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GEOLOGICAL SURVEY

Estimated Oil and Gas Reserves, Gulf of Mexico Outer Continental Shelf, January 1, 1979

By Floyd T. Bryan, John H. Knipmeyer, and E. Kenneth Schluntz

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This report has not been edited for conformity with Geological Survey editorial standards

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ABSTRACT

Remaining recoverable reserves of oil* and gas in the Gulf of Mexico Outer Continental Shelf area have been estimated to be about 2.76 billion barrels of oil and 37.2 trillion cubic feet of gas, as of January 1, 1979. These reserves are recoverable from 370 studied fields under the Federal submerged lands off the coasts of Louisiana and Texas. An additional 31 fields, discovered since September 1, 1977, have not been sufficiently developed to permit a reasonably accurate estimate of reserves.

Original recoverable reserves are estimated to have been 7.5 billion barrels of oil and 76 trillion cubic feet of gas from 385 fields in the same geographic area. Included in this number are 15 fields that are depleted and abandoned; not included are the 31 new fields. Estimates were made for individual reservoirs in 289 fields and on a field-wide basis for the other 96 fields.

* The term "oil" as used in this report includes crude oil, condensate, and gas-plant liquids.

INTRODUCTION

This report, which supersedes USGS Open-File Report 79-551 (Bryan, Knipmeyer, and Schluntz, 1979), presents estimates of original recoverable reserves, cumulative production through 1978, and estimates of remaining recoverable reserves as of January 1, 1979. The estimates of reserves for this report were completed in October 1979, and they represent the combined efforts of engineers, geologists, and other personnel of the U. S. Geological Survey's Metairie, La., office.

As in the previous report (for January 1, 1978), standard methods of estimating reserves were used, including volumetric calculations, decline curve analysis, material balance, and mathematical simulation.

Some graphs are included this year which compare the annual rates of discovery with the rates of production.

DEFINITION OF RESERVE AND RESOURCE TERMS

The reserve and resource terminology in this report conforms with that published by Miller and others (1975, p. 8-9). The quoted definitions of terms applicable to this report are:

"Resources.--Concentrations of naturally occurring solid, liquid, or gaseous materials in or on the Earth's crust in such form that economic extraction of a commodity is currently or potentially feasible."

"Reserves.--That portion of the identified resource which can be economically extracted."

"Measured reserves.--That part of the identified resource which can be economically extracted using existing technology, and whose amount is

estimated from geologic evidence supported directly by engineering measurements. In this study, they are considered to be equivalent to API and AGA proved reserves."

"Indicated reserves.--Reserves that include additional recoveries in known reservoirs (in excess of the measured reserves) which engineering knowledge and judgment indicate will be economically available by application of fluid injection, whether or not such a program is currently installed (API, 1974). In this study indicated reserves are equivalent to API indicated additional reserves."

"Demonstrated reserves.--A collective term for the sum of measured and indicated reserves."

Production data are the metered volumes of oil and raw gas as reported by the lease operators, the only available source for individual well and reservoir data. Liquid volume measurements and reserves are corrected to reference conditions of 60° Fahrenheit and one atmosphere (14.696 psia); gas reserves and production measurements, to 60° F. and 15.025 psia. Continuously measured volumes from production platforms and/or leases are allocated to individual wells and reservoirs based upon periodic well test "gauges." This introduces approximations in both production and reserves data by reservoirs, limiting accuracy to two or three significant figures.

