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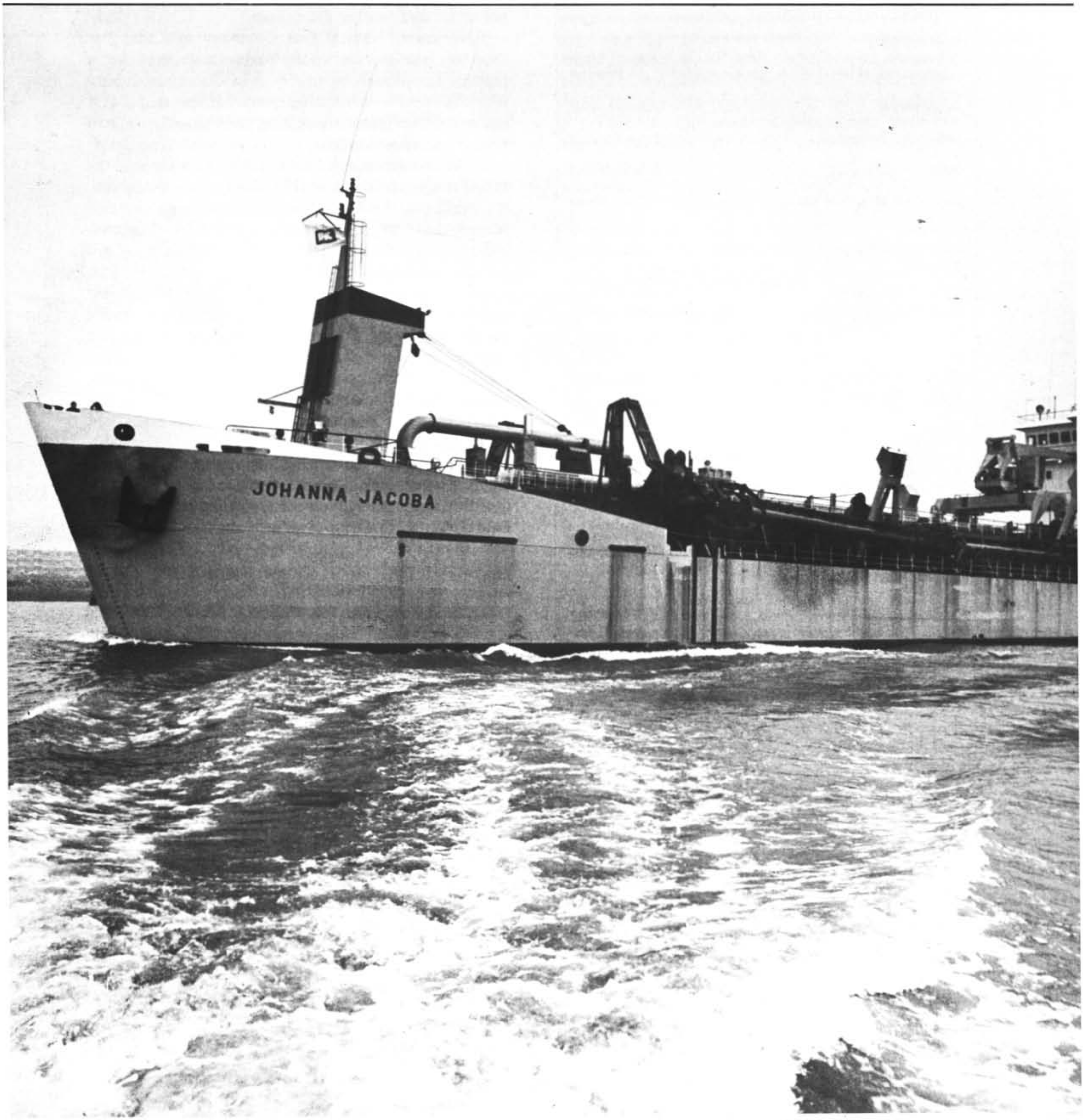

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COVER PHOTO

A modern trailing suction hopper dredge with suction pipe and draghead stowed for cruising. This vessel has speed of 12.8 knots, length of 104 m, hopper capacity of 3,250 m^3, and dredging depth of 35 m. (Photo courtesy IHC Holland Corporation)

Fourth Mist gas well largest yet

Reichhold Energy Corporation, Tacoma, Washington, and its partners, Diamond Shamrock Corporation and Northwest Natural Gas Company, hit the biggest of its four producing natural gas wells near Mist on August 14, 1979. This well has turned out to be the largest, with a flow rate that by itself surpasses the output of all three earlier discoveries.

Northwest Natural Gas Company said that "as soon as possible" it would begin final plans for a pipeline to connect the gas fields in Columbia County with the utility's distribution system. It also said that it had asked for eight more drilling permits to continue to explore the area this fall.

The companies involved in the exploration said the fourth well—identified as REC-Columbia County No. 6, Redrill No. 2—had a flow rate of 6.5 million cubic feet per day. Earlier wells showed flow rates of approximately 1.6 million, 865,000, and 3.75 million cubic feet per day respectively.

Participation by Columbia County in the exploration is by Northwest Natural Gas, through a wholly owned subsidiary, Oregon Natural Gas Development Corporation.

Northwest Natural Gas said the fourth well is in a separate fault block and indicates there is another gas pool in the area. The company said more drilling would be needed to determine its size.

The utility said it has completed preliminary engineering studies in preparation for right-of-way acquisition and construction for a pipeline from the Mist field to its North Coast pipeline, near Clatskanie. □

CONTENTS

Offshore sand and gravel resources of the Pacific Northwest

by George W. Moore and Michael D. Luken, U.S. Geological Survey, Menlo Park, California 94025

ABSTRACT

The Oregon and Washington continental shelf contains an estimated eight billion m³ of gravel, the potentially most valuable hard-mineral resource of the shelf. At the present rate of consumption in Oregon and Washington, the gravel on the outer continental shelf to a water depth of 100 m would last about 200 years. Modern dredging vessels, if permitted, may soon be able to deliver clean aggregate to discharge points at Portland and Seattle at a profit, as is now being done by the marine sand and gravel industries in the North Sea and off Japan.

