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SUMMARY OF OIL AND GAS EXPLORATION OFF THE COAST OF OREGON AND WASHINGTON 1961 - 1966

By V. C. Newton, Jr.*

Oil companies will be hard pressed to evaluate all their holdings on the continental shelf bordering Oregon and Washington before the leases expire. Federal OCS (outer continental shelf) leases will terminate in December 1969 for those 5760-acre tracts not definitely established as productive. The five-year period 1961 through 1965 was a time of vigorous activity involving geophysical studies and test drilling. By the end of 1966, the oil industry had expended an estimated $73 million in the Pacific Northwest venture to test promising offshore locations. To date no commercial discoveries have been announced. The two summer seasons left for drilling operations must yield a discovery well, or interest will decrease until another exploration cycle is generated.

Originally, 101 lease tracts were taken in the October 1964 sale (600,000 acres), but 20 tracts were dropped in December 1966. This leaves 470,000 acres to evaluate before the close of 1969.

Results Examined

Assessment of geophysical data and borehole-survey records lies solely with the oil-company scientists, since such information is available only to them and will not be released to outside organizations for some time. However, many deductions can be made concerning the offshore prospects by observing the activity of exploration companies. Increases or decreases in operations are easily noted, and lease cancellations are open to public perusal.

Cancellations occurred following the drilling of deep holes in the Alsea, Siletz, and Heceta offshore lease blocks in Oregon and in the lease block off Willapa, Wash. (see table 1). Undoubtedly, the drilling showed these areas to be unproductive. Just as significant as the cancellations are the leases retained near deep test holes (see accompanying maps). Standard and Union retained leases near the hole in the Siletz lease block on the west flank of Stonewall Bank. Therefore, these leases must still hold promise.

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Table 1. Lease Cancellations*

OCS No.	Lease Block	Tract No. **	Lessee
PO90	Alsea Bay, Ore.	54	Pan Am. 50%; Atlantic 25%; Sinclair 9.375%; Superior 7.375%; Canadian Superior 6.25%; J. Ray McDermott 2%.
PO93		57	
PO94		58	
PO95		60	
PO96		61	
PO99		64	
PO103	Siletz Bay, Ore.	74	Standard Oil; Union Oil.
PO106		79	
PO107		82	
PO108		87	
PO130	Heceta Head, Ore.	136	Union Oil.
PO135	Heceta Head, Ore.	142	Pan Am. 50%; Atlantic 25%; Sinclair 9.375%; Superior 7.735%; Canadian Superior 6.25%; J. Ray McDermott 2%.
PO136		143	
PO137	Heceta Head, Ore.	144	Texaco; Atlantic; Mobil.
PO148	Willapa, Wash.	14	Pan Am. 50%; Atlantic 25%; Sinclair 9.375%; Superior 7.375%; Canadian Superior 6.25%; J. Ray McDermott 2%.
PO149	Willapa, Wash.	16	Shell 50%; Pan Am. 25%; Sinclair 10.9375%; Superior 9.9375%; Canadian Superior 3.125%; J. Ray McDermott 1.0%.
PO151	Willapa, Wash.	20	Pan Am. 50%; Superior 19.875%; Sinclair 21.875%; Canadian Superior 6.25%; J. Ray McDermott 2%.
PO152		21	
PO153		24	
PO160		36	

* Cancellation data obtained from: Branch of Oil and Gas Operations Office, West Coast Region, U.S. Geological Survey, Los Angeles, Cal.

** Maps showing lease tracts can be found in the November 1964 ORE BIN.

Most leases in the Heceta Bank area have been maintained even after the abandonment of two deep holes. Union Oil Co. dropped its $2 million tract following drilling of a 12,285-foot hole in 1966, while Texaco, Atlantic, Pan American, and others relinquished three tracts nearby but no others.

