

STATE OF ALASKA  
DEPARTMENT OF NATURAL RESOURCES  
DIVISION OF GEOLOGICAL AND GEOPHYSICAL SURVEYS

ESTIMATED SPECULATIVE RECOVERABLE RESOURCES  
OF OIL AND NATURAL GAS IN ALASKA

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This report is preliminary and  
has not been edited or reviewed  
for conformity with Alaska  
Geological & Geophysical Surveys  
standards.

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## ABSTRACT

Basin to basin estimates are made of the speculative recoverable resources of oil and natural gas in Alaska. The estimates are made using a generally accepted approach of first calculating the total area of each sedimentary basin or province, finding the cubic miles of sedimentary section contained in the basin or province, and multiplying this by an estimate of the barrels of oil in a cubic mile. Natural gas resources are then calculated using an estimate of cubic feet of gas per barrel of oil.

The sedimentary provinces of Alaska are estimated to contain 76.1 billion barrels of speculative recoverable oil and 439.6 trillion cubic feet of speculative recoverable gas. The total discovered recoverable oil and gas in the State is 10.8 billion barrels and 31 trillion cubic feet. Of this, one field (Prudhoe Bay) contains 10 billion barrels of oil and 26 trillion cubic feet of gas.

The final figures are considered to be conservative, as they are necessarily based on averages of other areas. Historically, figures of this type do not take into consideration the possibility of discovering giant oil fields; a possibility which is considered much better than average in Alaska. Therefore, these figures may be as much as 50% too low.

## INTRODUCTION

In response to a request from the Joint State-Federal Land Use Planning Commission, the Division of Geological and Geophysical Surveys has calculated the estimated speculative recoverable resources of oil and natural gas for the State of Alaska. Included is a map of the State showing areas of oil and gas potential, and a table which summarizes the estimated speculative recoverable resources of oil and gas for each onshore basin and offshore petroleum province in the State.

It should be indicated that estimates of these types are subject to a high degree of error. However, the figures are considered to be conservative, as they assume an average distribution of reserves based on reasonable and moderate limits of other producing areas. Historically, calculations of this type do not take into consideration the possibility of discovering giant oil fields. Thus, the discovery of Prudhoe Bay; the possibility of 14 billion barrels of oil in the Marsh Creek anticline in the Arctic National Wildlife Refuge (Hartman, 1973), the large structures in the Gulf of Alaska and the large sedimentary province in the Bering Sea all suggest that there is a much better than average chance that Alaska contains a number of giant oil fields. It is therefore considered that pessimistically the figures could be 25% too high, but with the addition of a few giant oil fields they may be 50% too low.

Speculative recoverable petroleum resources are here defined as those petroleum resources which are completely undiscovered, and which after discovery can reasonably be expected to be produced using present technology and under present economic conditions.

## CALCULATIONS

The following method was used for calculating the estimated speculative recoverable petroleum resources in Alaska basins:

1. Each sedimentary basin was given a rank of I, II or III based on known parameters such as production, oil shows, age and quality of the sedimentary section, presence or absence of known reservoir and source beds and known structures that may contain oil and/or gas.

2. A search of the literature was made to determine reasonable recoverable oil figures per cubic mile of sediment. Recoverable oil per cubic mile of sediment has been calculated to be:

- a. 150 - 300 thousand barrels in selected Tertiary trends in the Gulf Coast (Mason, 1971)
- b. Average 80,000 barrels per cubic mile in Gulf Coast sediments (Mason, 1971)
- c. Average 50,000 barrels per cubic mile in contiguous United States producing basins (Mason, 1971)
- d. Crick, (1971) calculated in place reserves in Upper Cook Inlet, and came up with a figure of 1.5 million barrels per cubic mile. He estimated 386,000 barrels per cubic mile would be found in the entire Cook Inlet. This figure reduces to approximately 115,000 barrels per cubic mile assuming 30% recovery.