Environmental factors will mainly determine whether such operations begin. Only a small fraction of the offshore gravel lies in water shallower than 20 m, where coastal erosion and herring spawning grounds may present environmental restrictions. The rounded, 0.2-m-deep tracks left by suction dredges do not interfere with trawling nets, and, during a 6-month study in the English Channel, larva of fish-food organisms from the plankton rapidly recolonized a dredge test area. Biologic studies near clay discharges from an English ceramics plant show that open-sea fish are tolerant of suspended sediment, perhaps because storms also stir it up. The eggs of sole, rockfish, crab, and shrimp, the principal bottom species harvested on the outer continental shelf of the Pacific Northwest, mature near the water surface, where they would probably be little affected by the mining. More research is needed, however, to verify fully the compatibility between a local marine gravel industry and the fishing industry.

INTRODUCTION

Quarry operators in the United States mine enormous volumes of sand and gravel for construction, road bases, and fill. The industry produces about 3 m³ per year for each citizen (Evans, 1978). Oregon and Washington are endowed with large resources of sand and gravel, but because of a high transportation cost on land, the deposits adjacent to population centers are being depleted rapidly (Hines, 1969; Zimmerman and Moen, 1966). Also, some deposits near the cities have been removed from production because the land has become more valuable for other purposes. This situation is aggravated further by environmental factors — many of the remaining deposits lie where incompatible land uses impinge against them, where disposal of processing water is difficult, and where truck traffic generates complaints. Consequently, resources farther from urban areas are becoming more valuable. This paper assesses the resources of sand and gravel on the continental shelf off Washington and Oregon and evaluates the factors affecting their possible future utilization.

In the United Kingdom, Japan, and the Netherlands, a similar pressure caused by population growth and the consequent need for resources has created a gravel-dredging industry on the continental shelf (Baram and others, 1978). Initially, small dredges were used at nearshore sites, but the industry has now evolved to the extent that in the North Sea some vessels that process gravel from the sea floor have capacities as large as 9,000 m³, and a single dredge may alternate deliveries between London and continental Europe as the demand dictates.

Off the United Kingdom, dredging for sand and gravel is permitted only on the outer part of the continental shelf, where dredge-generated bottom disturbances and water-turbidity affect the fish and shellfish industries less, and where the sediment removal does not cause coastal erosion.

Operations where heavy seas are common require large ocean-going self-contained hopper dredges (Figure 1) (Hess, 1971). These vessels combine a ship's hull with dredging machinery and with holds for collecting and transporting the products. The most common type of dredge is the trailing suction dredge, in which a pump at the ship draws up a slurry of gravel and water from the sea floor while the vessel moves slowly forward.

In the North Sea, suction dredges routinely take gravel from depths as great as 50 m. A pump in the ship's hull lifts the gravel through steel trailing pipes, and in some cases jets at the draghead on the sea floor assist. Friction in the trailing pipes limits the working depth of nonassisted suction dredges, and the pipes need to be rigid so that the suction will not collapse them. A few new dredges, with pumps on the pipe at depth rather than at the ship, are now operating at a depth of 80 m (Koster, 1979). They can use flexible pipes above the pump, because collapse is not a problem.

On each pass over an area, a trailing suction dredge processes a sea floor layer about 0.2 m thick. It changes

Figure 1. British sand and gravel dredger Cambrook, *built in 1967, has capacity of well over 2,000 tons. (Photo from Hess, 1971)*

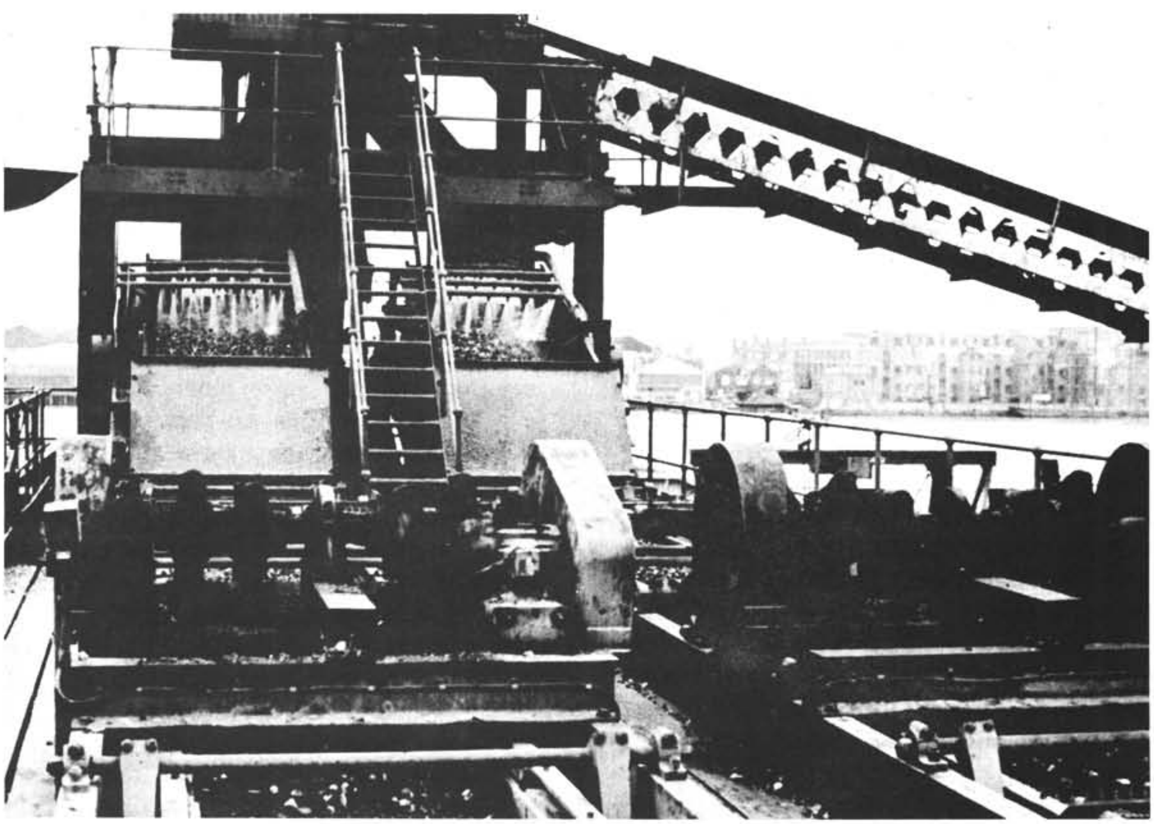
the sea-floor topography very little, a factor that is important where fish trawlers also use the area. Dredges can economically work areas where the gravel is less than 1 m thick, and they can mine thicker areas by repeated passes.