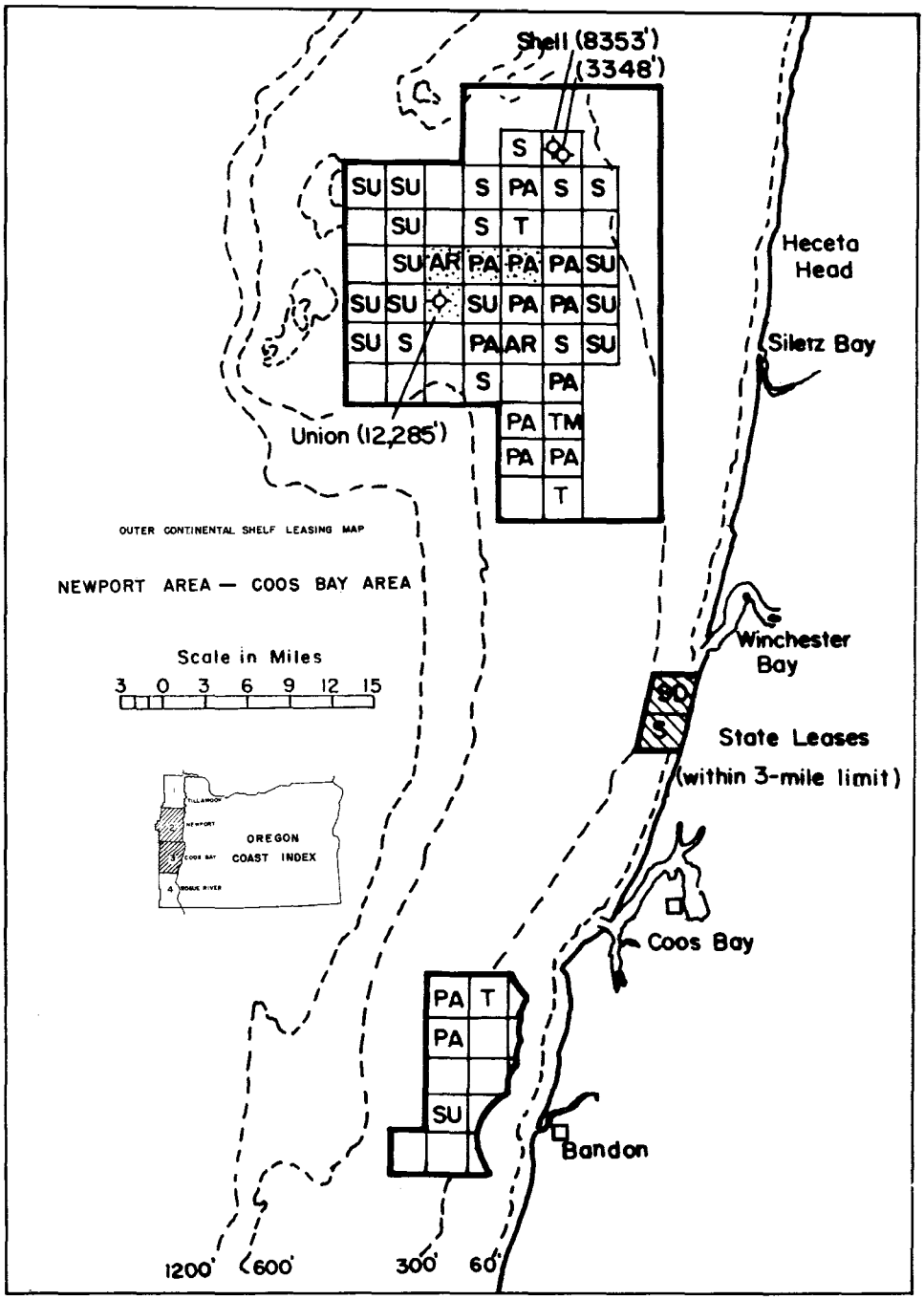
Shell Oil Co. has kept all of its offshore leases in Oregon and Washington, which is quite surprising since the firm has either drilled or been a part of the drilling of five of the eight holes thus far put down in the shelf region. It is also apparent that Shell has more information about the shelf geology than any of the other oil companies (see table 3). Attention should be drawn to the fact that Shell retained its lease off Willapa Bay with the deep hole drilled by Shell-Pan American Group, even though all the nearby leases were dropped. Several postulations could be made for this, but perhaps future deepening or redrilling is the most reasonable explanation. Sands containing hydrocarbons were tested and reported to be non-commercial. Re-entering the hole and drilling the lower portion in a new direction would allow testing of the sands at a nearby location, while utilizing the casing and the upper several thousand feet of the old hole. This would save the cost of drilling a second test on Shell's Willapa lease.

The decision by Pan American Petroleum not to bring Southeastern Drilling, Inc.'s large floating platform to the West Coast from Japan in 1966 was the first suggestion that at least some firms were becoming disenchanted with the Northwest shelf prospects. The conclusion to leave SEDCO "135A" in the South Pacific apparently came after an agreement was reached with Shell in the summer of 1966. Shell had an exclusive contract to operate the Blue Water II, but decided to let its competitors use the equipment. Most of Shell's leases are near enough to test holes to have been evaluated geologically, except three tracts in 1500 feet of water 30 miles off the coast from Tillamook and one tract 15 miles off the coast from Hoh Head. Since Pan American and others hold most of the leases in the Hoh Head area, Shell may agree to share costs of a test drilling with them.

Depth of holes drilled thus far off the Oregon and Washington coasts demonstrates that sediments are at least 15,000 feet thick. Some reports suggest thicknesses in excess of 20,000 feet. However, siltstones and mudstones are found to be the dominant rock types, with occasional sands. Clay and volcanic ash no doubt limit the permeability of the sands, a situation which is prevalent onshore along the coast. Apparently geologic conditions found to date in the search are partly encouraging and partly discouraging.

