74	Standard-Union	Nautilus No. 1	X = 1,020,659 Y = 457,162	12,628'	425'	Abandoned

In July, Shell Oil Co. towed the large floating platform Blue Water II from Eureka, Calif., to OCS Tract 43, located 17 miles off the coast from Newport. Drilling proceeded without any problems to a depth of 3,300 feet, then heaving shale became a serious obstacle. The test finally had to be abandoned because of the caving hole problem. The Blue Water II was moved

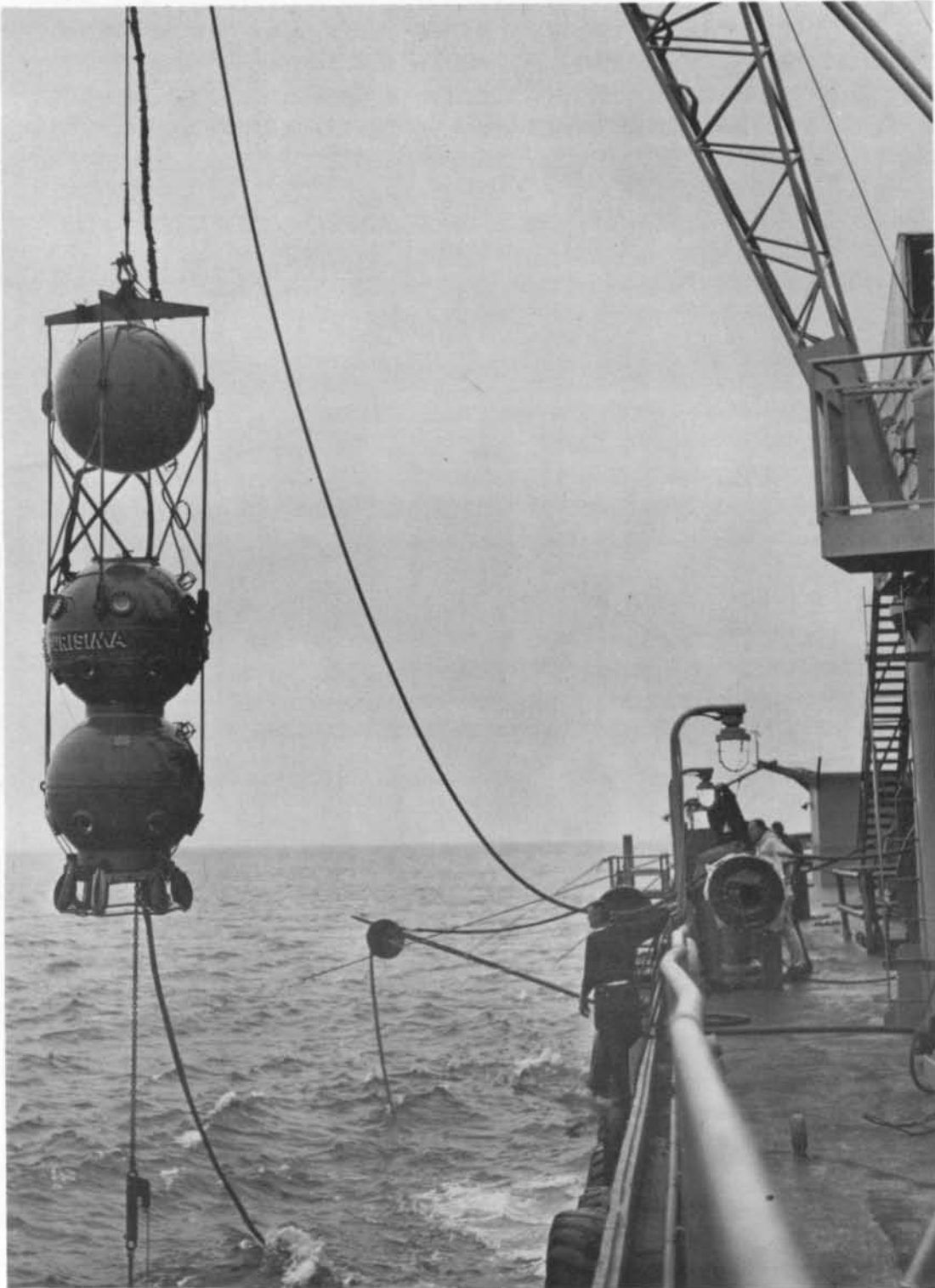


Figure 3. Diving bell used by Standard and Union Oil Companies for drilling operations off the Oregon coast in 1965.

