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Cook Inlet Basin Subsurface Coal Reserve Study

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Preliminary Report

COOK INLET BASIN SUBSURFACE COAL RESERVE STUDY

ABSTRACT

Data from exploratory and production wells drilled for hydrocarbons in the non-marine Cook Inlet Basin have been examined to establish subsurface coal reserves. These reserves are described without reference to the economics of recovering the coal. Coal trends and areas of favorable deposition are described. The speculative reserves of coal in place as determined by this report are listed below:

Interval (drilled depths)	Speculative Coal Reserves in Place
Surface to 2,000 feet	0.1 Trillion short tons
2,000 feet to 5,000 feet	0.3 Trillion short tons
Surface to 10,000 feet	1.3 Trillion short tons

Although much of this coal is not recoverable by known methods and technologies, future energy needs and development of new methods of recovering coal, or the energy contained within coal, may create a need for information of the type contained in this report.

INTRODUCTION

The Cook Inlet Basin contains numerous beds of coal in the Tertiary Kenai formation. There are sufficient data from exploratory oil and gas wells drilled within the confines of this basin to construct cumulative coal thickness maps extending from the town of Wasilla in the northern part of the basin to the southwest termination of the Kenai Peninsula. The western limits of well control extend to the Castle Mountain fault zone and to the east as far as the major fault zone along the western front of the Kenai Mountains (location map).

The objectives of this report are to examine the cumulative coal thicknesses as related to specific intervals and to establish reserve figures. Maps based on interval cumulative coal thickness will be useful in establishing areas in which coal exploration may be centered as downhole coal technologies are advanced. In particular, the shallow surface to 2,000 feet map (Plate 1), could be used to establish target areas along the west side of the Cook Inlet for gasification projects. The five figures (2 through 6) were constructed to show the geographic locations of one or more subsurface coal beds, each of which is over twenty feet thick. These maps also are keyed to intervals and will be useful to delineate the areas where thick coal beds would be encountered.

GEOLOGY

Stratigraphy

The general stratigraphy and the relationship between the stratigraphy of the Beluga-Chuitna Rivers and the remainder of the Cook Inlet Basin are listed below.

Tertiary age rocks

The uppermost bedrock unit exposed in the Beluga-Chuitna area is a sequence of siltstone, claystones, sandstones and conglomerates that includes beds of subbituminous coal and lignite. Barnes (1966) considers these sediments to be a continuation of the Tertiary Kenai formation exposed on the west side of the Kenai Peninsula and separates the Kenai formation in the Beluga-Chuitna area into a lower and a middle member. The lower member is a non-marine gray and yellow sequence of claystones, siltstones, sandstones and conglomerates that contains little coal. The middle member overlies this member conformably and consists of non-marine claystones, siltstones, sandstones and conglomerates containing nearly all the coal reserves.

In the deeper part of the Cook Inlet Basin, the Kenai Group is more than 20,000 feet thick and is divided into five formations named from oldest to youngest, the West Forelands formation, Hemlock formation, Tyonek formation, Beluga formation and Sterling formation (Calderwood and Fackler, Bull. AAPG, V 56, no. 4). Direct correlations between the coal-bearing middle Kenai formation in the Beluga-Chuitna area and the Kenai formation in drilled wells in the Cook Inlet have not been published. It is probable, however, that the section with the coals in the middle Kenai in the Beluga-Chuitna Rivers area is equivalent to the coals in the upper part of the Tyonek formation.

Quaternary age rocks

Much of the surface cover in the Beluga-Chuitna-Capps Glacier area is glacial deposits both morainal and outwash. The Quaternary sediments examined

in this study include sands, gravels and siltstones, and because of the difficulty in determining the contact between Quaternary and Tertiary sediments, has been included in the Sterling formation. Quaternary sediments do not contain significant bedded coals although detrital coals are common.

PROCEDURE

Coal counts were made in 86 wells drilled for hydrocarbons in the Cook Inlet (Table 1). Counts were based on electric log data including information from resistivity, sonic and density logs. The mud logs were used to verify coal picks from the electric logs. A minimum thickness of 2 feet was used as the lower thickness parameter.

The cumulative coal thicknesses obtained from the well counts were contoured for three different depth intervals. A shallow, surface to 2,000 feet map (Plate 1) was constructed to delineate the areas where the most easily accessible coals occur. The varying thickness of the Quaternary sediments and the lack of shallow data in the unlogged upper portions of the control wells make this an incomplete map. Plate 2, 2,000 feet to 5,000 feet vertical drilled depth, is generally below the influence of the Quaternary sediments and since most of the control wells were drilled deeper than 5,000 feet, the results for this interval are the most complete. Plate 3 is a cumulative coal map for the interval surface to 10,000 feet. The depth of 10,000 feet is an arbitrary depth and there are coals in the Tertiary Kenai below this depth. An example diagram (Fig. 1) and a more elaborate description of the method used is included in this report.

The surface to 2,000 feet shallow map reflects the geographic locations of coals close to the surface. The trend of coal deposition parallels the

linear direction of the basin axis and local thickening of the cumulative coals reflects optimum coal deposition environment during the time of deposition. The method used in determining the coal counts, relating to depth rather than stratigraphic intervals, also tends to reflect structure and thinning of the Quaternary sediments over structural highs.