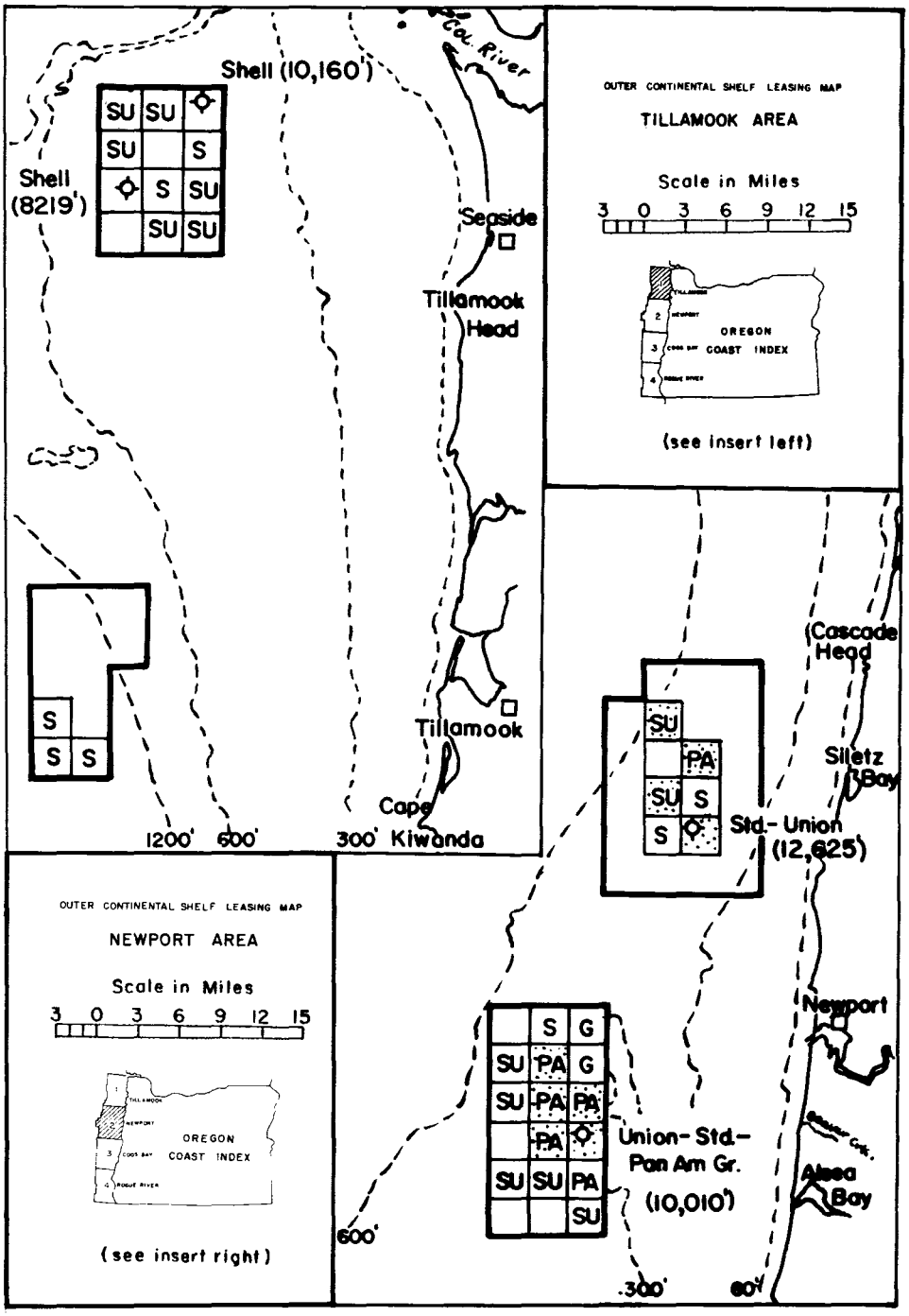
Benefits Accrued

What gain has the offshore work been to the Oregon economy? Lease bonus payments and rentals totalling $43 million have gone into the U. S. Treasury with no compensation paid the states. Nonetheless, Oregon has benefited from the $30 million expended in exploration studies offshore in



Atlantic-Richfield	AR	Shell Oil Co.	S
Gulf Oil Corp.	G	Standard Oil and Union Oil	SU
Pan American Petrol.	P	Superior and Pan American	SP
Pan American Petrol. Group	PA	Texaco, Inc. and Mobil Oil	TM
		Texaco, Atlantic-Richfield, Mobil	T

[Stippled areas indicate cancelled federal leases, and lined areas show state leases.]



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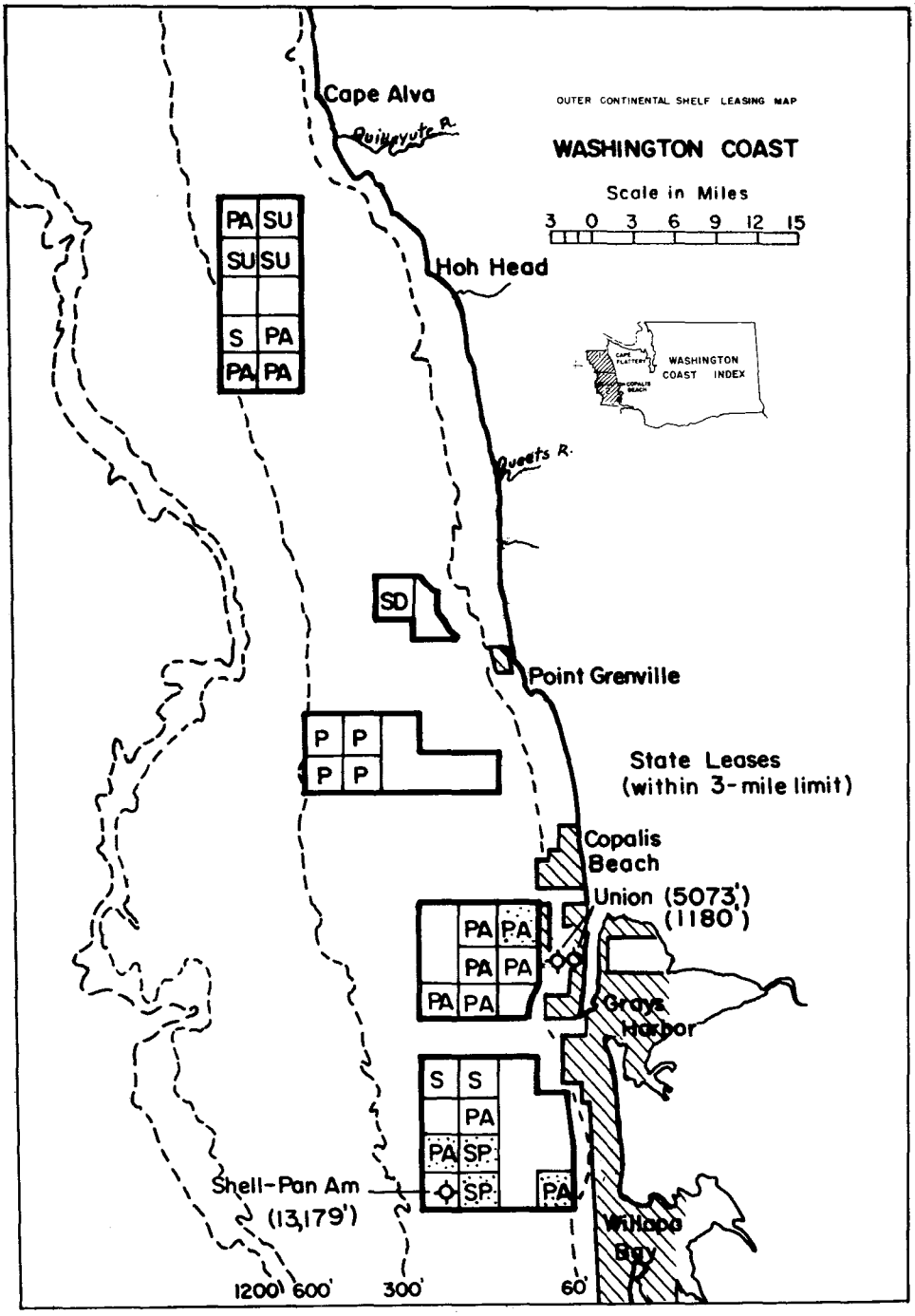