FIELDS REPORTED BY AREA

Estimates for all producing fields as well as all fields discovered prior to September 1977 are included in area totals (table 1). The areas (fig.1) are those delineated by the Bureau of Land Management for administrative purposes. The reserves reported in table 1 include estimates

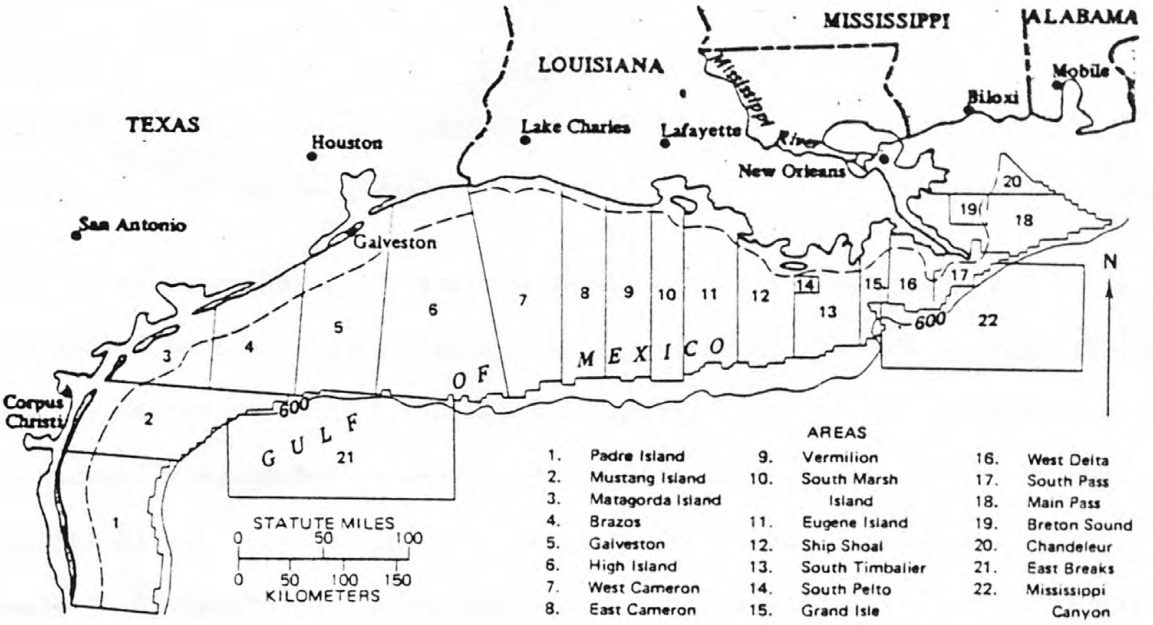

Figure 1.–Index map showing Outer Continental Shelf leasing areas off Texas and Louisiana. Dashed lines, shown at 3 marine leagues (9 nautical miles) from the Texas coast and 3 nautical miles from the Louisiana coast, indicate boundary between State and Federal waters. Solid line indicates 600-foot water depth.

Table 1.--Estimated demonstrated oil and gas reserves for 385 fields, Gulf of Mexico Outer Continental Shelf and Slope, January 1, 1979

[Demonstrated reserves: the sum of measured and indicated reserves. Liquids expressed in millions of barrels, gas in billions of cubic feet. "Liquids" include crude oil, condensate, and gas-plant products sold; "gas" includes both associated and nonassociated dry gas. Remaining recoverable reserves estimated as of January 1, 1979.]

Area (fig. 1)	Fields[1/] (total 385)	Original recoverable reserves		Cumulative production		Remaining recoverable reserves	
		Liquids	Gas	Liquids	Gas	Liquids	Gas
Mustang Island [2/]	5	1.8	230	0	0	1.8	230
Brazos	7	7.8	670	3.8	220	4.0	450
Galveston	5	34	780	25	630	9	150
East Breaks	2	18	310	0	0	18	310
High Island	59	103	5800	6	700	97	5100
West Cameron	49	191	12400	81	5500	110	6900
East Cameron	34	132	6200	78	3600	54	2600
Vermilion	46	315	8600	162	5400	153	3200
South Marsh Island	31	530	8400	210	4100	320	4300
Eugene Island	40	1050	10000	650	5600	400	4400
Ship Shoal	31	870	7700	570	4500	300	3200
South Timbalier[3/]	18	1030	3560	800	2150	230	1410
South Pelto	4	70	186	39	81	31	105
Grand Isle	10	740	2900	640	1920	100	980
West Delta	14	1080	3470	770	2330	310	1140
South Pass	8	610	1660	410	930	200	730
Main Pass[4/]	19	610	2500	320	1300	290	1200
Mississippi Canyon	3	130	800	0	0	130	800
Total	385	7522.6	76,166	4764.8	38,961	2757.8	37,205