Five figures (Figs. 2 - 6) were constructed to show the areal distribution of coals in excess of 20 feet in thickness in selected depth intervals. The data values listed for individual wells are the cumulative thicknessess for coals over 20 feet thick and the outlines areas indicate that one or more coal beds at least twenty feet thick are present within the specified area.

Reserves, Calculations and Parameters

Speculative reserves are based on the following methods and parameters:

1. Contoured cumulative coal thickness maps were constructed and speculative reserves were calculated based on areas and coal thickness under the areas.

2. The final calculations were based on square mile areas times cumulative feet of coal under the areas times one million short tons. The one million short tons parameter is an average value and represents a one foot bed of coal in place over an area of one square mile. This is based on published data that 25 cubic feet of coal in place is equivalent to approximately one short ton.

PHYSICAL ASPECTS OF THE COAL

The coal where exposed and sampled in the Beluga-Chuitna area is classified as subbituminous to lignite and is dull black, locally with a slight brown cast and includes a few thin layers and lenses of bright vitrain. The moisture content is high, ranging from 21 to 33 percent and ash content is generally high ranging from 2.1 to 22.2 percent. Sulfur content is low, generally .2 to .3 percent and heating values average slightly more than 10,000 BTU for a composite average of 47 samples (Barnes, 1966). The physical aspects of the more deeply buried coals are unknown but it can be anticipated that the average rank would be higher with increased temperatures and pressures.

CONCLUSIONS

1. The coal beds in the Cook Inlet are lenticular and even the thickest beds are difficult to correlate beyond a lateral distance of 7,000 feet. The strongest correlations are between points oriented northeast and southwest from each other suggesting that the individual beds have their longest dimensions in this direction.

2. The thickest coal beds near the surface are in a coal fairway extending along the west side of the Cook Inlet from the surface outcrops along the Beluga River and extending at least as far south as Kalgin Island. (Plates 1, 2, and 3)

3. A second coal fairway extends in a southwest direction from the Swanson River Oil Field to the Homer area. These coals are generally covered with a thicker cover of sediments than the coals present in the western fairway. The south end of this fairway is the Homer coal district where coals outcrop on the surface.

4. A third potential coal area is located in the Wasilla area where well control is sparse.

5. Coal gasification projects may be feasible only in the thicker coal beds that are relatively shallow. Figures 2 through 6 were constructed to indicate the most likely areal extent of coal beds in excess of twenty feet. They represent target areas for future exploration.

6. Very little is known about coal potential in the triangle shaped area from Petersville to the confluence of the Yetna and Susitna Rivers. The presence of the Kenai formation is known in this area from outcrops (Barnes, 1967). However, the actual potential for this large area will require core holes to determine if coals are present.

7. Speculative coal reserves calculated for the Cook Inlet Basin are listed below:

Interval (drilled depths)	Speculative Coal Reserves in Place
Surface to 2,000 feet	0.1 Trillion short tons
2,000 feet to 5,000 feet	0.3 Trillion short tons
Surface to 10,000 feet	1.3 Trillion short tons