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the Northwest. For the past five years the ports of Astoria, Coos Bay, and Newport have been the headquarters for supplies and services for the seismic and drilling fleets. The fleet used in offshore exploration consisted of: 1 floating platform, 1 heavy drilling ship, 6 light drilling ships, 7 supply ships, 12 auxiliary boats, and 14 seismic boats.

Several other recent industrial developments may be an indirect result of the value expressed by oil companies in offshore prospects. Oregon industries were made aware of prospective business opportunities associated with the offshore activity through efforts of this Department and through cooperative projects with the Oregon Division of Planning and Development. Whether or not such apprising of industry influenced its actions is not known, but industrial development related to petroleum resources has occurred within the last year or two. Northwest Natural Gas Co. constructed more than $11 million worth of new pipelines in 1965-66 to the coastal areas of the state. Shell Oil Co. completed a $10 million nitrogenous fertilizer plant in the summer of 1966 near St. Helens on the Columbia River in northwestern Oregon. The plant utilizes natural gas and atmospheric nitrogen. Annual production is estimated to be valued at $9 million. The Albina Engine & Machine Works of Portland has received several contracts for work on offshore drilling platforms. The company remodeled a self-elevating drilling platform for the J. C. Marthens firm in 1966 at a cost of $1.2 million and performed general repairs on the Brown & Root Co. Alaskan fleet early in 1967 (figure 1).

In October of last year, the American Pipe & Construction Co. received its third contract to build a large development platform for use in Alaska. Earlier in 1966, American P&C completed work on the 3900-ton "Monopod" and a four-legged platform of equivalent size. Building of each unit involved a multimillion-dollar contract requiring employment of 500 construction workers. Construction was done in the Vancouver, Wash., shipyards, but the firm's main office is in Portland.

What other gain has come from offshore work? There is no doubt but that the state's offshore mineral resources look more interesting. Successful drilling in deep ocean waters off the coast of Oregon has demonstrated that equipment is now available to exploit shelf minerals. This advance in technology has increased the potential value of shelf lands lying off the Oregon shore. Besides proving the feasibility of deep-water operations, offshore oil exploration has supplied valuable geologic data which can be used in future development.

Expenditures Estimated

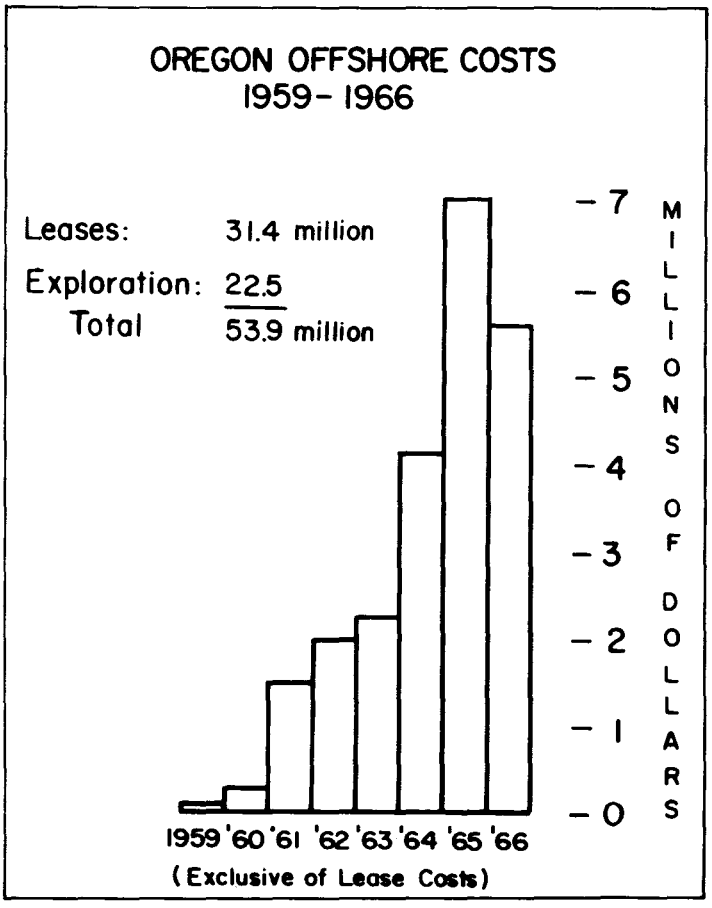
The most costly items of offshore exploration include seismic studies, bottom sampling, lease acquisitions, and deep drilling. Of the estimated $73 million spent on these activities off the coasts of Oregon and Washington, Shell Oil Co. has expended perhaps as much as 35 percent, while 16

Figure 1. Brown & Root Co. 500-ton crane shown installing the "Monopod" platform at Cook Inlet, Alaska, last summer. The $9 million drilling platform was built in Vancouver, Wash. shipyards by the American Pipe & Construction Co. of Portland. After erecting the "Monopod" and completing work on other structures in the inlet, the B & R fleet of four barges, two tugs, and three utility boats moved to Portland for repairs at the Albina Engine & Machine Works. (Photograph courtesy Brown & Root Co., Houston, Tex.)

other major companies have accounted for the remaining 65 percent. Of the 16 firms, Pan American Petroleum, Union Oil Co., and Standard Oil Co. of California are the main contributors.