1/ Represents 15 formerly productive, now abandoned fields and 370 of the 401 active (Sept. 1979) fields.
2/ And Matagorda Island area
3/ And Bay Marchand area
4/ And Breton Sound area

for 385 fields and constitute the current listing in the U.S. Geological Survey's Field and Reservoir Reserve Estimate (FRRE) data-processing system.

As of September 1979, there were 401 active fields in the federally controlled part of the Gulf of Mexico as listed by the U.S. Geological Survey, Gulf of Mexico Regional Field Names Committee. Of these, 370 were considered sufficiently developed to warrant estimation of reserves for this study. Another 31 were not sufficiently developed to permit a reasonably accurate estimate of reserves. In addition to the 370 developed fields, 15 depleted fields (abandoned after significant production) have been included in the report. This makes a total of 385 fields for which oil and gas reserves were estimated. The 15 depleted fields are not included in the Regional Field Names Committee's 401 active fields, but are reported here in order to give a complete record of cumulative oil and gas production. For any field that is partly in State waters and partly in Federal waters, reserves are estimated for the Federal portion only.

STUDIES CONDUCTED

Estimates for 289 of the 385 fields are based on studies of 6,500 individual reservoirs. For each reservoir, a volumetric estimate was made, and for many of them, at least one other estimation method was also used. The subsequent performance of each reservoir is periodically compared to the original predictions. Reserve estimates for the remaining 96 fields in the FRRE system were made on a field-wide basis from production studies or, for nonproducing fields, from volumetric studies.

Each abandoned lease that had significant production of oil or gas is assigned a value for original recoverable hydrocarbons equal to the amount actually produced.

FIELD-SIZE DISTRIBUTION

The distributions of the sizes of field reserves are shown in figures 2 and 3. Nine fields are included in both histograms because they contain significant reserves of both oil and gas. A geometric progression was selected for the horizontal scales in consideration of the log-normal type of distribution.

Figure 2 illustrates that the most common gas field reserve (mode) is about 90 billion cubic feet (BCF) of gas. The median (exceeded by 50 percent of the fields) was determined to be 85 BCF and the weighted average (mean) reserve is 207 BCF of gas.

Among the 90 oil fields (fig. 3) the mode reserve is about 57 million barrels. The median is 36 million barrels and the mean is 65 million barrels of oil per field. The petroleum industry commonly rates as "major" oil fields those having original reserves of 100 million barrels or more. In this group of oil fields, 18 contained at least 100 million barrels each and a total reserve amounting to 66 percent of the original reserves contained in the 90 fields.