To meet the requirements of operating in the open sea, the European marine sand and gravel industry has developed hopper dredges that can carry a large and valuable load for many hours of running time to distant markets. This evolution of the equipment also assures a profitable traverse up the River Thames to London, a long inland run similar to those at Portland and Seattle.

The process of lifting and loading the sand and gravel removes most of its intermixed silt and clay, and vessels that screen the product at sea have been tried in Europe. At many onshore processing plants, disposal of the fines and waste water has become expensive and environmentally difficult. When unneeded fractions are washed out and discharged at sea, payloads are increased and operations at the unloading stations are simplified.

Self-contained hopper dredges designed for mining, processing, and transporting sand and gravel can serve a group of widely separated docks, each situated near a local market. Scraper buckets and belt conveyors unload clean gravel onto dockside conveyors (Figure 2). Drained marine aggregate usually can be used directly for concrete without extracting the remaining salt.

Figure 2. Dockside sand and gravel treatment plant in the London area. (Photo from Hess, 1971)



Where specifications do call for the salt to be flushed out, any remaining silt and clay that are removed with it can be caught in settling tanks to avoid harbor pollution.

New York, Boston, and Los Angeles are likely to lead the way for offshore sand and gravel mining in the United States. Oregon and Washington now dredge navigational channels to keep them open, and offshore mining in the Pacific Northwest will probably first be permitted for use at coastal sites. As urban aggregate supplies shrink, a need to maximize onshore and offshore environmental safeguards will probably govern the future dredging of marine sand and gravel for construction.

DISTRIBUTION OF OFFSHORE SAND, GRAVEL, AND SHELL DEPOSITS

Two main types of data sources supplied the seafloor information for this paper. Bottom-character notations came from the 20 U.S. National Ocean Survey Charts in the series 18480 to 18602 that cover this coast, and sediment analyses came from cores and grab samples collected by Oregon State University and the University of Washington (Burnett, 1968; Chambers, 1968; Runge, 1966). Where these two sources of data overlap, the agreement between them is excellent.

Figure 3 shows the distribution of sediment types and rock outcrops on the continental shelf off Oregon and Washington. Figure 4 is a genetic summary diagram illustrating the geography of the northern part of the shelf area at the time when the coarser deposits were laid down.

ORIGIN OF THE DEPOSITS

Present-day bottom currents on the outer continental shelf off Oregon and Washington are too weak to redistribute gravel extensively. The gravel beds are relict, dating from about 15,000 years ago during the Pleistocene Epoch. Sea level was then about 200 m lower than it is now, and the continental shelf was exposed because ice sheets on the continents incorporated an enormous volume of water that has since been returned to the oceans.

Two main types of processes formed the gravel bodies. In the north, vigorous meltwater streams flowed across the exposed continental shelf from former glaciers in Washington and British Columbia and laid down broad fans of gravel beyond the positions of the ice fronts (Figure 4). In the south, off Oregon, Pleistocene waves reworked gravel from stream deposits and eroded rock from former headlands and shelf platforms to produce smaller gravel bodies, most of which lie near submarine rock outcrops.

Nearly all of Canada was covered by the continental ice sheet. The ice margin reached to the edge of the continental shelf off British Columbia, impinged against the north flank of the Olympic Mountains, and extended southward as a long lobe in the Puget lowland east of the mountains (Prest, 1969). Wells drilled for oil off southern British Columbia show that the glacial deposits on the shelf are 60 to 160 m thick (Shouldice, 1971, Figure 17). The gravel beds seaward of the mouth of the Strait of Juan de Fuca are most extensive on banks at a water depth of 170 m, near the depth to which sea level was lowered during the Pleistocene. Subsequent marine deposition has not covered the well-sorted gravel on the sea floor.