3. Each basin was assigned a barrels per cubic mile figure based on its rank. A Rank I basin was assigned 75,000 barrels per cubic mile; Rank II - 50,000 and Rank III - 30,000.

The exceptions to this were the Cook Inlet, which has enough production to get a more accurate figure; the North Slope Basin which has significant oil discoveries and high future potential, and the Gulf of Alaska offshore which is considered to have at least as much potential as Cook Inlet.

4. A map was made showing all the potential oil and gas areas in the State. This was done for sedimentary basins onshore where the basin outlines are relatively well known. Sedimentary provinces were used offshore rather than basins. A sedimentary province is defined as an area with sufficient sedimentary section to have accumulated and trapped petroleum. Public data is very limited in offshore areas and it was therefore felt that a province approach was more realistic. The provinces are limited to the 1500 meter water depth. The surface area of each basin and province was then calculated from the map.

5. The average thickness of sedimentary rock was calculated for each basin and province. This figure was obtained from published data, well penetration depths, geophysical information, measured sections, and experience of different members of the Division of Geological and Geophysical Surveys. An effective economic total thickness of 25,000 feet was used even though some basins contained 30,000 to 40,000 feet of sediment.

6. Speculative recoverable oil was calculated by multiplying the area times average sediment thickness times the anticipated barrels of oil per cubic mile. Speculative recoverable gas was calculated using the Cook Inlet ratio of 7.3 M.C.F. per barrel of oil in Tertiary basins, and the Prudhoe Bay ratio of 2.7 M.C.F. per barrel of oil in Mesozoic and Paleozoic basins. (These figures were obtained from State of Alaska, Division of Oil and Gas.)

#### RESULTS

The results of the above calculations are shown in Table I and on the map titled "Estimated Speculative Petroleum Potential" dated January 1974. Total speculative recoverable resources are estimated to be 76.1 billion barrels of oil and 439.6 trillion cubic feet of gas. Total discovered recoverable

reserves are 10.5 billion barrels of oil and 29.7 trillion cubic feet of gas. Cumulative production as of March 1973 was .5 billion barrels of oil and .6 trillion cubic feet of gas. These figures sum to an estimated total potential ultimate production of onshore and offshore Alaska of 86.6 billion barrels of oil and 469.3 trillion cubic feet of gas.

By order of  
(These figures)