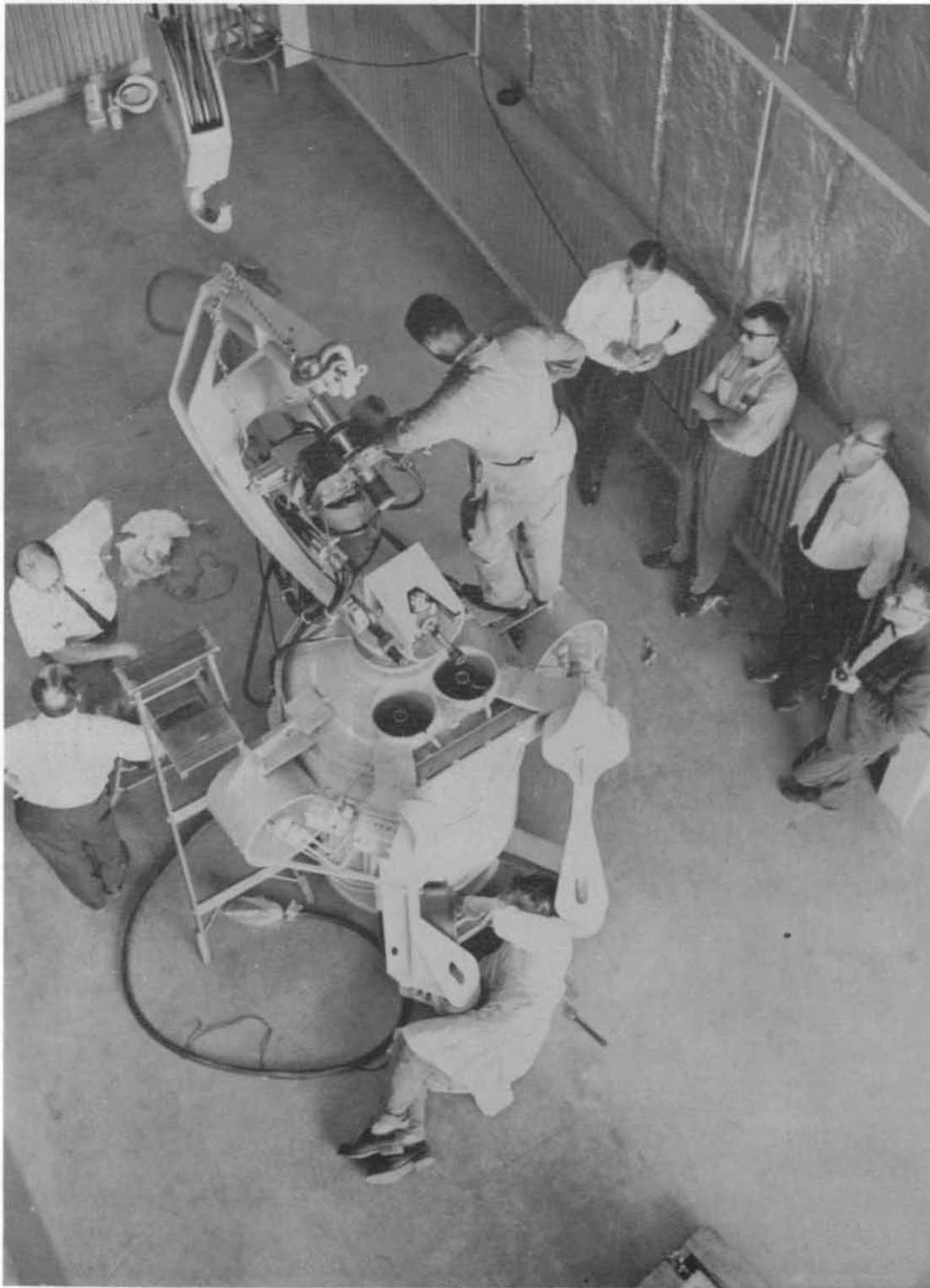


Figure 4. Shell Oil Co.'s \$300,000 underwater Mobot, which was developed jointly with the research group of Hughes Aircraft Co.



Figure 5. Electronic control panel for Shell's Mobot. Movements of the Mobot are monitored by use of closed-circuit television.

1,000 feet south and a second hole drilled to 8,306 feet. The hole was abandoned in October as a dry test.

Blue Water II was then towed 125 miles north to Tract 18, 25 miles offshore from the coastal town of Seaside, not far from the mouth of the Columbia River. Heavy seas and strong winds greeted the Blue Water II off the northern coast, so that three attempts were made before surface casing could be set. Drilling advanced to 5,600 feet before wind-driven swells caused the huge floating island to shift location and shear off the riser pipe connecting Blue Water II with installations on the ocean floor. Drilling was resumed after a three-week delay.

Offshore Research

The first season of drilling offshore in Oregon was one of experimentation. Techniques were tried which will be used in offshore work all over the world, especially in the North Sea, where water depth and weather are similar.

Remotely controlled latching devices for making connections with underwater wellheads were tested by both drilling groups in 1965. Standard and Humble gained experience with the apparatus while drilling with Wodeco III in 600 feet of water off the coast of southern California in 1964. The ship was moved off location in southern California waters to avoid a storm, and two weeks later returned to the site, re-entered the hole, and resumed drilling. Underwater television and sonar equipment enabled them to find the ocean bottom equipment and slip the drill pipe into the hole.

Union and Standard experimented with diving techniques as well as mechanical devices when they were drilling off Oregon last year. Divers from Ocean Systems, Inc., Santa Barbara, Calif., reached a depth of 422 feet while working for Union and Standard. Because of the extreme depth, the divers breathed a mixture of oxygen and helium to prevent bends. Divers stayed on bottom for several minutes, then spent three hours returning to the surface. After reaching the ship, they entered a decompression chamber for another three hours.