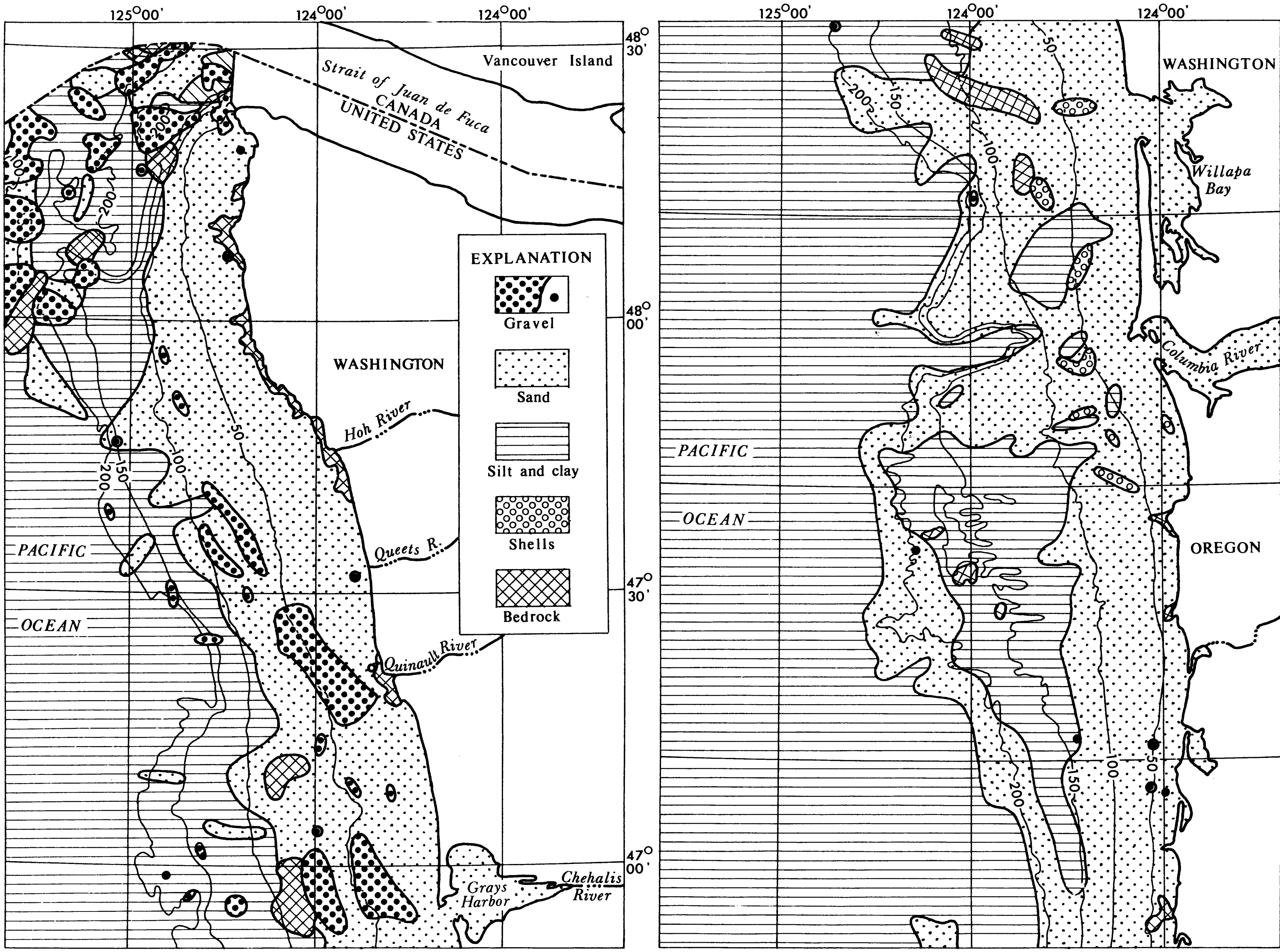
The composition of a gravel bed off Grays Harbor, Washington, gives a clue as to its source. Venkatarathnam and McManus (1973) report that the pebbles in this deposit are 69 percent andesite, a rock uncommon in the nearby Coast Range but the predominant rock of the volcanoes of the Cascade Range, 200 km farther inland. During the Pleistocene, meltwater from the Puget glacial lobe and from glaciers at Mount Rainier carried the andesite pebbles and other glacially derived Cascade Range rocks down the valley of the Chehalis River and out onto the continental shelf at Grays Harbor. There, the river laid down the nonindigenous clasts on a terrain where the bed rock is almost totally dissimilar.

Gravel on the continental shelf off the Olympic Mountains farther north contains almost no andesite and probably originated as outwash from valley glaciers flowing down from the nearby Olympic Mountains, which contain little andesite (Tabor and Cady, 1978).

Kulm and others (1975) used distinctive minerals on the continental shelf as natural tracers of transport paths to show that present-day, long-wavelength winter waves stir the bottom and keep fine river sediment moving across the shelf to submarine canyons and the continental slope. This process prevents the gravel beds from being covered by silt and fine sand.

Several of the larger gravel bodies off Oregon lie in swales between submarine banks. During the postglacial rise of sea level, the surf concentrated the gravel clasts in pocket beaches that filled former shoreline reentrants on what is now the continental shelf. Such wave action improved the quality of the gravel aggregate by breaking down and removing soft sedimentary and metamorphic pebbles.

Relict shell beds lie near many submarine rock outcrops, and former surf probably concentrated the shells in the same way as it did the gravel. An even larger group of shell beds arcs around the mouth of the Columbia River at an average depth of 70 m. The exposure of these old surf-sorted shells on the sea floor verifies that the bulk of the suspended load from the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CANADA
UNITED STATES
WASHINGTON
Hoh River
Queets R.
Quinault River
Grays Harbor
Chehalis River
PACIFIC
OCEAN
EXPLANATION
Gravel
Sand
Silt and clay
Shells
Bedrock
Willapa Bay
Columbia River
OREGON
50
100
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200