Lease bonuses and yearly rentals amount to $43 million, while geophysical and geological studies probably cost $16 million in the five-year period, 1961-1966. Deep drilling is estimated to have cost more than $14 million. The first year of drilling (1965) was inordinately expensive because there had been no prior experience in this region; costs ranged between $100 and $300 per foot. As sea conditions became known, later operations experienced less difficulty and footage costs averaged $60 (Montgomery, 1966).

Expense of seismic work and bottom sampling was figured using a weekly crew cost for the different types of equipment: geophysical, $15,000; bottom sampling with rotary, $20,000; bottom sampling with drop barrel, $2000; and geological party, $2000. Overhead is estimated to have been between 20 and 30 percent, depending on the type of work done. The accompanying graph shows yearly expenses for Oregon offshore exploration.



Exploration Work Recounted

Drilling operations were conducted by Shell Oil Co. on a year-around basis off the Northwest coast from August 1965 to the end of October 1966. Working offshore through the winter months was hazardous and expensive for Shell. A large helicopter was lost while transferring crew members during a winter storm, but fortunately the men were rescued by the U.S. Coast Guard. On another occasion, huge waves and hurricane winds forced the 9800-ton drilling platform, Blue Water II (figure 2), off location and nearly two months were lost in repairing casing and wellhead equipment. Blue Water II, however, proved itself capable of deep-water operation in the North Pacific by drilling six deep holes in 14 months and deepening a seventh hole from 5600 to 10,000 feet. No winter drilling in the Northwest was planned for 1966-67.

Union and Standard, using Western Offshore Drilling & Exploration Co. drilling barge No. 3, put down two deep holes off the Oregon coast in 1965 within a six-month period. Costs per foot were much higher for WODECO III than for the Blue Water II during the Oregon operations, but more drilling would probably have lowered footage costs for the large drillship.

Formation tests were made on the Shell-Pan American group Willapa Bay hole, but company officials did not confirm discovery of any commercial zones in the well. No shows were reported from any of the other seven test holes (table 2).

Table 2. Deep Offshore Wildcats

Company	Area Name	Water Depth	Drilled Depth	Status
Shell-Pan Am. et al.	Willapa Bay	237'	13,179'	Abandoned 6/4/66. 7" csg set at 10,000'; oil shows tested.
Shell	Seaside	470'	8,219'	Abandoned 3/14/66.
Shell	Seaside	400'	10,160'	Abandoned 7/2/66.
Shell	Heceta Head	330'	3,348'	Abandoned Sept. 1965.
Shell	Heceta Head	330'	8,353'	Abandoned 10/17/65.
Standard-Union	Siletz Bay	425'	12,625'	Abandoned 8/5/65.
Union-Standard-Pan Am. et al.	Alsea Bay	200'	10,010'	Abandoned 10/13/66.
Union	Heceta Head	400'	12,285'	Abandoned 8/24/66.

During 1963 and 1964, prior to the lease sale, most of the firms did extensive bottom sampling to supplement geophysical data. Hundreds of samples were taken by simply dropping a heavy steel tube to bottom and punching out a "biscuit" of rock from the sea floor. Where bedrock was not exposed it was necessary to drill through the recent unconsolidated material with rotary drilling equipment to obtain fresh rock samples. Cores were studied to determine the nature of the sediments and to date the age of the rock by paleontological means. In spite of great difficulty from ocean currents and swells, operators of light drilling ships were able to obtain the information they sought. A fleet of six drilling ships was used in these operations; two ships utilized dynamic positioning equipment which allowed drilling to be done without setting anchors.

Geophysical studies began in June 1961 following passage of the Oregon Submerged Lands Act. Explosive and non-explosive equipment was employed in seismic work by the oil companies (table 3). It was believed that penetration of sound waves deep into the shelf rocks could be obtained only by use of explosives. Early surveys were met with a great deal of opposition from fishermen, who felt their livelihood was being jeopardized by the seismic work. Careful supervision of the seismic operations by the State Fish and Game Commissions proved that no harm to the fisheries industry resulted from the operations (figure 3). After the lease sale in October 1964, seismic work diminished to an occasional survey.

Land ownership and locations of the holes drilled off Oregon and Washington are shown on the accompanying maps. The major portion of state submerged lands shown under lease off the Washington coast was acquired in 1961 because of the discovery of oil near Ocean City by the Sunshine Mining Co. Later submerged land auctions in Washington did not generate much competition.

Economic Factors Described

The possibility of finding oil and gas on the continental shelf bordering Oregon must be evaluated by industry in context with the prospects of all other areas open to exploration by United States firms. Such a comparison is understandably difficult, and for each oil company a different set of controlling factors affects the decision of where to look for new resources and how much money to spend.

If a discovery is made in a new area, the whole oil industry must decide whether or not to rush in and obtain land rather than allow one or two firms to control a significant amount of production. It is this sort of competition that can drain exploration capital away from one prospective area to another in a matter of a few months.