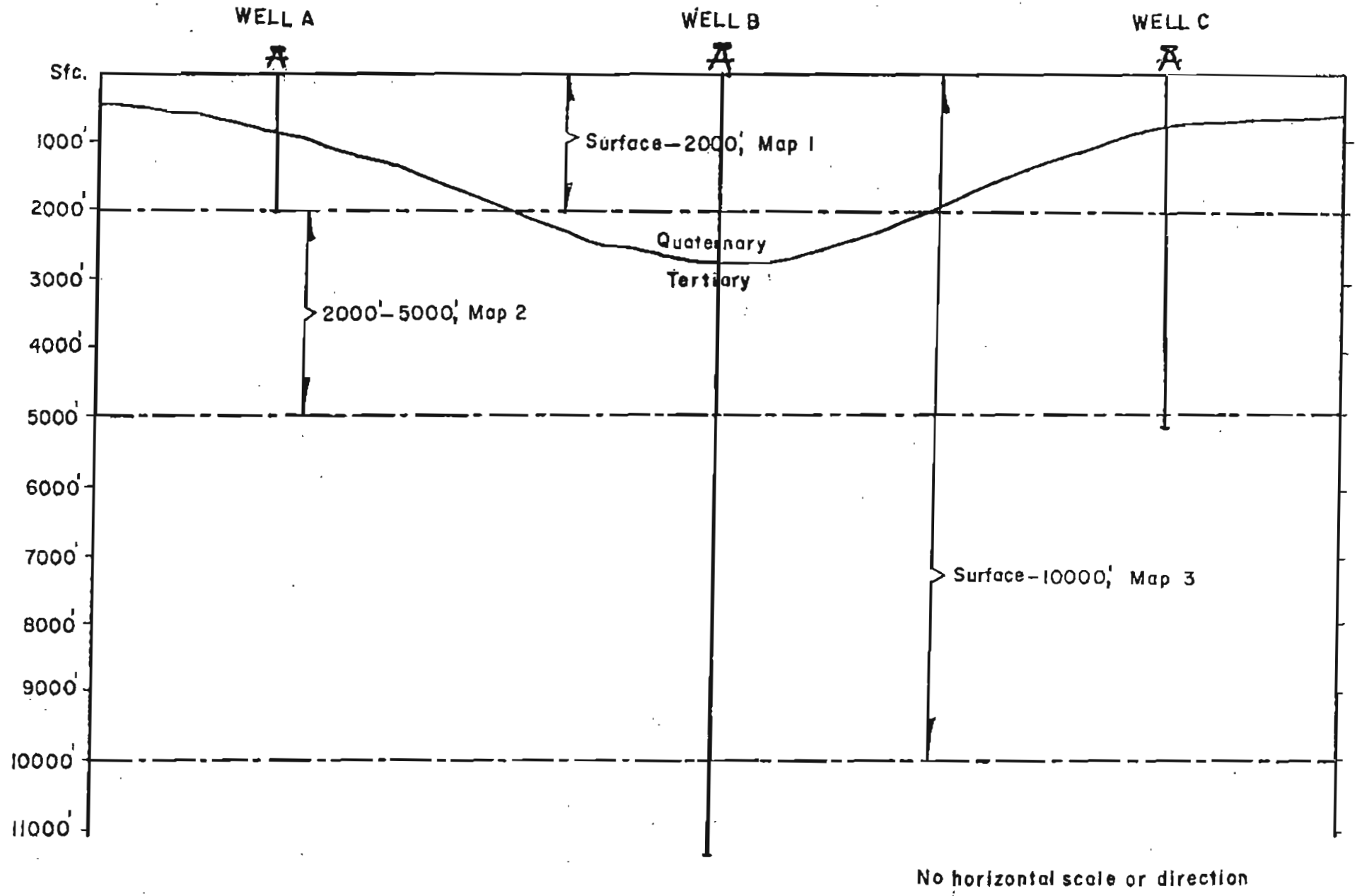

Figure 1 - Example Diagram

EXPLANATION OF EXAMPLE DIAGRAM

Well A did not log hole above 1,000 feet and no coal counts were made in this interval. The Quaternary does not affect the count since it is not logged. Coal counts were made for the interval 1,000 to 2,000 feet and this accumulative total is the value used for the surface to 2,000 foot interval map for this well (Plate 1). Since the total depth of the well is 2,000 feet, no coal counts could be made below this depth and no data are available for the deeper interval maps.

Well B is a deep test exceeding 11,000 feet total depth. The well was drilled in a deep portion of the basin and the base of the Quaternary is below 2,000 feet. Zero values for coal would be assigned this hole for the interval to 2,000 feet. Coal counts for the interval 2,000 to 5,000 feet drilled depths would be used for Plate 2. These are the actual accumulative coal thicknesses for the penetrated interval even though the interval from 2,000 to 2,500 feet is Quaternary and does not contain bedded coal. The total accumulative coal thickness from surface to 10,000 feet reflects the coal in the Kenai formation below the Quaternary.

Well C is an exploratory borehole drilled to a depth of 5,000 feet below the surface. Again the Quaternary sediments are encountered from the surface to about 800 feet and Plate 1 reflects the coal in the Tertiary from 800 to 2,000 feet. The interval from 2,000 feet to total depth is entirely in Kenai formation and the coal count reflects the amount of coal in this particular part of the Kenai formation.

Thus the maps are independent of the formations and indicate accumulative coal thicknesses in the depth interval below the surface. In some cases coal

counts were made in wells that did not reach 10,000 feet and values obtained from these wells must be considered as incomplete. However, if penetration was relatively near the 10,000 foot depth, values were plotted. No consideration was given to fault repetition or to regional or structural dips. In most of the wells examined the dips are relatively low and coal thickness has not been significantly increased. Deviated holes drilled from offshore platforms were generally not used. Wildcat wells with minor deviations from vertical were considered as having coal counts accurate within a narrow percentile range, probably in most cases not exceeding 5.0 percent of the coal count.

Coal percentages were also calculated based on the interval counted and the amount of coal present in this interval. These would yield a more accurate evaluation of the speculative coal reserves since hole deviation and formation dip would be eliminated.

Table 1

LIST OF WELLS FOR DATA POINTS

WELL	LOCATION	Surface - 2,000'	Per-cent	2,000' - 5,000'	Per-cent	Surface - 10,000'	Per-cent
Union Pittman #1	T18N, R2W	87'	6.6	59'	1.9	146'	2.6
Anchorage Oil and Gas Rosetta #3	T18N, R3W	31'	2.1	---	-	---	-
Lum Lovelly Beaver Lakes State #1	T18N, R3W	37'	2.3	115'	3.8		
Farms Oil Co. Red Shirt Lake #1	T18N, R5W	72'	5.8	---	-	---	-
British Petroleum Wasilla State #1	T17N, R1W	31'	1.6	48'	1.7	79'	1.7
American Quasar Big Lake #1	T17N, R3W	--	-	111'	3.7	---	-
Union Oil Co. Fish Creek #1	T16N, R3W	50'	5.9	112'	3.7	173'	3.3
Union Oil Co. Knik Arm #1	T16N, R4W	73'	7.3	85'	8.4	158'	7.9
Pan American Big Lake #1	T15N, R4W	58'	3.1	145'	6.4	203'	4.9
Humble Susitna State Unit #1	T15N, R4W	--	-	210'	7.0	352'	4.4
Gulf Oil Middle Lake Unit #1	T15N, R5W	--	-	---	-	303'	6.1
British American Bell Island #1	T15N, R7W	--	-	102'	4.4	291'	4.1
Union Oil Co. Knik Arm State #1	T14N, R4W	60'	5.9	48'	3.0	108'	4.1
Atlantic Richfield Lorraine State #1	T14N, R4W	32'	5.3	87'	2.9	146'	2.8
Std. Oil California Lewis River 13-2	T14N, R9W	10'	0.7	77'	2.6	209'	2.0