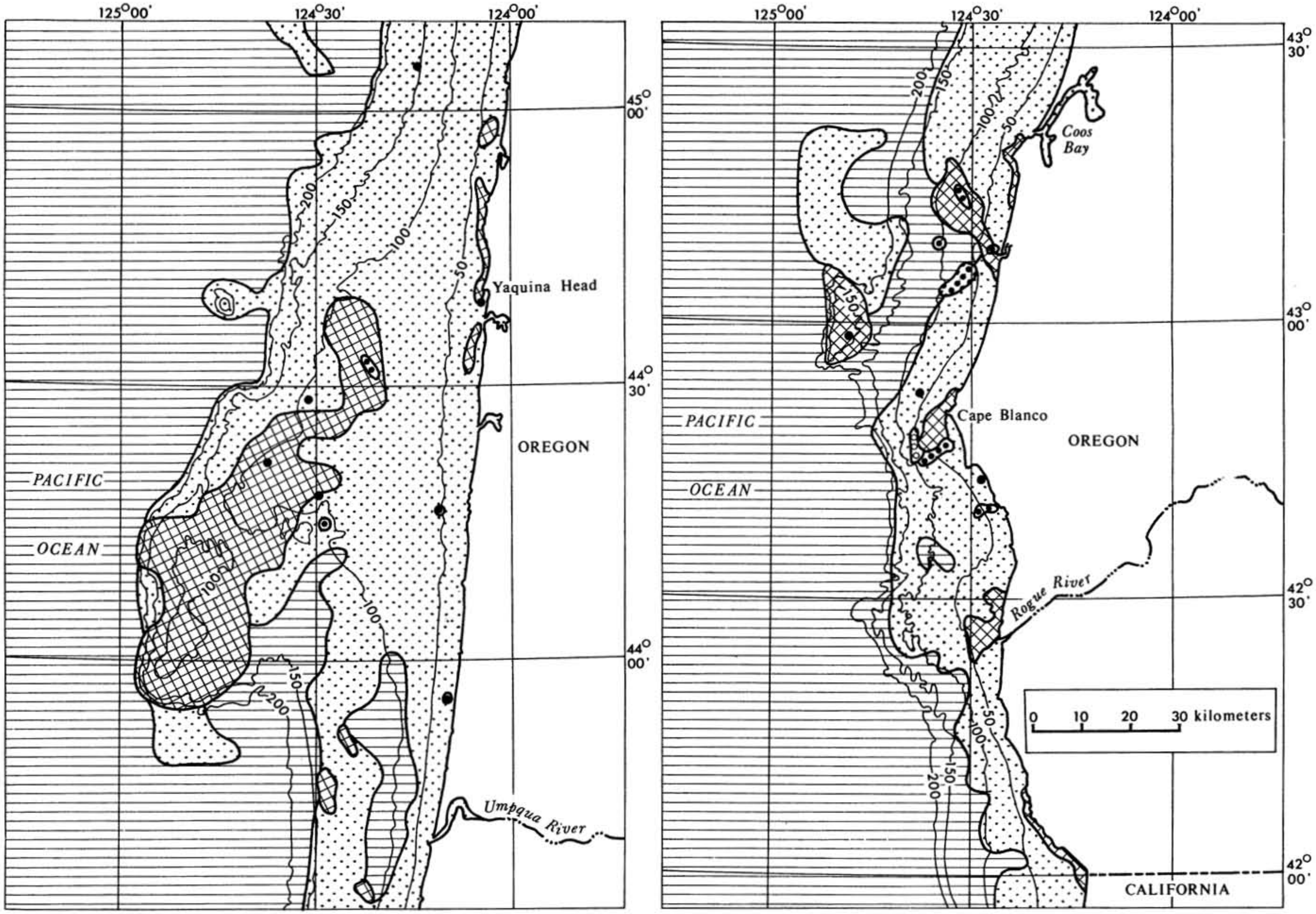

Figure 3. Sea floor materials off the coast of Washington and Oregon. Submarine contours in meters.

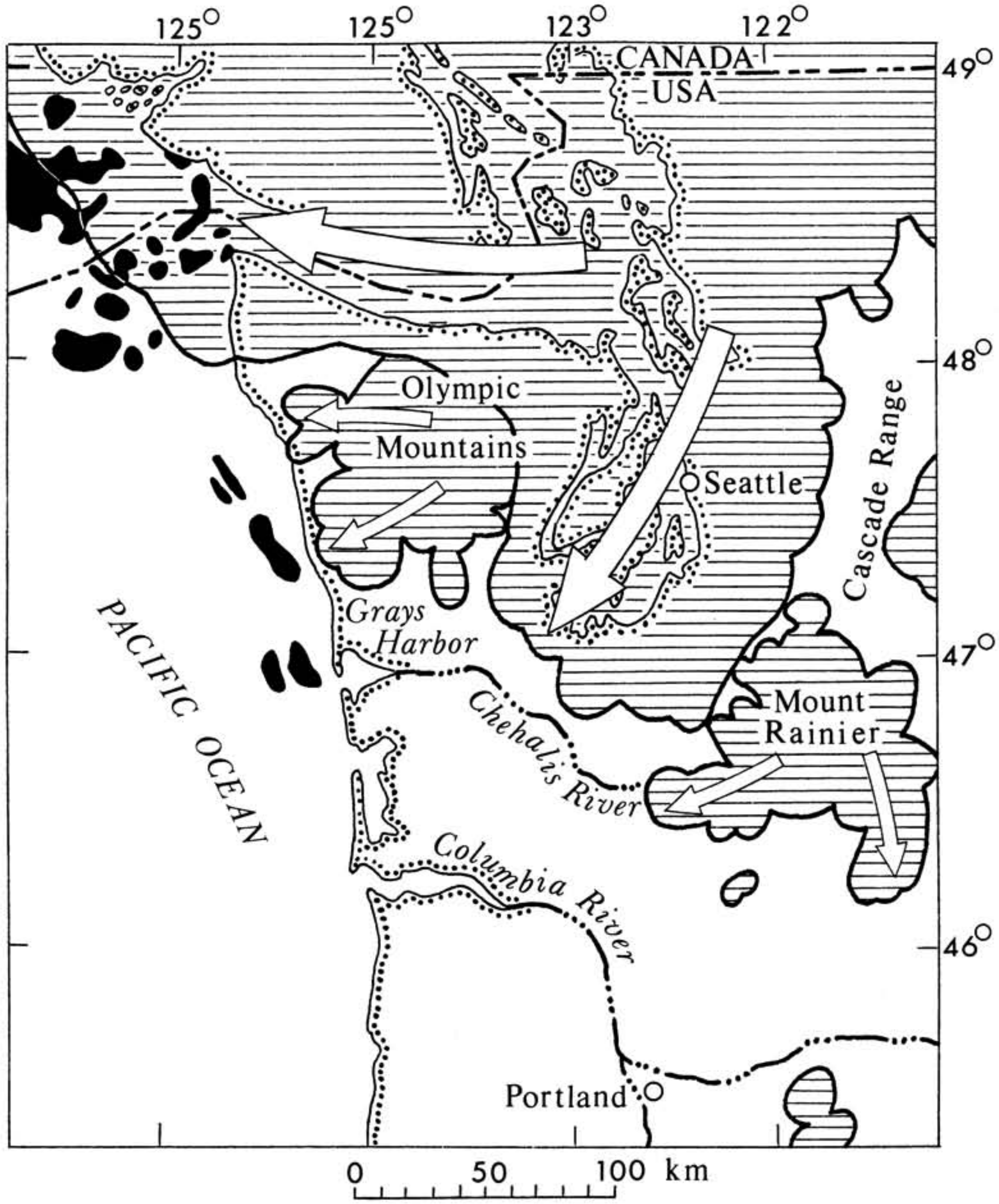

Figure 4. Spatial relations between gravel deposits on the continental shelf (black areas) and the extent of former glacial ice (ruled). Smaller arrows indicate the flow directions of ice in mountain glaciers; larger arrows the directions in the continental ice sheet (Prest, 1969).

