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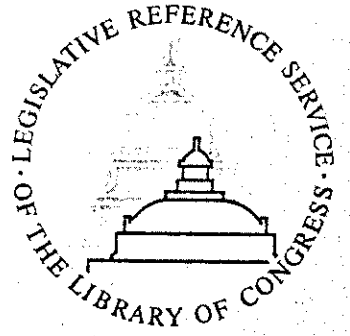

MINERAL RESOURCES OF THE UNITED STATES CONTINENTAL SHELF: Some Common Questions

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Preface

Recent developments in resource management have combined to create an increased awareness of and interest in the minerals and petroleum of the ocean floor, especially the region known as the continental shelf.

The developments include the growing scarcity of economic onshore sources of some minerals such as sand and gravel, or oil and gas; the accidents in Santa Barbara Channel and in the Gulf of Mexico where serious oil spills resulted from drilling operations; and the May 23, 1970 proposal by President Nixon to develop an international agreement renouncing all national claims to resources of the seabed beyond the 200 meter depth.

Our knowledge of the ocean floor and the resources to be found there is fragmentary. Only extensive geological surveys and sampling can provide meaningful information on what minerals are present, in what amounts and with what potential values. The technology to economically recover those resources is, with the exception of oil and gas and shallow water deposits, generally lacking.

Still, the interest in ocean mineral resources persists. It is because of this interest that the following brief series of most frequently asked questions and answers has been prepared by the Environmental Policy Division of the Legislative Reference Service.

It is evident that the list of questions is not comprehensive, but this is because the concern here is primarily with mineral resources and their recovery.

Q. What is the continental shelf? The outer continental shelf?

A. The CONTINENTAL SHELF is, geographically, the portion of the ocean bottom extending from the edge of the continent, or the mean low-water line, seaward to a point where the rate of slope toward the deep ocean floor increases greatly.

Figure 1 contains a profile of the ocean floor at the edge of a continent. (In Geological Survey Circular 619, p. 2.)