WELL	LOCATION	Surface - 2,000'	Per-cent	2,000' - 5,000'	Per-cent	Surface - 10,000'	Per-cent
Halbouty Theodore River #1	T14N, R9W	--	-	97'	3.2	453'	5.6
Yukon Service Co. Campbell Point #1	T13N, R4W	12'	3.9	124'	5.9	146'	6.1
Std. Oil California Ivan River Unit #44-1	T13N, R8W	11'	0.6	37'	1.2	186'	1.9
Std. Oil California Beluga River #1	T13N, R10W	--	-	108'	4.5	320'	4.3
Pan American Romig Park #1	T12N, R4W	4'	1.2	13'	0.4	17'	0.8
Superior Oil Co. Three Mile Creek #1	T12N, R11W	64'	3.5	56'	1.9	285'	2.8
Superior Oil Co. Chuit State #1	T12N, R11W	86'	4.8	336'	11.2	565'	5.7
Superior Oil Co. Chuit State #2	T12N, R11W	96'	9.2	314'	10.5	649'	7.9
Pan American Chuitna River State #1	T12N, R12W	84'	4.4	75'	2.5	217'	2.2
Pan American Stedatna Creek Unit #1	T12N, R12W	--	-	32'	1.1	32'	1.1
Shell Oil Co. North Cook Inlet State #1	T12N, R9W	--	-	38'	2.5	216'	3.3
Std. Oil California Tyonek Unit 44-8	T11N, R11W	87'	5.1	93'	3.1	471'	4.9
Humble Tyonek Res. B-1	T11N, R11W	56'	3.4	59'	1.9	410'	4.2
Pan American Tyonek St. 17588 #1	T11N, R11W	54'	5.7	33'	1.1	346'	3.9
Mobil Oil Co. West Tyonek #1	T11N, R12W	52'	2.1	134'	4.4	212'	3.5
Shell Oil Co. Cottonwood State #1	T11N, R12W	36'	3.1	61'	2.9	97'	2.9
Texaco Pt. Possession Unit #1	T10N, R7W	--	-	40'	1.3	294'	3.5

WELL	LOCATION	Surface - 2,000'	Per-cent	2,000' - 5,000'	Per-cent	Surface - 10,000'	Per-cent
Shell Oil Co. SRS State #1	T10N, R11W	--	-	53'	1.8	145'	1.6
Mobil Oil Co. Granite Point #1	T10N, R12W	32'	2.2	120'	4.0	387'	4.1
Mobil Oil Co. Tower #1	T10N, R12W	50'	4.0	109'	3.3	573'	6.2
Atlantic Richfield Trading Bay State #2	T10N, R12W	32'	3.8	77'	2.6	350'	5.3
Mobil Oil Co. Tower #2	T10N, R12W	56'	4.0	94'	3.1	532'	5.6
Pan American N.M.G.S. 18745	T10N, R12W	49'	4.1	263'	8.7	569'	6.2
Atlantic Richfield N.T.B.S.S. #1	T10N, R13W	16'	1.0	281'	9.4	620'	6.4
Texaco Swanson Lakes Unit #1	T9N, R7W	--	-	5'	0.2	134'	2.4
Std. Oil California Birch Hill Unit #22-25	T9N, R9W	30'	1.7	56'	1.8	233'	2.9
Shell Oil Co. South Cook Inlet #2	T9N, R11W	--	-	22'	1.4	202'	3.2
Placid Oil Co. State 17580	T9N, R12W	30'	2.2	72'	2.4	386'	4.1
Pan American N.M.G.S. State 17595 #5	T9N, R12W	--	-	---	-	---	-
Pan American E.M.G.S. 18751	T9N, R12W	45'	3.2	48'	1.6	388'	4.1
Atlantic Richfield McArthur State #1	T9N, R13W	51'	7.6	277'	9.2	636'	7.3
Union Oil Co. Grayling 1-A	T9N, R13W	58'	4.8	254'	8.4	547'	5.9
Cherryville Corp. Middle River St. Unit #2	T9N, R14W	21'	1.4	231'	7.7	370'	4.9
Shell Oil Co. Kustatan Ridge #1	T9N, R14W	53'	3.2	230'	7.7	333'	3.1

WELL	LOCATION	Surface - 2,000'	Percent	2,000' - 5,000'	Percent	Surface - 10,000'	Percent
Atlantic Richfield W. Foreland Unit #5 & 5-A	T9N, R14W	37'	2.8	123'	4.1	403'	4.3
Shell Oil Co. S.R.S. Cook Inlet St. #2	T9N, R11W	--	-	22'	1.4	179'	3.6
Std. Oil California SRV 34-10	T8N, R9W	--	-	53'	1.7	213'	4.2
Forest Oil Co. Sunrise Lake Unit #1	T8N, R8W	--	-	14'	0.6	226'	3.1
Std. Oil California Swanson River Unit #10	T8N, R9W	25'	3.8	130'	4.3	730'	8.4
Pan American West Foreland Unit #1	T8N, R14W	9'	0.7	195'	6.5	473'	5.1
Shell Oil Co. Kustatan River #1	T8N, R15W	104'	7.1	107'	5.2	211'	6.3
Hartog Oil Co. N. Kustatin St. Unit #1	T8N, R15W	8'	1.0	132'	4.4	380'	4.3
Cities Service W. Forelands State A #1	T8N, R15W	56'	3.5	212'	7.1	397'	4.8
Pan American Bachatna Creek #1	T8N, R15W	30'	-	175'	5.8	255'	5.9
Shell Oil Co. Johnson Slough #1	T8N, R16W	106'	8.0	137'	4.5	247'	4.8
Union Oil Co. Bachatna Creek Unit #1	T8N, R16W	15'	1.2	36'	3.4	51'	2.2
Std. Oil California Mink Creek Unit #14-20	T7N, R9W	7'	0.5	60'	2.0	287'	5.7
Pan American Redoubt Shoal St. 29690	T7N, R13W	90'	6.6	56'	1.9	299'	3.2
Pan American Redoubt Shoal State #1	T7N, R14W	40'	3.0	58'	1.9	268'	2.9
Tenneco State 36465	T7N, R14W	--	-	38'	1.5	66'	1.3
Std. Oil California Kustatan Unit 43-30	T7N, R15W	48'	3.5	276'	9.2	660'	7.0