The offshore search for oil in Oregon and Washington was initiated in 1960, three years before the Shell-Standard-Richfield discovery in the Cook Inlet, Alaska, and five years before the U.S. Supreme Court awarded

Figure 2. Blue Water II, a huge floating platform owned by the Santa Fe Drilling Co., is shown being towed to one of the drilling sites off the Oregon coast. The equipment was used to drill six of the seven deep holes off the Northwest coast during 1965-1966. (Photograph courtesy Crowley Launch & Tugboat Co., San Francisco, Cal.)

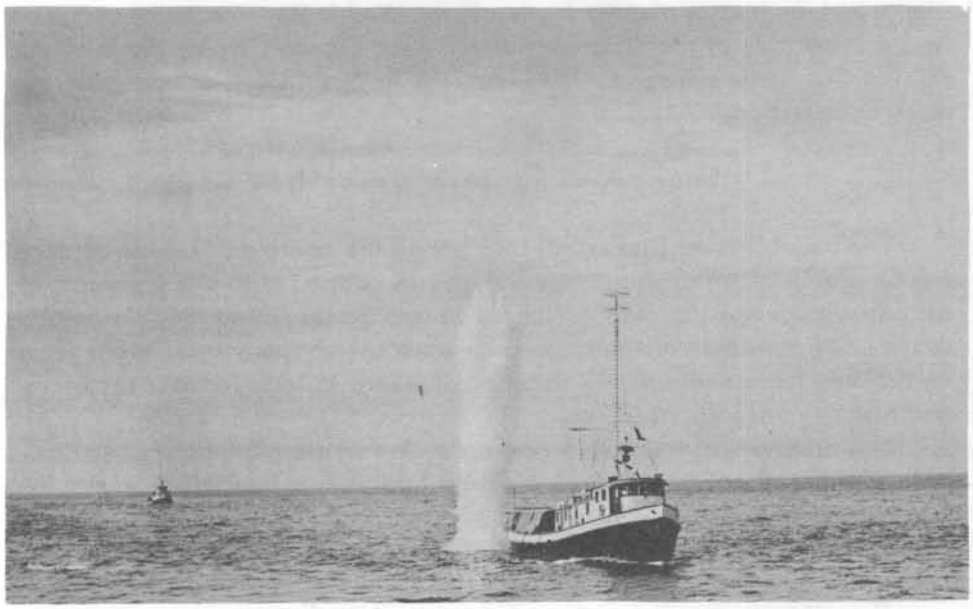


Figure 3. Seismic operations off the Oregon coast in 1964. The fleet consisted of a data recording boat (not shown), an explosives boat, and a fisheries observation boat. (Photograph courtesy of Shell Oil Co.)

Table 3. Estimated Geological and Geophysical Activity Offshore in Oregon and Washington

Company	Type Survey	Crew Weeks	Core ship & Contractor	Date
Atlantic-Richfield Co.	seismic	12	La Ciencia-Global Marine Expl.	1963-65
	bottom sampling	7		1963
	coastal geology	7		1963-64
	geochemical	2		1964
Atlantic-Richfield-Mobil	bottom sampling	12	Exploit-Submarex Corp.	1964
Continental Oil	seismic	2		1965
Gulf Oil Corp.	seismic	15		1961
	bottom sampling	4	(?)	1961
	coastal geology	12		1961
Humble Oil & Ref.	seismic	8		1964
	bottom sampling	3	Submarex-Global Marine Expl.	1964
Mobil Oil Co.	seismic	11		1964
*OSU & Scripps Inst.	seismic	2		1965
Pan American Petrol.	coastal geology	18		1964
Shell Oil Co.	seismic	215		1961-66
	bottom sampling	102	Eureka-Shell Oil	1961-64
	coastal geology	25		1961-63
Standard Oil Co.	seismic	17		1961-66
	coastal geology	15		1961-63
Standard-Union	bottom sampling	12	Caldrill-Caldrill, Inc.	1964
Standard Group I				
Humble	aeromagnetic	5		1961
Pan American				
Superior				
Marathon				

(continued)

* This work was not included in coast estimates.

Table 3. Continued

Company	Type Survey	Crew Weeks	Core ship & Contractor	Date
Standard Group I, continued				
Texaco				
Mobil				
Phillips				
Richfield				
Standard Group II				
Humble	seismic	12		1962
Pan American				
Superior				
Marathon				
Texaco				
Superior	gravity	12		1962
	seismic	17		1962-64
Superior-Pan American	bottom sampling	8	Submarex-Global Marine Expl.	1964
Texaco, Inc.	seismic	4		1964
Texaco-Humble	bottom sampling	7	Western Explorer-Global Marine Expl.	1964
Union Oil Co.	seismic	18		1961-62
	bottom sampling	7	La Ciencia-Global Marine	1962
Union-Standard	bottom sampling	8	Exploit-Submarex Corp.	1963

submerged lands lying between the mainland of southern California and offshore islands to the federal government. Undoubtedly the important discovery in Alaska diverted attention from the Oregon and Washington programs and forced immediate appropriations by oil firms to compete for production in the Cook Inlet. Several hundred million dollars have been expended over the past three years in the Alaskan development.

The first federal sale off the coast of southern California was held in December 1966 and record per-acre bonuses were paid for one lease ($10,600 per acre for one tract off Carpinteria, Santa Barbara County). The lease bordered an oil field which is on state submerged land. More OCS

sales are expected on the southern California shelf. Had the settlement of the disputed shelf lands off southern California been made at a later time, capital now allocated for that region would have been available for Oregon. It is the press of competition for productive lands in California and Alaska, accompanied by the drilling of six dry offshore holes, that has dampened the activity in Oregon.