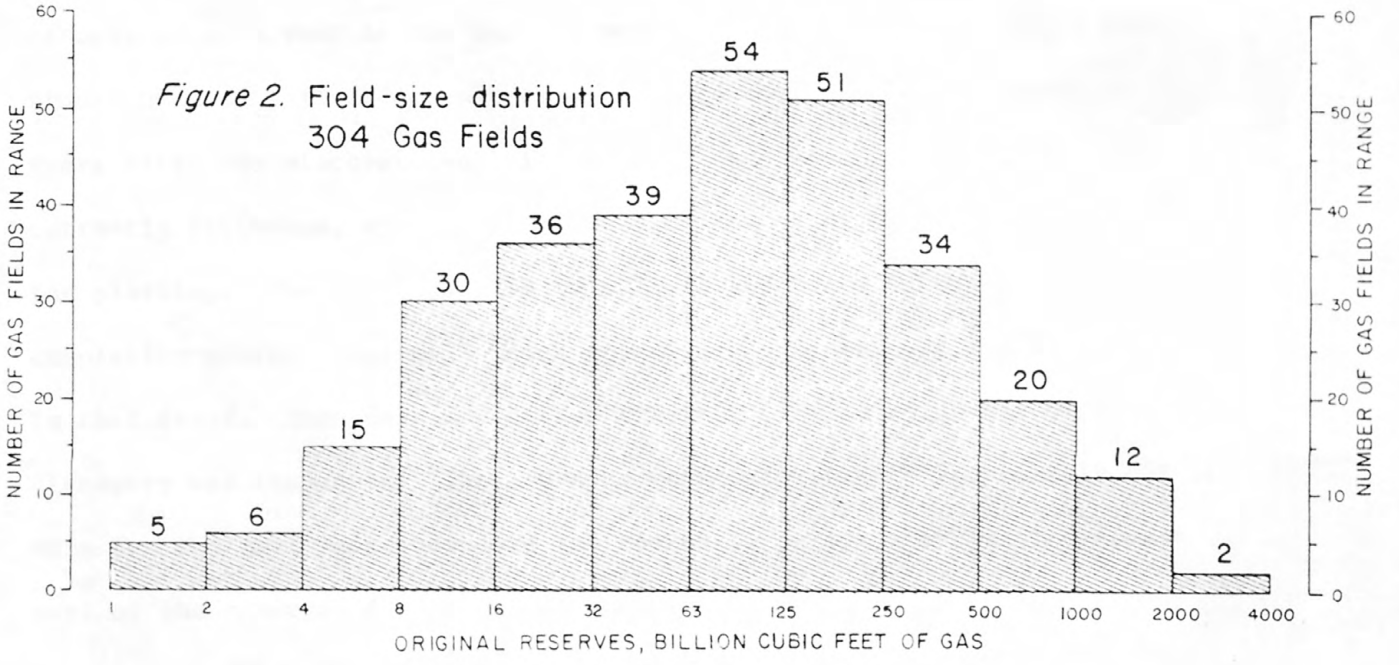

Figure 2. Field-size distribution
304 Gas Fields

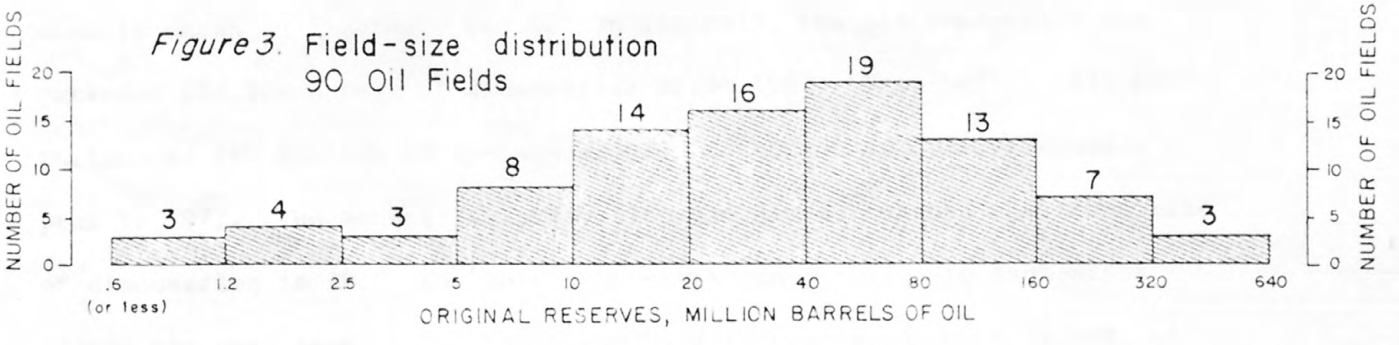

Figure 3. Field-size distribution
90 Oil Fields

RESERVES DISCOVERED EACH YEAR, DISCOVERY TRENDS AND ANNUAL PRODUCTION

Figures 4 and 5 show the reserves of gas and oil, respectively, discovered each year in the Gulf of Mexico Outer Continental Shelf. Even though much of a field's reserves is usually not proven until several years after the discovery well is drilled, the total reserves, as currently estimated, are allocated to the year of discovery and combined for plotting. The year assigned to a field discovery is the year of completion of the first well which encountered significant hydrocarbons in that field. This date may differ from the year in which the field discovery was announced. These graphs terminate with 1977; probably the data for the last year shown are too recent to permit a realistic assessment of the reserves discovered in that year.