WELL	LOCATION	Surface - 2,000'	Per-cent	2,000' - 5,000'	Per-cent	Surface - 10,000'	Per-cent
Union Oil Co. Bachatna Creek Unit #7	T7N, R16W	8'	0.7	4'	0.6	12'	0.7
Std. Oil California Naptowne Unit 24-8	T6N, R82	--	-	26'	1.1	242'	3.3
Trinity Canadian Homesteaders #1	T5N, R9W	--	-	---	-	195'	2.3
Union Oil Co. Kenai Unit 41-2	T5N, R11W	13'	1.7	83'	2.8	96'	2.1
Union Oil Co. Kenai Unit 13-8	T5N, R11W	--	-	52'	1.7	72'	-
Hunt Oil Co. Kalgin Island State #1	T5N, R15W	--	-	80'	2.8	370'	4.7
Atlantic Richfield Drift River State #1	T5N, R15W	34'	2.1	58'	1.9	102'	2.0
Union Oil Co. Kenai Unit #14-6	T4N, R11W	5'	0.5	50'	1.7	305'	1.4
Mesa Petroleum Kasilof State Unit #2	T3N, R12W	--	-	56'	1.9	164'	2.7
Union Oil Co. Kasilof Unit #1 and 2	T3N, R12W	9'	0.8	58'	1.9	187'	2.1
Hunt Oil Co. Old Mans Bay State #1	T3N, R16W	55'	3.9	90'	3.0	495'	5.3
Marathon Oil Co. Clam Gulch #1	T1N, R13W	9'	0.7	55'	1.8	292'	3.1
Mobil Oil Co. Ninilchik #1	T1S, R14W	29'	1.5	37'	1.2	610'	6.2
Std. Oil California Deep Creek #1	T2S, R13W	45'	2.3	81'	2.7	361'	3.6
Superior Oil Co. Happy Valley #1	T2S, R13W	58'	3.2	90'	3.0	366'	3.7
Pennzoil Starichkof State Unit #1	T3S, R15W	78'	5.2	134'	4.5	261'	3.2
Pennzoil Starichkof State #1	T3S, R15W	48'	3.3	122'	4.1	229'	2.8

WELL	LOCATION	Surface - 2,000'	Per-cent	2,000' - 5,000'	Per-cent	Surface - 10,000'	Per-cent
Std. Oil California North Fork Unit 11-14	T4N, R13W	60'	3.4	70'	2.3	362'	3.7
Std. Oil California Anchor Point #1	T5S, R15W	40'	2.2	155'	5.2	337'	3.4
Texaco Coal Bay State #1	T6S, R12W	54'	4.2	80'	4.1	134'	4.1