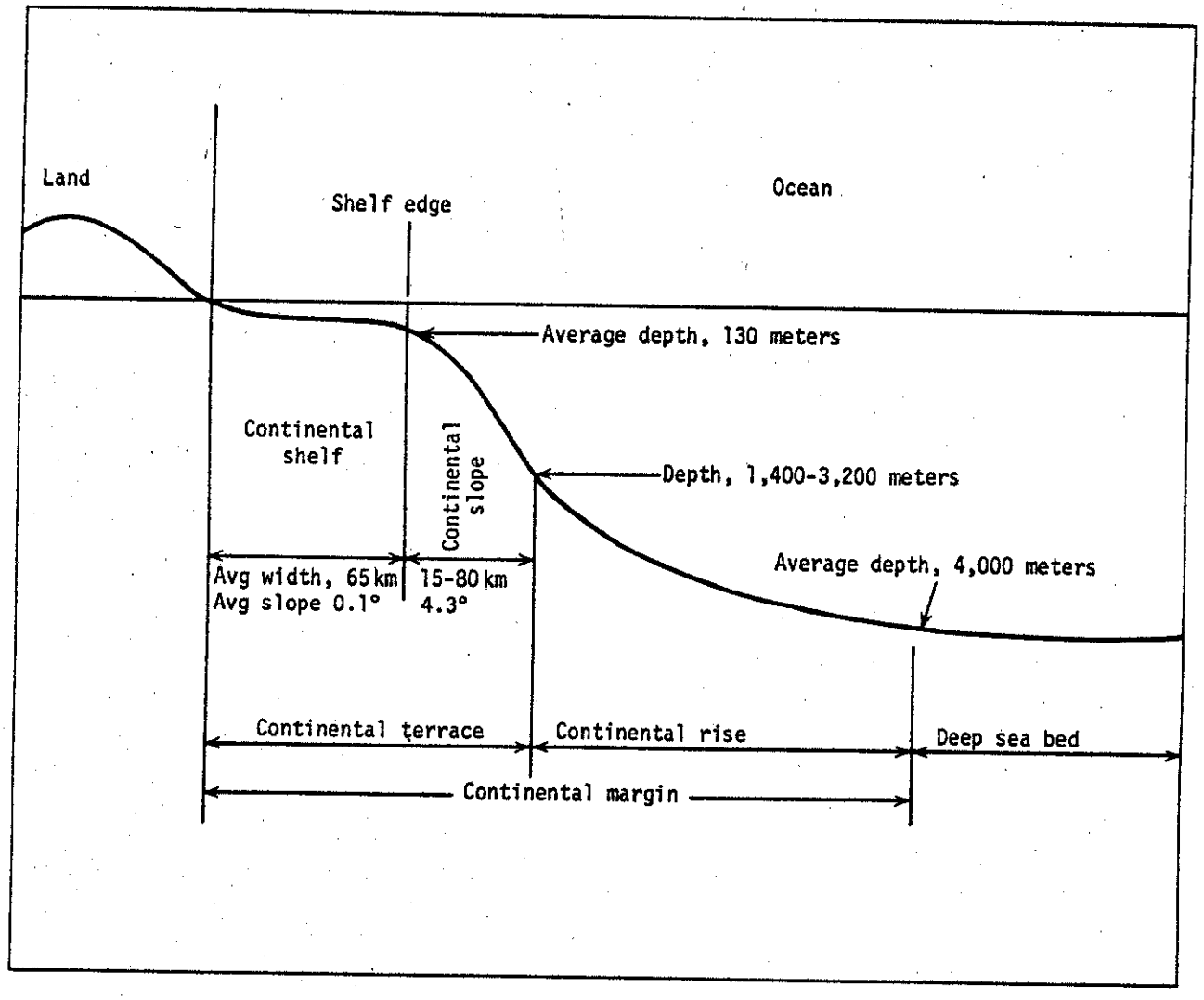

Figure 1.—Diagrammatic profile of continental margin showing average widths and depths and terminology (modified from Heselton, 1969).

A legal definition of the CONTINENTAL SHELF holds it to be "the seabed and subsoil of the submarine areas adjacent to the coast but outside the area of the territorial sea, to a depth of 200 meters...." This is the language of the 1958 Geneva Convention on the Continental Shelf, Article 1. Nations may recover minerals beyond that limit, "to where the depth of the superjacent waters admits of the exploitation of the natural resources of the said areas."

The OUTER CONTINENTAL SHELF is that portion of the shelf "which lies seaward of the portion of the submerged lands along the coast of the United States which Congress granted to the adjacent coastal States in 1953."[1/] Generally this means a distance of three miles from the coastline although, in the case of the Gulf coasts of Texas and Florida, State jurisdiction extends 9 miles offshore.

1/ U.S. Dept. of the Interior, Petroleum Production, Drilling and Leasing on the Outer Continental Shelf (Washington: U.S. Govt. Print. Off., 1966), p. 1.

Q. What is the size of the U.S. continental shelf?

A. As can be seen from the answer to the preceeding question, there is varied opinion as to what constitutes the continental shelf. Notwithstanding this difficulty, several estimates of size have been made, of which the following are representative. In a 1966 study for the Coast and Geodetic Survey of the Department of Commerce, the Batelle Memorial Institute included this table:

Table I

	Area (Thousands of Square Statute Miles)	
	Within 3 Nautical Miles of State Shores	Within 100-Fathom Contour
Atlantic Coast	10	140
Gulf Coast	8	135
Pacific Coast	5	25
Alaska Coast	?	550
Other	Small	Small
Total	23+	850+

The dry-land area of the U.S. and its territories is 3,628,000 square statute miles. Thus, the sea-floor area out to the 600-foot depth is a significant percentage (23 per cent) of the total U.S. dry-land territory.2/

2/ Batelle Memorial Institute, Development Potential of U.S. Continental Shelves (Washington: U.S. Govt. Print. Off., 1966), p. I-2.