Conclusions

The results of drilling in the Northwest to date are not as discouraging as they appear to be. Sedimentary rocks exist on the shelf in great thickness and areal extent. The prospective shelf region off Oregon and Washington covers at least 9000 square miles to a water depth of 600 feet. Although sands reportedly have been lacking in the holes drilled to date, they do occur at many places on shore along the coast. Two or three wells on the shore at Ocean City, Wash., have produced significant amounts of oil and the E. M. Warren "Coos County 1-7" drilled in 1963 a few miles south of Coos Bay obtained shows of oil and gas.

Statistically, Oregon has as good a potential for oil discovery as any other wildcat area. The probability of finding oil in a prospective area is 1 chance in 10, and 1 chance in 50 that a field larger than 1 million barrels will be discovered. Western Alaska offers a fair comparison with Oregon on a statistical basis, as far as oil and gas exploration is concerned.

	Prior to Discovery			Since Discovery		
	Expl. costs	Total holes	Holes 5000'+	Expl. costs	Total holes	Holes 5000'+
Alaska	$80 million	121	17	$720 million	257	240
Oregon	$75 million	177	25	-	-	-

Alaska's Swanson River Field was discovered in 1957 by Richfield Oil Corp. Middle Ground Shoals Field was discovered in Cook Inlet six years later by a consortium of Shell, Richfield, and Standard Oil Companies. In 1966 an average of 12 drilling rigs operated in the Cook Inlet; of these 5 were of the floating type and 7 were bottom supported. The rapid transition of the Cook Inlet within a three-year period from a wildcat test to an important producing province points out the necessity of competing in new areas. Exploration programs of oil companies must be flexible enough to allow large diversions of capital to new developments. Thus the work offshore from Oregon is subject to the fluctuation of oil company commitments, especially those on the West Coast.

If the right geologic conditions exist in a region, and we believe they exist in Oregon, the discovery of oil and gas is directly related to the

number and depth of holes drilled. If 25 additional deep holes were drilled in the state, an oil discovery would very likely be made. Controlling factors outside the state will determine the future of such test drilling.

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METALS AND MINERALS COMING TO PORTLAND

The Pacific Northwest Metals and Minerals Conference will convene at the Sheraton Motor Inn April 19, 20, and 21. The conference, which was first held in Portland 19 years ago, was originally sponsored solely by the Oregon Section of the American Institute of Mining and Metallurgical Engineers. Because of the success of the conference over the years, cosponsorship by the American Society for Metals and the American Welding Society has been added. The conference meets in Portland every third year, with Spokane and Seattle hosting the meet in turn. Last year the conference was invited to Vancouver, B. C.

The theme selected for this year's meeting is "Materials for Inner and Outer Space." Papers stressing the problems and solutions to the conquest of interplanetary "outer space" and the "inner space" beneath the waves and under the ground will be presented by speakers from industry, private research organizations, and state and federal agencies.

First technical session of the conference will be the Marine Mining meeting held Wednesday afternoon, April 19. Numerous plant tours and field trips are also scheduled for the opening day. Technical sessions to be held on Thursday include Welding, Electric Furnace, Mining and Geology, three Material Science sections, and Minerals Beneficiation. On Friday the third Gold and Money Session will start with the delivery of a series of papers by internationally recognized authorities on the problems of gold.

Following the Gold and Money Luncheon, a panel composed of the morning speakers will explore the papers read in greater depth. Other technical sessions scheduled for Friday include Welding, Material Science, and Petroleum.

The conference will also feature exhibits by manufacturers and service organizations, a full two-day program for ladies, and an after-the-papers-are-over social evening Friday which will include a cocktail party, banquet, and dancing.

CONFERENCE CALENDAR

Wednesday

8:00 - 5:00	Registration and Exhibits.
9:00	Ladies' Hospitality and registration
11:00 - 6:00	Field trip to Albany exotic metals plants.
12:00	No-host luncheon.
1:00 - 4:00	Field trip to Oregon Steel Mills.
	Field trip to Port of Portland dredge.
1:00 - 4:00	Field trip to Portland Dock Commission bulk ore-handling facility.
1:00 - 4:00	Ladies cruise of Portland Harbor.
	Field trip to West Hills twin-bore tunnel.
1:30 to 4:30	Marine Mining Technical Session.

Thursday

7:30 - 8:30	Speaker's Breakfast.
8:00 - 5:00	Registration and Exhibits
8:30 - 10:00	Ladies Hospitality Room open.
8:30 - 11:30	Material Science Technical Sessions.
8:30 - 11:30	Welding Technical Session.
8:30 - 11:30	Electric Furnace Technical Session.
8:30 - 11:30	Mining and Geology Technical Session.
10:00 - 4:45	Ladies Tour of Portland, Fashion Lunch.
12:30	National President's Luncheon.
1:30 - 4:30	Material Science Technical Sessions.
	Welding Technical Session.
	Minerals Beneficiation Session.
7:00 - 9.30	ESCO Plant Tour.

Friday

7:30 - 8:30	Speaker's Breakfast.
8:00 - 5:00	Registration
9:00	Ladies Hospitality Room open.
8:30 - 11:30	Material Science Technical Sessions.
	Welding Technical Session.
	Gold and Money Session.
12:00	Ladies' Travel Luncheon.
12:30	Gold and Money Luncheon.
1:30 - 4:30	Gold and Money Panel.
	Welding Technical Session.
	Petroleum Technical Session.
5:00 - 6:00	Cocktail Party.
7:00 - 9:00	Banquet.
9:00 - 12:00	Dancing.

TECHNICAL SESSIONS

Marine Mining Session
Wednesday, 1:30 to 4:30 P. M.