The result

Geologic Basin or Province	Rank <sup>1</sup>	Geologic Section	Sq. Miles	Ave. Thick. (miles)	Cu. Mi. of Sediment (To Max. Drilling Depth of 25,000')	Bbls. of Oil Per Cu. Mi.	Estimated Speculative Recoverable Resources - Oil (Billions of Barrels)	MCF per Barrel	Estimated Speculative Recoverable Resources - Gas (Trillions of Cu. Ft.)
<b>ONSHORE</b>									
Cook Inlet	I	Tertiary & Mesozoic	6,063 <sup>2</sup>	1.31	8,064 <sup>2</sup>	115,000	.93 <sup>2</sup>	7.3	6.67 <sup>2</sup>
Copper River	III	Tertiary	3,840	1.4	5,376	30,000	.16	7.3	1.20
Holitus	III	Tertiary	1,200	.47	564	30,000	.02	7.3	.12
Mitchevina	III	Tertiary	4,000	.47	1,894	30,000	.06	7.3	.41
Middle Tanana	III	Tertiary	5,440	.47	2,556	30,000	.08	7.3	.55
Yukon - Kandik	II	Tertiary & Paleozoic	15,440	1.9	29,336	50,000	1.50	7.3	10.90
Yukon - Kandik	III	Mesozoic & Paleozoic	4,064	1.42	5,770	30,000	.17	2.7	.47
Gulf of Alaska	I	Tertiary	10,080 <sup>2</sup>	2.08	20,966 <sup>2</sup>	75,000	1.6 <sup>2</sup>	7.3	11.6 <sup>2</sup>
Brintol Bay	II	Tertiary & Mesozoic	12,320 <sup>2</sup>	1.52	18,726 <sup>2</sup>	50,000	.94 <sup>2</sup>	7.3	6.83 <sup>2</sup>
Kotzebue (Selavik)	II	Tertiary & Mesozoic	3,200 <sup>2</sup>	1.89	6,048 <sup>2</sup>	50,000	.30 <sup>2</sup>	7.3	2.19 <sup>2</sup>
North Slope	I	Tertiary & Mesozoic	66,400	1.9	126,160	100,000	12.6	2.7	34.0
North Slope	II	Mesozoic & Paleozoic	30,240	1.9	57,456	50,000	2.9	2.7	7.8
Yukon - Koyukuk	I	Mesozoic	2,400	1.89	4,545	75,000	.34	2.7	.91
Yukon - Koyukuk	III	Mesozoic	53,440	1.9	101,536	30,000	3.1	2.7	8.4
Bethel	II	Tertiary & Mesozoic	13,760	1.9	26,144	50,000	1.3	2.7	3.5
Subtotal			231,887		413,141		26		95.5
<b>OFFSHORE</b>									
Cook Inlet	I	Tertiary & Mesozoic	7,377 <sup>3</sup>	1.89	13,943 <sup>3</sup>	115,000	1.6 <sup>3</sup>	7.3	11.68 <sup>3</sup>
Gulf of Alaska	I	Tertiary	40,000 <sup>3</sup>	1.8	72,000 <sup>3</sup>	100,000	7.2 <sup>3</sup>	7.3	52.6 <sup>3</sup>
Kodiak Island Prov.	I	Tertiary & Mesozoic	32,000	1.0	32,000	75,000	2.4	7.3	17.5
Bering Sea Prov.	I	Tertiary & Mesozoic	203,000	1.8	365,400	75,000	27.4	7.3	200.0
Kotzebue	I	Tertiary & Mesozoic	2,304 <sup>3</sup>	2.27	5,230 <sup>3</sup>	75,000	.39 <sup>3</sup>	7.3	2.84 <sup>3</sup>
Hopa Province	I	Tertiary	21,000	1.14	23,940	75,000	1.8	7.3	13.0
Chukchi Province	II	Tertiary, Mesozoic & Possibly Older	70,000	1.89	132,575	50,000	6.6	5.0	33.0
Beaufort Prov.	I	Tertiary & Older	19,200	1.89	36,288	75,000	2.7	5.0	13.5
Subtotal			394,881		681,376		50.1		144.1
Total Speculative Petroleum Resources							76.1		439.6
Total Discovered but not Produced Resources							10.5		29.7
Total Cumulative Production as of March 1973							.5		.6

<sup>1</sup> - Each basin is ranked according to its estimated petroleum potential (see text for details)