Superimposed on each plot of yearly discoveries is a line depicting the 7-year moving average, which better indicates the overall trend by smoothing out the peaks. The average presented is the total of the hydrocarbons discovered in a 7-year period divided by seven and plotted for each middle year.

For comparison with the rate of discoveries, the annual production also is shown on figures 4 and 5. In figure 5, the oil production has exceeded the trend rate of discoveries since 1967. This undoubtedly has influenced the decline of the annual oil production after it reached a peak in 1971. The annual gas production had almost reached the trend rate of discoveries in 1970 and these two curves ran parallel to each other during the next four years. The peak rate for gas production is not yet apparent.

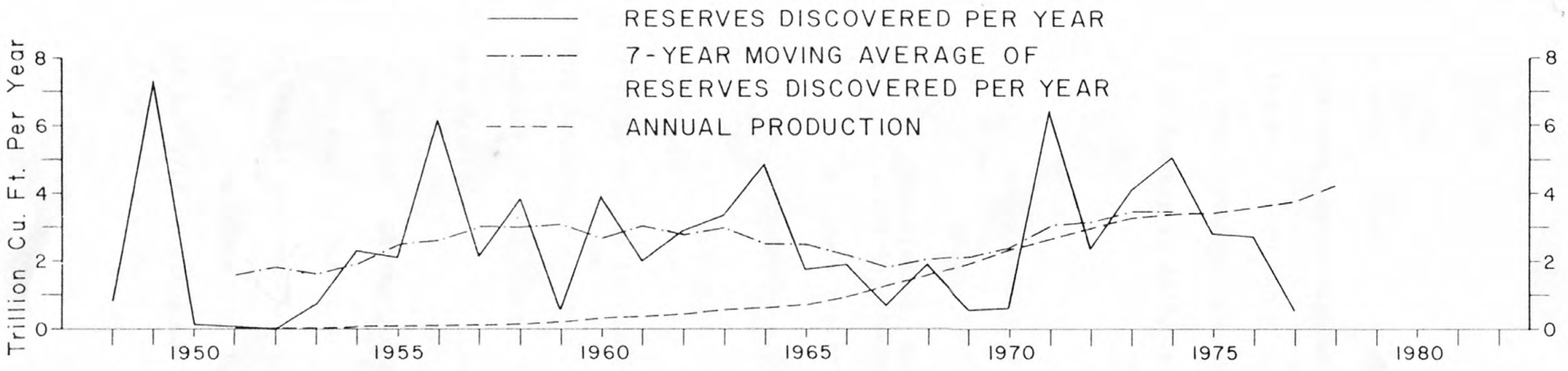

Figure 4.--Gas Reserves Discovered And Gas Production

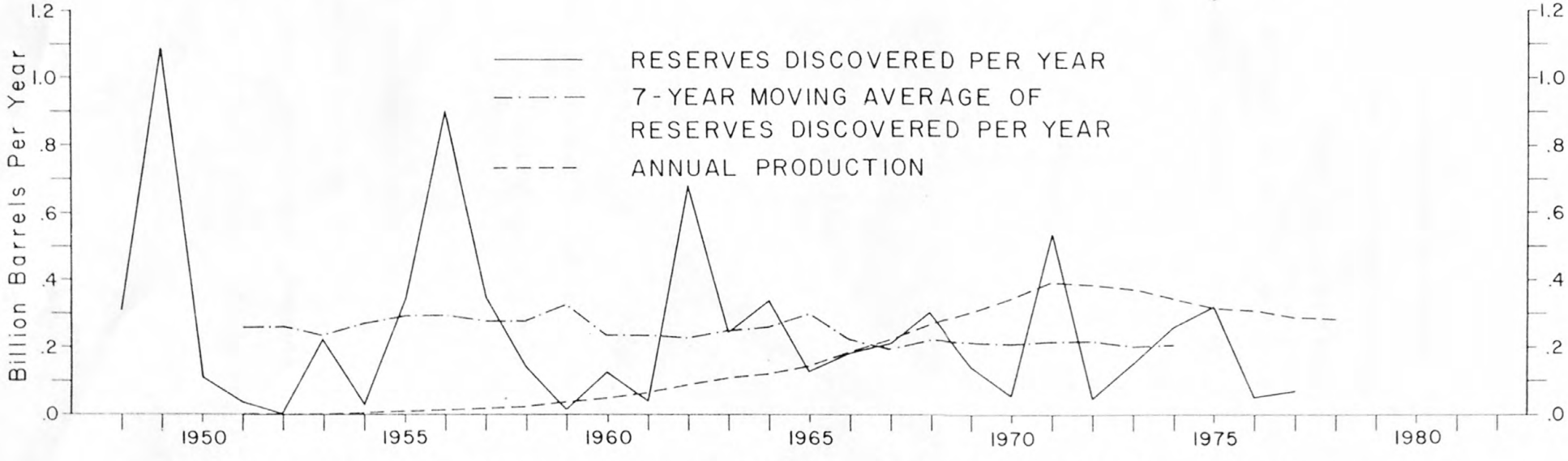

Figure 5.--Oil Reserves Discovered And Oil Production

Owing to the approximations in the production and reserves as listed in table 1, partly caused by rounding field data to two significant figures, adjustments to cumulative production totals may be necessary in reconciling balances between annual reports. A comparison between the oil and gas reserves previously reported as of January 1, 1978, and those now reported as of January 1, 1979, is summarized as follows:

		Oil (billion bbl)		Gas (trillion cu ft)
Reserves 1-1-78		2.71		34.2
Production, 1978	(-)	0.30	(-)	4.0
Discoveries, Revisions, and Adjustments	(+)	0.35	(+)	7.0