Columbia bypasses the continental shelf, for otherwise they would be covered by sediment. Between sea-floor bedrock outcrops 20 km north and south of the mouth of the river, the continental shelf has an area of about 1,900 km^2. If the annual sediment load of the Columbia River of 12 million m^3 (Kulm and others, 1975) had been deposited within this area since sea level reached its present height about 5,500 years ago, river sediment would now bury the relict shells to a depth of 35 m.

RESOURCES

Although fairly good information is available on the thickness of the Pleistocene deposits as a whole (Snavely and others, 1977), we do not now have good information on the thickness of the individual sea-floor layers that have been mapped. Because at least several data points define the larger deposits, we tentatively hypothesize that they are at least 1 m thick. At onshore

Table 1. Offshore gravel deposits of Washington and Oregon

Center of deposit N lat	Center of deposit W long	Area (square kilometers)	Volume (million cubic meters) 1-meter thickness	Volume (million cubic meters) 5-meter thickness	Average water depth (meters)
48°28'	124°56'	58	58	290	150
48°27'	124°47'	22	22	110	280
48°24'	125°08'	32	32	160	170
48°23'	124°46'	24	24	120	70
48°21'	124°55'	85	85	425	200
48°19'	125°20'	128	128	640	140
48°19'	125°05'	36	36	180	170
48°19'	124°42'	1	1	5	20
48°17'	125°58'	4	4	20	210
48°14'	125°10'	5	5	25	210
48°14'	125°31'	13	13	65	160
48°11'	125°19'	94	94	470	170
48°07'	125°44'	2	2	10	20
48°05'	125°07'	23	23	115	170
48°03'	125°27'	313	313	1565	170
48°01'	125°13'	47	47	235	170
47°56'	124°55'	5	5	25	90
47°51'	124°52'	8	8	40	90
47°47'	125°02'	2	2	10	170
47°39'	125°03'	5	5	25	170
47°37'	124°42'	59	59	295	70
47°34'	124°46'	37	37	185	90
47°32'	124°24'	2	2	10	20
47°30'	124°41'	4	4	20	80
47°30'	124°53'	9	9	45	170
47°25'	124°47'	8	8	40	170
47°22'	124°21'	1	1	5	20
47°22'	124°28'	209	209	1045	40
47°14'	124°28'	7	7	35	60
47°09'	124°24'	8	8	40	50
47°08'	124°18'	5	5	25	30
47°04'	124°30'	2	2	10	70
47°02'	124°48'	4	4	20	140
46°59'	124°54'	1	1	5	160
46°57'	124°50'	3	3	15	170
46°57'	124°29'	90	90	450	70
46°57'	124°20'	127	127	635	40
46°56'	124°43'	16	16	80	130
46°51'	124°52'	2	2	10	200
46°32'	124°30'	4	4	20	170
45°53'	124°38'	1	1	5	190
45°32'	124°13'	1	1	5	130
45°32'	124°02'	2	2	10	50
45°27'	124°02'	2	2	10	50
45°27'	124°00'	1	1	5	30
45°05'	124°14'	1	1	5	150
44°39'	124°05'	1	1	5	10
44°32'	124°22'	9	9	45	60
44°29'	124°31'	1	1	5	90
44°22'	124°38'	1	1	5	90
44°18'	124°30'	1	1	5	90
44°16'	124°12'	2	2	10	50
44°15'	124°29'	6	6	30	100
43°56'	124°10'	3	3	15	20
43°14'	124°32'	8	8	40	70
43°09'	124°35'	5	5	25	90
43°08'	124°27'	3	3	15	20
43°06'	124°30'	9	9	45	60
43°04'	124°32'	20	20	100	70
42°58'	124°48'	1	1	5	170
42°52'	124°38'	1	1	5	70
42°46'	124°35'	15	15	75	40
42°43'	124°29'	1	1	5	10
42°40'	124°28'	5	5	25	40

outcrops, prisms of beach sediment and layers of outwash gravel are typically 5 m thick. Therefore, the resources of gravel are quoted on the basis of assumed thicknesses of 1 and 5 m (Table 1).

Assuming the 5-m thickness, the total resource of gravel without overburden of finer material on the Oregon and Washington continental shelf is 8.0 billion m^3. That on the outer continental shelf to a depth of 100 m is 3.3 billion m^3. At the present rate of consumption in Oregon and Washington, this supply would last about 200 years.

FACTORS AFFECTING UTILIZATION

Dredges will begin to mine sand and gravel off the coasts of Oregon and Washington when the demand is high enough and when society judges the environmental safeguards to be adequate.

As Oregon's supply of onshore sand and gravel has declined, crushed basalt has partly replaced gravel in construction aggregate. For many uses, however, gravel with rounded water-worn pebbles is superior to crushed stone with angular clasts because the gravel mixes better in concrete and takes the shape of forms better.

The history of the aggregate industry in Japan (Baram and others, 1978) might parallel that of the Pacific Northwest. As urbanization depleted local supplies of sand and gravel in Japan, the construction industry placed a greater reliance on crushed stone. Then, as the demand for high-quality aggregate increased further, large-scale offshore mining of gravel began.

If the mining industry is to utilize sand and gravel resources from the outer continental shelf, it must protect the fishing industry. Even though the dredges move slowly and cover only small areas during any one year, they are certain to kill some individual animals, especially slow-moving ones. An even more important consideration, however, is that the mining operations must not be permitted to damage fish habitats.

Most of the species caught by the fishing industry disperse buoyant eggs into the water, where they presumably would be little affected by the mining. But herring lay their eggs on the bottom, usually at a depth of less than 20 m, so expert biologic advice must guide any dredging at these depths.