More recently Dr. Vincent E. McKelvey published these estimates:

Table II

Area of the submerged parts of the continent bordering the United States (thousands of square miles).3/

	Between 3.5 mile (10.5 for Texas and Florida) limit and 200-meter contour	Between 200-and 2500-meter contours
Hawaii	0.4*	3.6
Alaska	560	212.2
Washington, Oregon and California Coast	15.4	76.2
Gulf Coast	107.5	84.2
Atlantic Coast	122	102.5
Total	805.3	478.7
United States Land Area:	3,615	

*Includes State Land

3/ V. E. McKelvey, "Mineral Potential of the Submerged Parts of the U.S.," Ocean Industry, (Sept, 1968), 37-43.

Q. What is the value of the mineral wealth of the continental margin?

A. No one knows, and the best estimates, apart from oil and gas, are little more than guesses. Dr. McKelvey has commented upon the dollar value of the minerals on, and in, our continental shelves saying:

> Considering that the rocks of the submerged parts of the continent are perhaps roughly comparable in their mineral content to those of the exposed parts, their full potential is better understood from a comparison with what has already been found on the land. The total value of mineral production in the United States from 1880 to 1967 is roughly $550 billion current dollars, or perhaps $800 to $900 billion in 1968 constant dollars--an average of $220,000 to $250,000 per square mile....
>
> The potential mineral wealth of continental rocks, then, is enormous and the submerged parts are sufficiently large to say that they too have an enormous potential mineral wealth, even though it is not possible now to say where and what much of it is or to visualize how to find and extract it. This is not to say that a square mile of seabed has a present value of "X" million dollars; on the contrary, all but a fraction of the seabed has no present mineral value whatsoever, for with the present state of knowledge and technology nothing can be extracted from it economically. But it is to say that submerged continental rocks do contain large quantites of minerals that will eventually make a valuable contribution to the U.S. economy.4/

While not an estimate of total wealth of the U.S. shelf, the following table from the 1970 report of the National Council on Marine Resources shows that materials worth nearly $11.5 billion were recovered from the seafloor in the period 1960-1970. An additional billion dollars of minerals was recovered from sea water.

4/ Ibid.

Table III

Value of Mineral Production From Oceans Bordering the United States, 1960-69[5/]

[In millions of dollars]

Year	From sea water	From wells in ocean subfloors	From beaches seafloors	Combined
	Magnesium metal and compounds, salt and bromine	Petroleum, natural gas, and sulfur	Sand and gravel, feldspar and cement rock*	
1960	69.0	423.6	46.8	539.4
1961	73.0	496.6	46.2	615.8
1962	89.1	620.7	44.3	754.1
1963	84.6	730.8	42.5	857.9
1964	94.5	820.3	43.6	958.4
1965	102.6	933.3	51.4	1,087.3
1966	117.0	1.177.7	51.6	1,346.3
1967	113.8	1,450.9	55.9	1,620.6
1968	146.1	1,980.0	52.8	2,178.9
1969 (preliminary)	151.7	2,327.3	56.0	2,535.0
10-year total	1,041.4	10,961.2	491.1	12,493.7

*Shell and calcareous marl.

Source: Bureau of Mines, Department of the Interior, Dec. 30, 1969.

A few estimates have been made of the value of specific mineral deposits on the continental shelf, including the following:

-- "...offshore sands in Norton Sound [Alaska] may be as rich or richer than the most famous gold-producing beach of all time...which yielded $100 million in gold."[6/]

-- "A coastal phosphate deposit valued at approximately $16 billion" was announced by the Georgia Dept. of Mines which said "about $8 million worth of phosphate can be recovered under current mining and processing technology."[7/]

5/ Marine Science Affairs--Selecting Priority Programs (Washington: U.S. Govt. Print. Off., 1970), p. 65.