SELECTED REFERENCES

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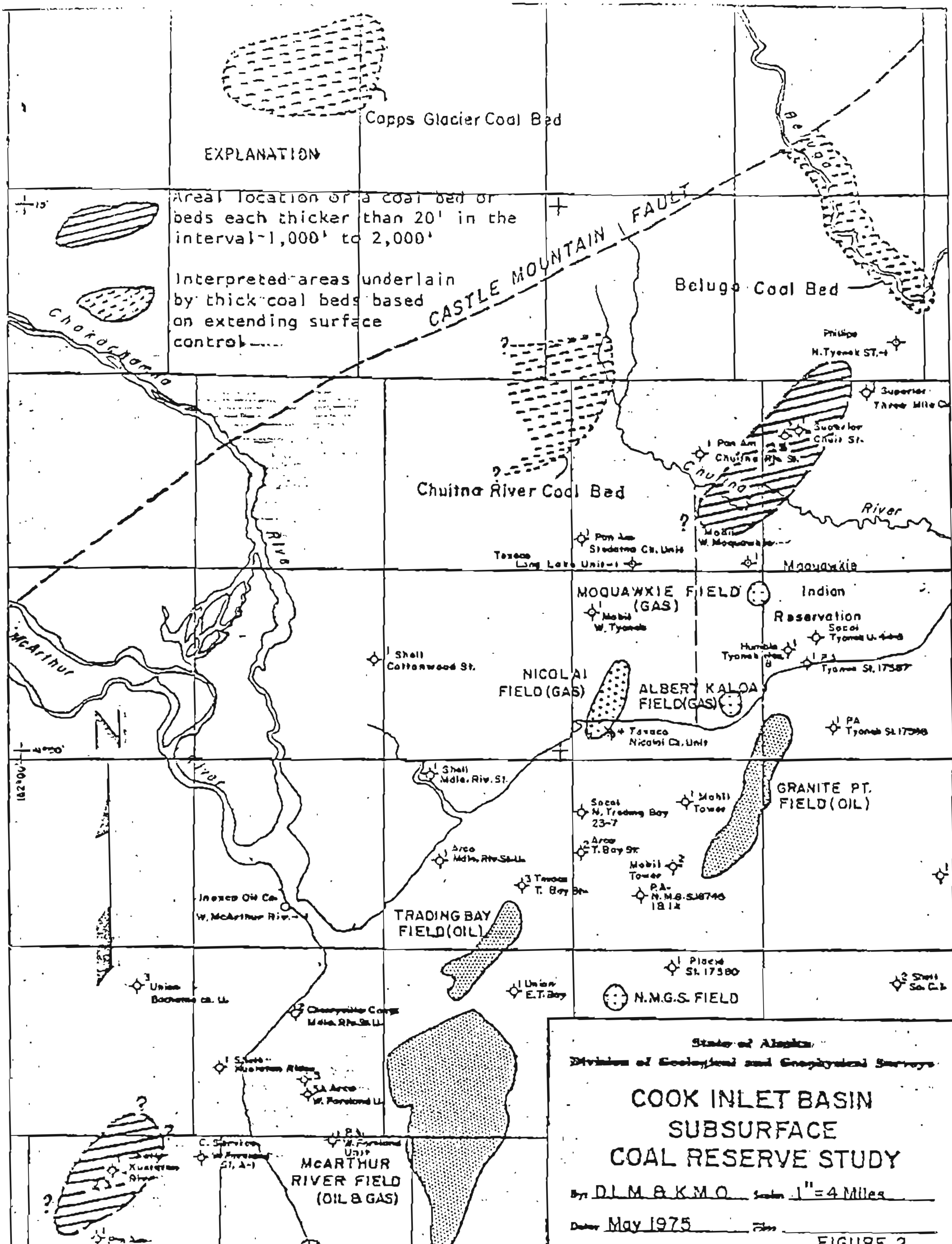
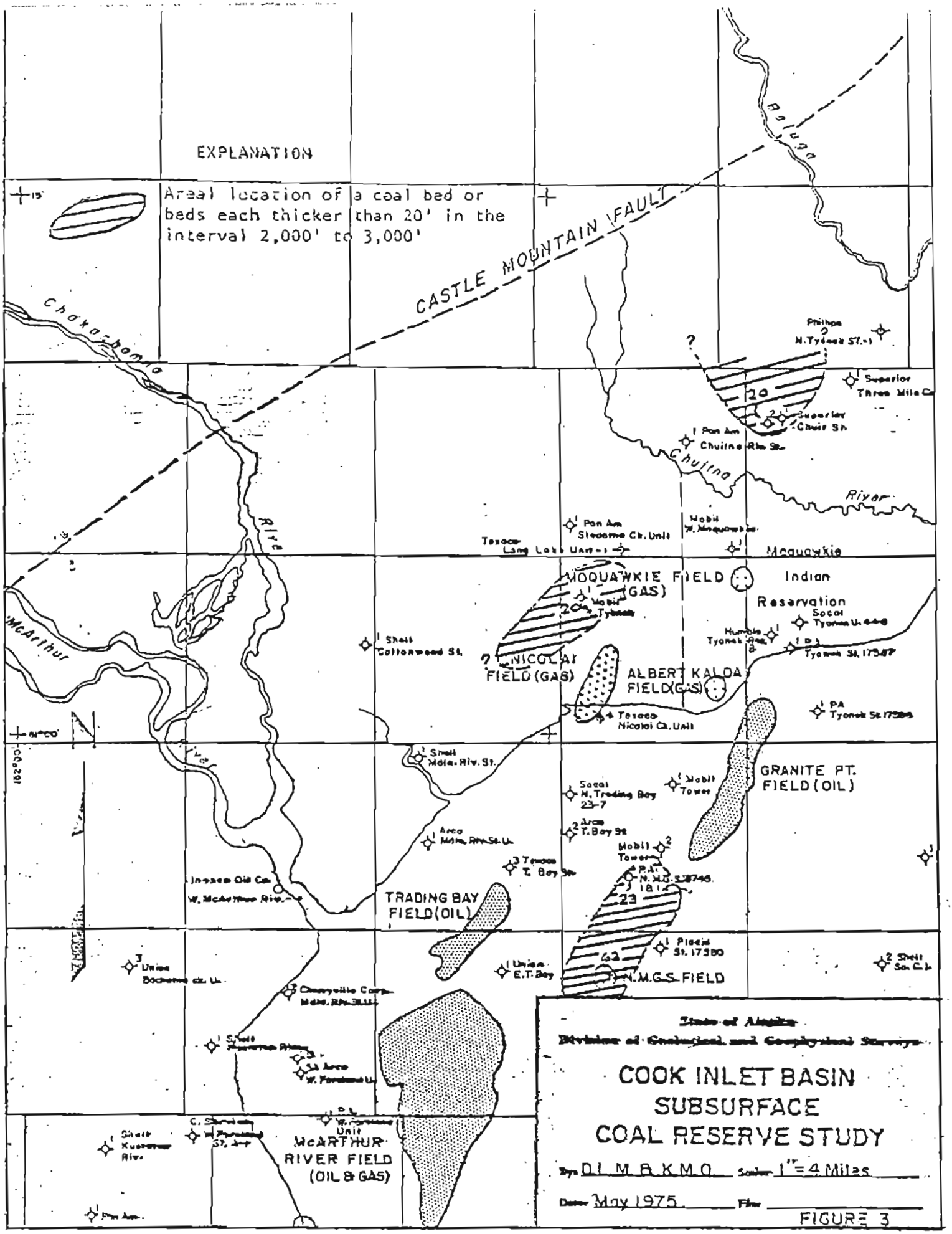
_____, 1967, Coal resources of Alaska: U.S. Geol. Survey Bull. 1242-B, pp. 1 - 36.