Among the bottom species off Oregon and Washington, the fishing industry now takes mainly sole, rockfish, crab, and shrimp (Pruter and Alverson, 1972). The boats catch some of these animals on substrates other than gravel — for example, they take shrimp from glauconite-bearing green mud near the outer edge of the continental shelf and crab mainly from sand bottoms. The larva of dungeness crab mature near the water surface, but one stage of the young of tanner crab prefers a gravel or rock bottom. They generally live at a depth of more than 400 m, however, which is deeper than dredging is likely to be undertaken.

During dredging, large fish often follow along to feed on sand fleas and worms that are uncovered by the disturbance at the draghead. Suction dredges only rarely capture fin fish, however, and present research suggests that silt and clay thrown into suspension in the open ocean by dredging is not toxic to them (Gustafson, 1972). For example, fish were found to be little affected by the discharge of a clay-slurry waste from a ceramics plant near Plymouth, England (Wilson and Connor, 1976).

Trailing suction dredges leave behind an undredged layer of gravel to avoid dilution of the commercial product by the substrate, and they also leave behind interspersed patches of virgin sea floor between the dredge tracks. These undredged patches may serve as centers of redispersal for invertebrate animals used as food by the fish. In a study of a wide dredged channel near Le Havre, France, biologic monitoring over a 6-month period showed that recolonization was rapid and that the most important source of recolonization of fish-food organisms was by the settling and development of larva from the plankton (Lee and others, 1977).

CONCLUSIONS

If marine sand and gravel dredging begins off Oregon and Washington, coastal construction and filling probably will utilize some of the first material that is produced. The gravel deposits that are likely to be exploited first are those off Washington adjacent to Grays Harbor and the southern Olympic Mountains. Where these deposits are more than 3 nautical miles from shore and shallower than a 50-m working depth for suction dredges, they have a combined area of 225 km^2. The deposits are about 200 km by water from Portland and 300 km from Seattle. This transport distance may be compared with a presently profitable 200-km run from North Sea dredging sites to London by the way of the River Thames.

Some aspects of offshore sand and gravel operations are more environmentally acceptable than onshore operations. Environmental pressures against the onshore operations and depletion of deposits near the cities will partly govern the future use of the offshore resources. Present evidence suggests that the dredging will have little harmful effect on the fish, crab, and shrimp species now being taken from the outer continental shelf and will not physically interfere with fish trawling. But silt and clay overflow must be conducted downward below the surface water layer that carries fish eggs and larva (Yagi and others, 1977). Also, because coastal marshes are nursery areas for commercially important fish, any filling in of such areas must be carefully monitored to ensure that it does not harm the fishing industry.

ACKNOWLEDGMENTS

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Oregon Surface Mining and Reclamation Law changed

The 1979 Oregon Legislative Assembly passed Senate Bill 712 amending the Oregon Surface Mining and Reclamation Law. The bill has been signed by the Governor and becomes effective October 4, 1979.

ORS Chapter 517.780 has been amended regarding the exemptions provided for city or county governments. The exemption provisions of the law remain unchanged, but the language has been clarified. The Department recommends that all cities and counties which have previously submitted ordinances for the Department's consideration review these ordinances in light of the changes contained in Senate Bill 712 and new model ordinances recommended by the Association of Oregon Counties.

The fees for mining operations provided in ORS 517.800 were also changed by Senate Bill 712. This change provides for a $30 per year increase in both the new application and the renewal fee. The new application fee after the effective date will be $295, and the annual renewal fee will be $195. New mining permit applications and October renewal applications will be accepted at the old rates of $265 and $165 respectively, if postmarked prior to October 4, 1979.

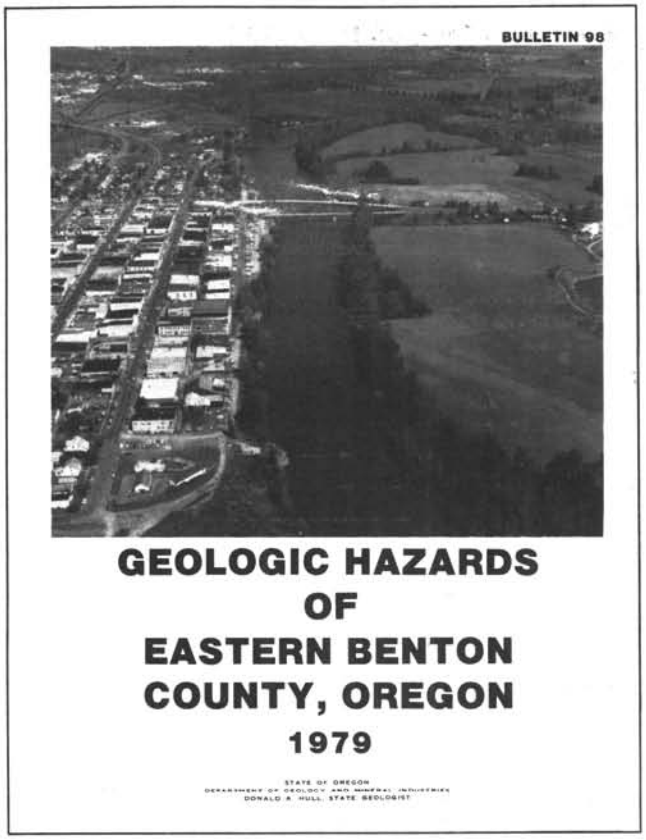
The changes in Senate Bill 712 will provide for more effective reclamation of Oregon mines and quarries and assist local governments in their mining activities. □