6/ "Ocean Bottom Minerals," Ocean Industry, (June 1968), p. 66.

7/ Engineering and Mining Journal, (Dec. 1969), p. 90.

-- In the Bahamas the Dillingham Corporation has been given rights to aragonite (a form of limestone) deposits in 8,235 square miles of shallow sea floor. "In these areas there are about four billion cubic yards--roughly 7.5 billion long tons--of aragonite. At rock-bottom price the whole deposit is worth more than $15 billion."8/

-- Shell deposits in Gulf of Mexico estuaries have been estimated to have a value of $1,283.2 million according to a recently completed but unpublished study by the Bureau of Mines.9/ The following table gives a more detailed breakdown.

Table IV

Shell Deposits in the Gulf of Mexico

	Accessible*		Total**	
	Volume (million cu. yds.)	Value (million $)	Volume (million cu. yds.)	(million $)
Alabama	50	40	100	80
Florida	29	23.2	112	89.6
Louisiana	387	309.6	830	664.0
Mississippi	8	6.4	16	12.8
Texas	341	272.8	546	436.8
Total	815	652.0	1,604	1,283.2

*Capable of being mined now by legal, economic and technological standards.
**Excluded from mining now largely by legal standards to protect the shellfish industry.

8/ Coles Phinizy, "Dredging Money From the Bank," Sports Illustrated, (July 6, 1970), p. 22.

9/ Personal conversation with Robert Arndt, Bureau of Mines, Office of Mineral Resources, U.S. Department of Interior, Bartlesville, Okla. Report in preliminary draft on "Project on impact of estuarine mining, Gulf Coast."

-- The following estimates of the domestic oil and gas potential of the continental shelf are adapted from a 1968 report by Economic Associates, Inc. to the National Council on Marine Resources.10/

Table V

Estimate of Ultimate Offshore Crude Oil Reserves, by Region and Water Depth

(billion barrels)

Region	Water depth 0-200'	Water depth 200-600'
Atlantic seaboard (excl. Florida)	1.0	4.3
Florida:		
Atlantic Coast	---	---
Eastern Gulf Coast	---	---
Northern Gulf Coast	3.2	1.0
Mississippi and Alabama	2.9	0.6
Louisiana	17.9	6.3
Texas	7.0	2.2
California:*		
Southern California	1.3	2.4
Northern California	---	---
Oregon; Washington	---	---
Alaska:		
Pacific Coast (excl. Gulf of Alaska)		
Gulf of Alaska	8.0	
Bristol Bay	16.0	
Bering Sea; Arctic margin**	(140?)	
Totals***	49.3	24.8

*One-third of California offshore ascribed to southern California.
**Uncertain as to exploitability by available methods. Not included in totals.
***Alaska resources (other than Bering Sea and Arctic margin) split 2:1 for 0-200' and 200-600'.

10/ The Economic Potential of the Mineral and Botanical Resources of the U.S. Continental Shelf and Slope, (Springfield, Va.: Federal Clearinghouse, 1968), p. 94, 95.

Table VI

Estimate of Ultimate Offshore Natural Gas Reserves, by Region and Water Depth

(trillion cu. ft.)

Region	Water depth	
	0-200'	0-600'
Atlantic seaboard (excl. Florida)	7.0	30.1
Florida:		
Atlantic Coast	?	?
Eastern Gulf Coast	?	?
Northern Gulf Coast	23.5	7.3
Mississippi and Alabama	21.3	4.4
Louisiana	131.5	46.2
Texas	49.5	15.6
California		
Southern California	1.7	2.5
Northern California	?	?
Oregon and Washington	?	?
Alaska:		
Pacific Coast	?	
Gulf of Alaska	45.8	
Bristol Bay	91.5	
Bering Sea and Arctic margin	?	
Total	477.9	

Current values for these resources are $3/bbl for oil, and 20¢/thousand cubic feet for natural gas, thus giving a total estimated value of $225 billion for offshore oil and $95.6 billion for natural gas.