Copps Glacier Coal Bed
EXPLANATION
Areal location of a coal bed or beds each thicker than 20' in the interval 1,000' to 2,000'
Interpreted areas underlain by thick coal beds based on extending surface control
CASTLE MOUNTAIN FAULT
Beluga Coal Bed
Chakachamna
Chuitna River Coal Bed
Chuitna River
McArthur River
MOQUAWKIE FIELD (GAS)
Moquawkie Indian Reservation
NICOLAI FIELD (GAS)
ALBERT KALOA FIELD (GAS)
GRANITE PT. FIELD (OIL)
TRADING BAY FIELD (OIL)
N.M.G.S. FIELD
McARTHUR RIVER FIELD (OIL & GAS)
Shell Cottonwood St.
Shell Mdle. Riv. St.
Inexco Oil Co. W. McArthur Riv.
Union E.T. Bay
Texaco Nicolai Cr. Unit
State of Alaska
Division of Geological and Geophysical Surveys
COOK INLET BASIN SUBSURFACE COAL RESERVE STUDY
By: D.L.M. & K.M.O. Scale: 1"=4 Miles
Date: May 1975
FIGURE 2



State of Alaska
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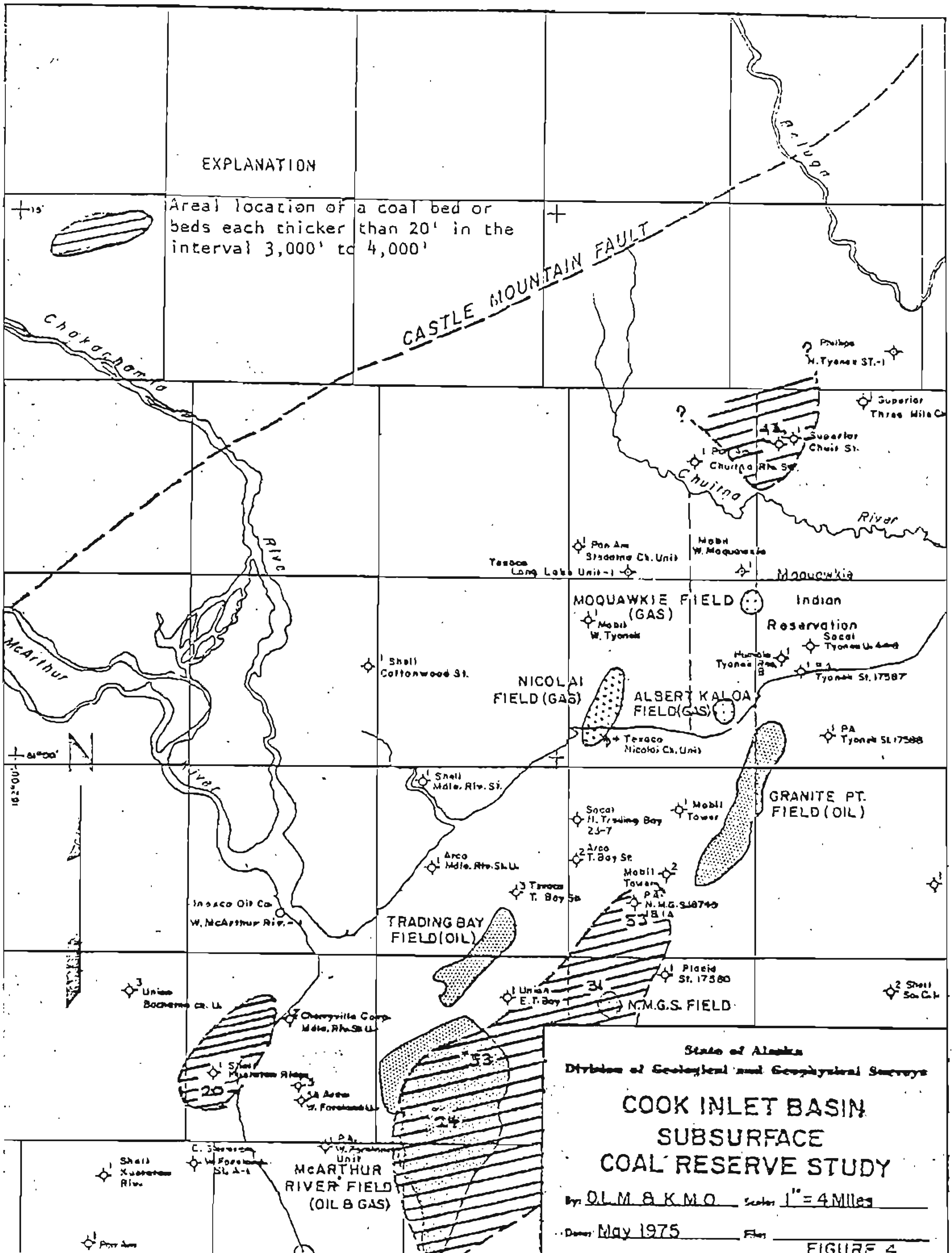