Reserves 1-1-79		2.76		37.2

CONCLUSIONS

The most significant change from the previous report (for January 1, 1978) is the net increase of 51 field studies. Four-fifths of those added were discovered after January 1976. Fifty-seven additional fields were studied: 46 gas fields, 5 oil fields, and 6 oil and gas fields. Six fields were deleted, none of which had significant reserves.

The 385 oil and gas fields studied in the federally controlled part of the Gulf of Mexico originally contained reserves estimated at 7.52 billion barrels of oil and 76.2 trillion cubic feet of gas. Remaining recoverable reserves, as of January 1, 1979, are estimated to be 2.76 billion barrels of oil and 37.2 trillion cubic feet of gas.

REFERENCES CITED

American Petroleum Institute, American Gas Association, and Canadian Petroleum Association, 1974, Reserves of crude oil, natural gas liquids, and natural gas in the United States and Canada as of December 31, 1973: New York, Am. Petroleum Inst.

Bryan, F. T., Knipmeyer, J. H., and Schluntz, E.K., 1978, Estimated oil and gas reserves, Gulf of Mexico Outer Continental Shelf, January 1, 1977: U.S. Geological Survey Open-File Report 78-87, 11 p. (Superseded by Open-File Report 79-551)

____ 1979, Estimated oil and gas reserves, Gulf of Mexico Outer Continental Shelf, January 1, 1978: U.S. Geological Survey Open-File Report 79-551, 11 p. (Superseded by present report)

Miller, Betty M., and others, 1975, Geological estimates of undiscovered recoverable oil and gas resources in the United States: U.S. Geological Survey Circular 725, 78 p.