All the above figures must be taken in reference to the monumental lack of extensive factual information which was noted in the preface.

Q. What agency is responsible for leasing of the Outer Continental Shelf?

A. Statutory responsibility for leasing and managing federally-owned offshore lands--the 805,000-square-mile Outer Continental Shelf--is vested in the Department of the Interior, specifically in the Bureau of Land Management and the Geological Survey. The Bureau of Land Management prepares leasing maps, holds lease sales, and approves assignment of lease interests. It also issues rights-of-way for pipelines and related facilities and, during the past year, completed a study on the place of offshore oil in the total national supply. In progress is a study designed to identify the economic impact of recent revisions in the regulations which govern leasing and drilling on the Outer Continental Shelf. The Geological Survey is the agent for gathering information on the geology and mineral resources of the offshore areas and for supervising resource production activities. The two bureaus work together to identify tracts to be offered for lease and development; to assess the economic value of the acreage for purposes of establishing acceptable bonuses; and to plan for long-term development of the OCS.11/

11/ Marine Science Affairs--Selecting Priority Programs (Washington: U.S. Govt. Print. Off., 1970), p. 73.

Q. Where is petroleum being produced on the Federal portion of the continental shelf?

A. Petroleum is now being produced on the Outer Continental Shelf in the Gulf of Mexico and off the California coast in the Santa Barbara Channel.

Q. How many Federal leases have been granted at depths of 200 meters or greater?

A. In the Santa Barbara Channel there are 51 leases which are all or partly at the 200 meter depth, or greater. There is none in the Gulf of Mexico at this time.

Q. What is the maximum distance from shore of petroleum leasing and operations?

A. In the Gulf of Mexico there is a lease 87 miles from shore. A discovery has been made 83 miles from shore in 373 feet of water, and production is taking place in another lease 70 miles from shore in 340 feet of water.

Q. What is the maximum water depth in which leasing and petroleum operations have taken place?

A. Depth records are held by the Santa Barbara leases, some of which are for tracts in 1,500 feet of water. One company has reported "a major oil discovery" at 1,300 feet following a previous strike on another tract at 640 feet.

Natural resources lawyer Northcutt Ely has recently written on the matter of offshore mineral activity and the 200 meter depth of the Convention on the Continental Shelf as follows:

> The U.S. has granted a phosphorite lease in water depths up to 1,340 meters, and petroleum leases in water depths up to 550 meters. It has asserted its jurisdiction over resource development on the Cortes Banks, about 100 miles from the California mainland, separated from the mainland by a trench about 1,500 meters deep. It has granted special exploration permits in waters more than 1,500 meters deep. In 1968, a U.S. lessee drilled a well in 1,299 ft. of water (395 meters), penetrating rock to a depth of 13,622 ft. That well was plugged and abandoned. Subsequently, a major discovery was announced in Santa Barbara Channel at a water depth of about 1,200 ft. Consequently, the figure of 200 meters in the Convention has become a dead number.12/

Another recent report addressing itself to the matter of recovery of petroleum from offshore stated:

> Within less than five years, technology will allow drilling and exploitation in water depths up to 1,500 feet (457 meters). Within ten years technical capability to drill and produce in water depths of 4,000-6,000 feet (1,219-1,829 meters) will probably be attained.13/

Q. What revenues have been derived from Outer Continental Shelf leasing?

A. The following table summarizes the money received from leasing of the Outer Continental Shelf from 1953 through 1969.

12/ Northcutt Ely, "Legal Problems in Undersea Mineral Development," Journal of Petroleum Technology, (March 1970), p. 241.

13/ National Petroleum Council. Petroleum Resources under the Ocean Floor. (Washington, March 1969), p. 8.