Chairman: Arthur P. Nelson, Research Director, Marine Minerals Technology Center, U.S. Bureau of Mines, Tiburon, Cal.

"Mining Diamonds off South West Africa," by Norman A. Grant, Production Manager, International Exploration and Production Division, Tidewater Oil Co., Los Angeles, Cal.

"Offshore Tin Exploration and Dredging in Indonesia and Thailand," by Dr. Rudolph Osberger, Manager, Offshore Exploration and Mining, Indonesian Tin Mining Enterprises, Indonesian Government, Djakarta, Indonesia.

"Legal and Political Aspects of Mining the Sea," by William E. Grant, Pacific Coast Outer Continental Shelf Office, Bureau of Land Management, Los Angeles, Cal.

"Potential of Submersible Systems for Undersea Mineral Exploration and Exploitation," by Dr. Andreas B. Rechnitzer, Director, Ocean Sciences, Ocean Systems Operations, North American, Inc., Anaheim, Cal.

Mining and Geology Session
Thursday, 8:30 to 11:30 A. M.

Chairman: A. E. Weissenborn, Research Geologist, Branch of Resources Research, U.S. Geological Survey, Spokane, Wash.

"Machine Bored Tunnels and Raises: Their Application to Underground Mining," by R. J. Robbins and Donald L. Anderson, to be presented by R. J. Robbins, President of James S. Robbins and Associates, Seattle, Wash.

"Near Shore Heavy Metal Program of USGS in Southern Oregon and Northern California," by H. Edward Clifton, U.S. Geological Survey, Menlo Park, Cal.

"Bureau of Mines Research Using Simulated Lunar Materials," by Thomas C. Atchinson and David E. Fogelson, U.S. Bureau of Mines, Minneapolis, Minn.

"Land Conflicts in the Minerals Industry," by A. L. Service, U.S. Bureau of Mines, Spokane, Wash.

"Is the Mineral Leasable or Locatable?" by Russell Wayland, Assistant Chief, Conservation Division, U.S. Geological Survey, Washington, D. C.

"Bureau of Mines Participation in Developing Lunar Drill Systems," by James Paone, U. S. Bureau of Mines, Minneapolis, Minn.

Minerals Beneficiation Session
Thursday, 1:30 to 4:30 P. M.

Chairman: Horace R. McBroom, Mining Engineer, U. S. Bureau of Land Management, Portland, Ore.

"Gold Milling at the L-D Mines Operation," by A. J. Almquist, Mill Superintendent, Wenatchee, Wash.

"Magnesite Beneficiation from Pit to Finished Product," by Gene M. Kerns, Mill Superintendent, Northwest Magnesite Co., Chewelah, Wash.

"Big Rod Mill at Permanente," by Arnold Kackman, Project Engineer for Kaiser Engineers, Oakland, Cal.

"Mill Design Problems and Their Influence on Capital Costs," by R. S. Shoemaker, Chief Metallurgical Engineer for the Mining and Metals Division of Bechtel Corp., San Francisco, Cal.

"It's What's Up Front That Counts," by Leland Terry, Product Manager for Dredging, Esco Corp., Portland, Ore.

Gold and Money Session
Friday, 9 to 11:30 A. M.

Chairman: Hollis M. Dole, State Geologist, Portland, Ore.

Paper on Gold Reserves of the World, by Dr. Paul M. Kavanagh, Chief Geologist, Kerr Addison Mines, Ltd., Toronto, Canada.

"Is Gold as Good as the Dollar?", by Dr. Lorie Tarshis, Executive Head, Economics Department, Stanford University, Stanford, Cal.

Paper on The Fundamental Approach to the Monetary Problem as Between the Gold School and Management School, by Dr. John E. Holloway, former Secretary of Finance of the Union of South Africa, and former Ambassador to Washington, Johannesburg, South Africa.

Gold and Money Luncheon
Friday, 12:30 P. M.

Speaker: C. Austin Barker, Partner-Economist, Hornblower and Weeks-Hemphill, Noyes, New York City.

Subject: The Growing Need for Sound Monetary Policy.

Master of Ceremonies: C. B. Stephenson, Chairman of the Board, The First National Bank of Oregon, Portland, Ore.

Gold and Money Panel
Friday, 1:30 to 4:30 P. M.

Moderators: Dr. Donald H. McLaughlin, Chairman of the Board, Homestake Mines, San Francisco, Cal.,; and Henry L. Day, President, Day Mines, Inc., Wallace, Idaho.

Panelists: Dr. Paul M. Kavanagh, Dr. Lorie Tarshis, Dr. John E. Holloway and C. Austin Barker.

Subject: Topics presented during morning session.

Petroleum Session
Friday, 1:30 to 4:30 P. M.

Chairman: Vernon C. Newton, Jr., Petroleum Engineer, State of Oregon Department of Geology and Mineral Industries, Portland, Ore.

"Deep Water Drilling Operations off the Coasts of Oregon and Washington," by E. L. Shannon, President, Santa Fe Drilling Co., Santa Fe Springs, Cal.

"Trends in World Crude Oil Production and Reserves," by E. C. Babson, Consulting Petroleum Engineer, Pasadena, Cal.

West Coast Shelf Developments with Particular Reference to Oregon and Washington," by D. W. Solanas, Regional Oil and Gas Supervisor, U. S. Geological Survey, Los Angeles, Cal.

"Oil and Gas Prospects in Oregon and Washington," by H. J. Buddenhagen, Consulting Petroleum Geologist, Grants Pass, Ore.

"Progress of the Alaska Petroleum Industry," by J. A. Williams, Director of Division of Mines and Minerals, Juneau, Alaska.