A diving bell was also employed on the Union-Standard operation. The bell consisted of two seven-foot spheres weighing five tons (figure 3). The diving bell (Purisima - a Union Carbide research vehicle) was designed to work at depths as much as 2,000 feet. One chamber can be kept near atmospheric pressure and the other at water pressure, so that an observer can use the upper compartment while a diver uses the lower one.

Shell's highly sophisticated underwater robot, or Mobot (manipulator-operated robot) was used in operations off the Oregon coast this past year (figure 4). The Mobot is approximately 14 feet tall and weighs 7,000 pounds, and can be used to a depth of 1,000 feet. The mechanical man's main tool is a socket wrench which exerts 1,000 ft./lb. torque at 20 rpm. Valves and bolts in the underwater installations are aligned in a horizontal plane, so that the Mobot can manipulate them.

The Mobot can be monitored from the surface through its television head and sonar-scanning gear (figure 5). Besides a socket-wrench arm, the Mobot has swimming motors which guide it to a track on the wellhead. Shell offers a similar but more versatile Mobot to industry on a lease basis for \$2,500 per 8-hour day and \$315 per hour overtime. Human divers are now competing with these Mobots, and one diving firm engaged in offshore work predicts it will have divers working at depths as much as 1,000 feet, breathing mixtures of oxygen and helium.

Offshore drilling equipment also provided a means of experimentation by Oregon State University's Department of Oceanography this past summer. University scientists placed electronic devices on the Wodeco III so that ocean currents and tidal surges could be studied. Results of this research will be published in an article written by W. V. Burt and S. Borden for a future issue of The ORE BIN.

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