Table VII

OUTER CONTINENTAL SHELF
Total Revenues
1953-1969

YEAR	BONUSES	MINIMUM ROYALTIES	RENTALS	SHUT-IN GAS PAYMENTS	ROYALTIES	TOTAL REVENUE
ALL STATES						
1953	$ -	$ -	$ 1,359,630	$ 30,650	$ 967,892	$ 2,358,172
1954	140,969,005	-	3,855,333	86,950	2,748,977	147,660,265
1955	108,528,725	-	3,406,351	122,000	5,140,006	117,197,082
1956	-	-	4,006,193	79,950	7,629,383	11,715,526
1957	-	68,581	3,270,122	110,268	11,391,245	14,840,216
1958	-	184,396	2,420,584	121,218	17,423,878	20,150,076
1959	89,746,993	171,036	2,285,725	84,984	26,539,977	118,828,715
1960	282,717,065	316,975	3,603,140	49,350	37,095,301	323,781,831
1961	-	314,121	3,073,861	37,100	47,920,332	51,345,414
1962	489,481,111	517,722	8,412,207	62,200	66,096,334	564,569,574
1963	12,807,587	668,339	8,435,184	52,950	76,999,225	98,963,285
1964	95,874,326	820,343	9,798,573	45,800	88,400,230	194,939,272
1965	33,740,309	1,072,699	8,731,378	38,450	102,862,540	146,445,376
1966	209,199,893	1,367,250	6,869,277	41,700	136,987,537	354,465,657
1967	510,109,742	1,891,515	6,208,936	41,400	157,607,609	675,859,202
1968	1,346,487,097	2,145,178	8,230,787	52,300	201,136,931	1,558,052,293
1969	111,660,685	1,923,632	8,312,607	41,650	240,090,666	362,029,240
TOTAL ALL STATES	$3,431,322,538	$11,461,787	$92,279,888	$1,098,920	$1,227,038,063	$4,763,201,196

Source: U.S. Geological Survey.

Q. How are rent and royalty payments determined?

A. All OCS leaseholders are required to pay rent at one of the following rates:

1. $3/acre/year in the case of general lease sales for wildcatting (chance drilling in unproven areas).

2. $5/acre/year for development tracts in which the existence of oil is partially proven.

3. $10/acre/year for drainage tracts adjoining producing leases.

With regard to royalty payments, the report of the Public Land Law Review Commission[14/] has stated:

> To date, all Outer Continental Shelf leases have been issued with a fixed royalty of 16 2/3 percent and have been awarded on cash bonus bids. In the interest of conservation, the Secretary may permit a reduction of royalties if the lease cannot be operated successfully at the statutory minimum of 12 1/2 percent. No applicant for this discretionary relief has been filed since leasing activity began in 1954.

The Commission report contains the following recommendation:

> Recommendation 75: The Outer Continental Shelf Lands Act should be amended to give the Secretary of the Interior authority for utilizing flexible methods of competitive sale. Flexible methods of pricing should be encouraged, rather than the present exclusive reliance on bonus bidding plus a fixed royalty. In addition, the timing and size of lease sales, both of which are presently irregular, should be regularized. Furthermore, while discretion to reject bids should remain with the Secretary, this authority should be qualified to require that he state his reasons for rejection.

14/ One-third of the Nation's Land. (Washington: Public Land Law Review Commission, 1970), p. 192.

A 1966 Interior Department publication[15/] provides the following additional information on OCS leases:

> Lease terms are for five years, and for as long thereafter as oil or gas may be produced in paying quantities or drilling or re-working operations as approved by the Secretary are conducted. For leasing purposes the Continental Shelf has been sub-divided into blocks. Lease block sizes are 5,000 acres off Louisiana, and 5,760 acres off Texas, Washington, Oregon and California.

15/ U.S. Dept. of the Interior, Petroleum Production, Drilling & Leasing on the Outer Continental Shelf, (Washington: U.S. Govt. Print. Off., 1966), p. 7.

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