Applications for Oil and Gas Drilling Permits in Oregon

Permit number	Date issued	Company	Lease name and county	Location	Total depth (ft)
91	7-13-79	Reichhold Energy Corporation	Columbia County No. 6 (Columbia County)	SW¼ sec. 10, T. 6 N., R. 5 W.	3,466 2,956 RD-1 2,800 RD-2
92	7-13-79	Reichhold Energy Corporation	Columbia County No. 7 (Columbia County)	SE¼ sec. 4 T. 6 N., R. 5 W.	———
93	8-3-79	American Quasar Petroleum Co.	Longview Fibre Well No. 30-13 (Columbia County)	NW¼ SW¼ sec. 30 T. 6 N., R. 4 W.	———
94	8-3-79	American Quasar Petroleum Co.	Longview Fibre Well No. 25-33 (Columbia County)	NW¼ SE¼ sec. 25 T. 6 N., R. 5 W.	———
95	8-22-79	Reichhold Energy Corporation	Columbia County No. 8 (Columbia County)	SE¼ sec. 10 T. 6 N., R. 5 W.	———
96	8-22-79	Reichhold Energy Corporation	Libel No. 2 (Columbia County)	SE¼ sec. 15 T. 6 N., R. 5 W.	———
97	9-5-79	Floyd L. Cardinal	Watson Well No. 1 (Clatsop County)	NE¼ sec. 14 T. 7 N., R. 9 W.	———
98	9-11-79	Reichhold Energy Corporation	Columbia County No. 9 (Columbia County)	NW¼ sec. 1 T. 6 N., R. 5 W.	———
99	9-11-79	Reichhold Energy Corporation	Columbia County No. 10 (Columbia County)	SW¼ sec. 3 T. 6 N., R. 5 W.	———
100	9-11-79	Reichhold Energy Corporation	Columbia County No. 11 (Columbia County)	SE¼ sec. 11 T. 6 N., R. 5 W.	———

Applications for Oil and Gas Drilling Permits in Oregon (continued)

Permit number	Date issued	Company	Lease name and county	Location	Total depth (ft)
101	9-11-79	Reichhold Energy Corporation	Hammerberg No. 1 (Columbia County)	NE¼ sec. 14 T. 6 N., R. 5 W.	----
102	9-11-79	Reichhold Energy Corporation	Wall No. 1 (Columbia County)	SW¼ sec. 13 T. 6 N., R. 5 W.	----
103	9-11-79	Reichhold Energy Corporation	Busch No. 1 (Columbia County)	SW¼ sec. 15 T. 6 N., R. 5 W.	----
104	9-11-79	Reichhold Energy Corporation	Rawlinson No. 1 (Columbia County)	NW¼ sec. 13 T. 6 N., R. 5 W.	----
105	9-11-79	Reichhold Energy Corporation	Longview Fibre No. 2 (Columbia County)	SW¼ sec. 11 T. 6 N., R. 5 W.	----
106	9-12-79	American Quasar Petroleum Co.	Longview Fibre No. 31-24 (Columbia County)	SE¼ SW¼ sec. 31 T. 6 N., R. 4 W.	----
107	9-12-79	American Quasar Petroleum Co.	Longview Fibre No. 31-33 (Columbia County)	NW¼ SE¼ sec. 31 T. 6 N., R. 4 W.	----
108	9-12-79	American Quasar Petroleum Co.	Crown Zellerbach No. 15-14 (Columbia County)	SW¼ SW¼ sec. 15 T. 6 N., R. 4 W.	----
109	9-12-79	American Quasar Petroleum Co.	Crown Zellerbach No. 21-41 (Columbia County)	NE¼ NE¼ sec. 21 T. 6 N., R. 4 W.	----
110	9-12-79	American Quasar Petroleum Co.	Laubach No. 24-11 (Columbia County)	NW¼ NW¼ sec. 24 T. 6. N., R. 5 W.	----



Study of geologic hazards of eastern Benton County released

The Oregon Department of Geology and Mineral Industries (DOGAMI) has completed its *Geologic Hazards of Eastern Benton County, Oregon*, published as Bulletin 98. The author is James L. Bela.

The bulletin details the results of a year-long study intended to provide practical information about specific geologic hazards and engineering geology conditions in eastern Benton County. It will be useful to land use planners and land managers.

The text contains many illustrations and descriptions of such hazards as landslides, soil erosion, high ground water and ponding, stream erosion and deposition, and earthquakes.

In addition, Bulletin 98 includes four 7½-minute geologic maps and one 15-minute county-wide geologic map. Geologic hazards are shown on the maps.

Price of the complete bulletin is $9.00. Address orders to the Oregon Department of Geology and Mineral Industries, 1069 State Office Building, Portland, OR 97201. Payment must accompany orders of less than $20.00. □

DOE selects joint venture for negotiation of contract in Basalt Waste Isolation Program

The Department of Energy (DOE) has selected the joint venture of Kaiser Engineers, Oakland, California, and Parsons-Brinkerhoff, Quade and Douglas, Inc., San Francisco, for negotiation of a contract to provide architectural-engineering services to the Basalt Waste Isolation Program (BWIP).

The BWIP is responsible for assessing the feasibility and providing the technology to design and construct a licensed geologic repository for disposal of radioactive waste in the Columbia River Basalt Group, a 50,000 sq mi range of basalt running through parts of Washington, Oregon and Idaho.

Under terms of the contract, the joint venture will prepare a conceptual design of a basalt repository. Pending completion of negotiations, the two-year effort would be completed by September 1981 at a cost of approximately $4.5 million.

If ongoing site studies determine that the Hanford Site near Richland, Washington, is suitable for location of a repository, DOE has the option of continuing the services for preliminary and detailed design plus field services during construction. These site studies are being performed under the direction of DOE's Richland Operations Office by Rockwell Hanford Operations, a division of Rockwell International.

The BWIP is part of DOE's Nuclear Waste Terminal Program which is performing analysis characterizing various host rocks that show some potential as repository sites. Prior to any site selection for a repository, DOE will complete all the necessary steps required under the National Environmental Policy Act. □

Surface mine reclamation specialist position available

A surface mine reclamation specialist is needed by the State of Oregon Department of Geology and Mineral Industries. This position is with the Mined Land Reclamation Division. Primary reponsibilities include field inspections and enforcement. Considerable in-State travel required. This position requires technical education in one of the following fields: geology, forestry, engineering, or related fields. Preference will be given to applicants with specific experience in surface mine reclamation. Send resume and references to: Department of Geology and Mineral Industries, Mined Land Reclamation Division, 1129 S.E. Santiam Road, Albany, Oregon 97321, telephone: (503) 967-2039. □

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