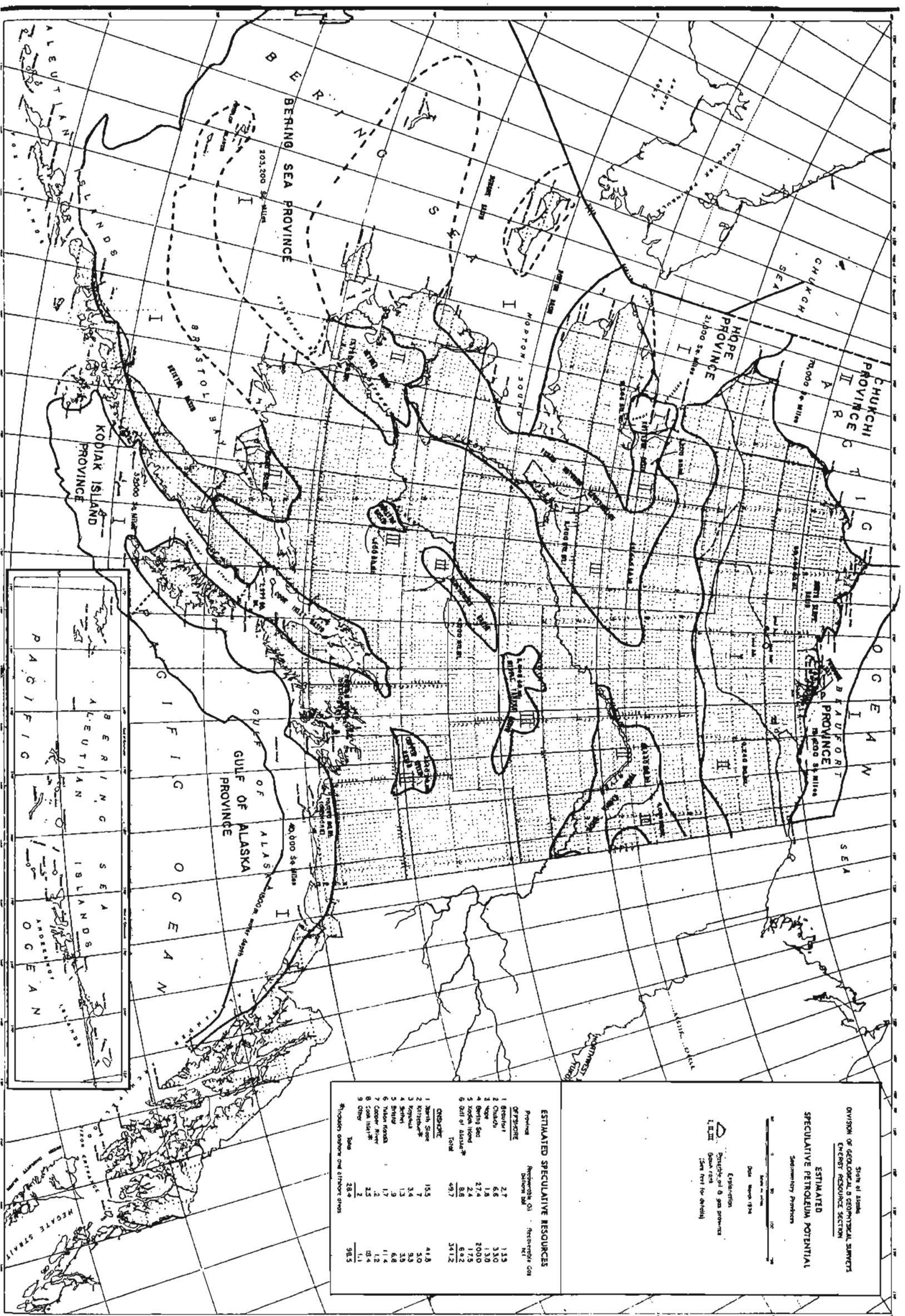
<sup>2</sup> - Onshore portion only

<sup>3</sup> - Offshore portion only



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State of Alaska  
 DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS  
 ENERGY RESOURCE SECTION

**ESTIMATED SPECULATIVE PETROLEUM POTENTIAL**

Exploration  
 Possible oil & gas provinces  
 Open area  
 (See map for details)

Secondary Producers

Scale in miles  
 0 20 40 60 80 100  
 Date: March 1974

**ESTIMATED SPECULATIVE RESOURCES**

Province	Reserve Oil Billion bbl	Recoverable Gas Mcf
<b>OF PROSPECT</b>		
1 Bering	2.7	135
2 Chukchi	6.6	330
3 Beaufort	1.8	130
4 Bristol Bay	27.4	2000
5 North Slope	5.6	642
6 Gulf of Alaska	49.7	3412
<b>TOTAL</b>		
1 North Slope	15.5	415
2 Koyukuk	7	30
3 Koyukuk	3.6	8.5
4 Seward	1.3	3.5
5 Seward	1.9	6.8
6 Yukon-Kuskokwim	1.7	11.4
7 Copper River	2	1.2
8 Cook Inlet	2.5	18.4
9 Other	2	1.1
<b>Total</b>	<b>28.4</b>	<b>98.5</b>

Resources include oil and offshore gases