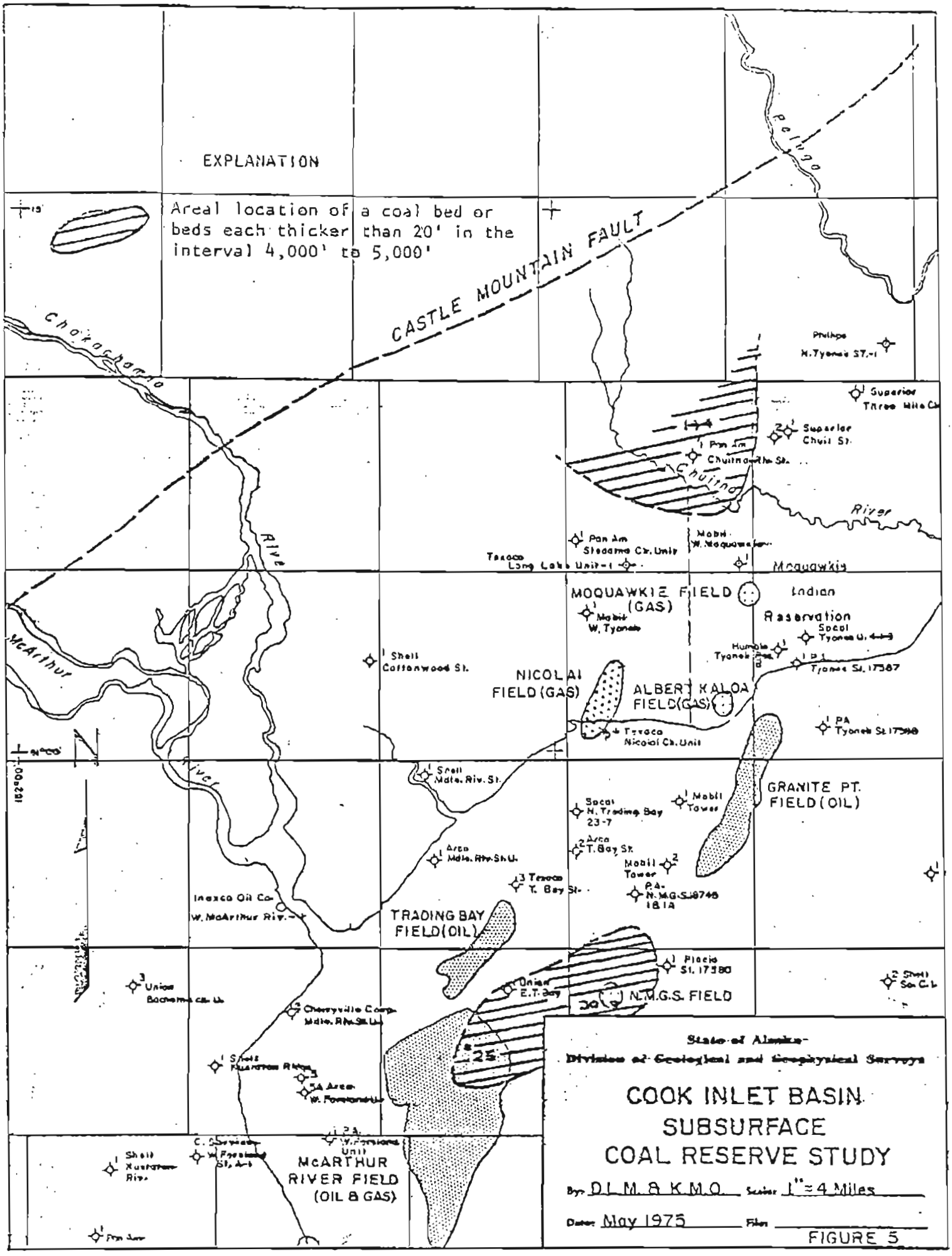
COOK INLET BASIN SUBSURFACE COAL RESERVE STUDY

By: D. L. M. & K. M. O. Scale: 1" = 4 Miles

Date: May 1975 File:

FIGURE 3


EXPLANATION
Areal location of a coal bed or beds each thicker than 20' in the interval 3,000' to 4,000'
CASTLE MOUNTAIN FAULT
Chakachamna
McArthur
River
Chuitna
River
Moquawkie
Indian
Reservation
MOQUAWKIE FIELD (GAS)
NICOLAI FIELD (GAS)
ALBERT KALOA FIELD (GAS)
GRANITE PT. FIELD (OIL)
TRADING BAY FIELD (OIL)
N.M.G.S. FIELD
McARTHUR RIVER FIELD (OIL & GAS)
Shell Cottonwood St.
Texaco Nicolai Ck. Unit
Texaco Long Lake Unit-1
Mobil W. Tyonek
Inexco Oil Co. W. McArthur Riv.-1
Placid St. 17580
42
53
31
53
24
20
State of Alaska
Division of Geological and Geophysical Surveys
COOK INLET BASIN
SUBSURFACE
COAL RESERVE STUDY
By: O.L.M. & K.M.O.
Scale: 1" = 4 Miles
Date: May 1975
File:
FIGURE 4



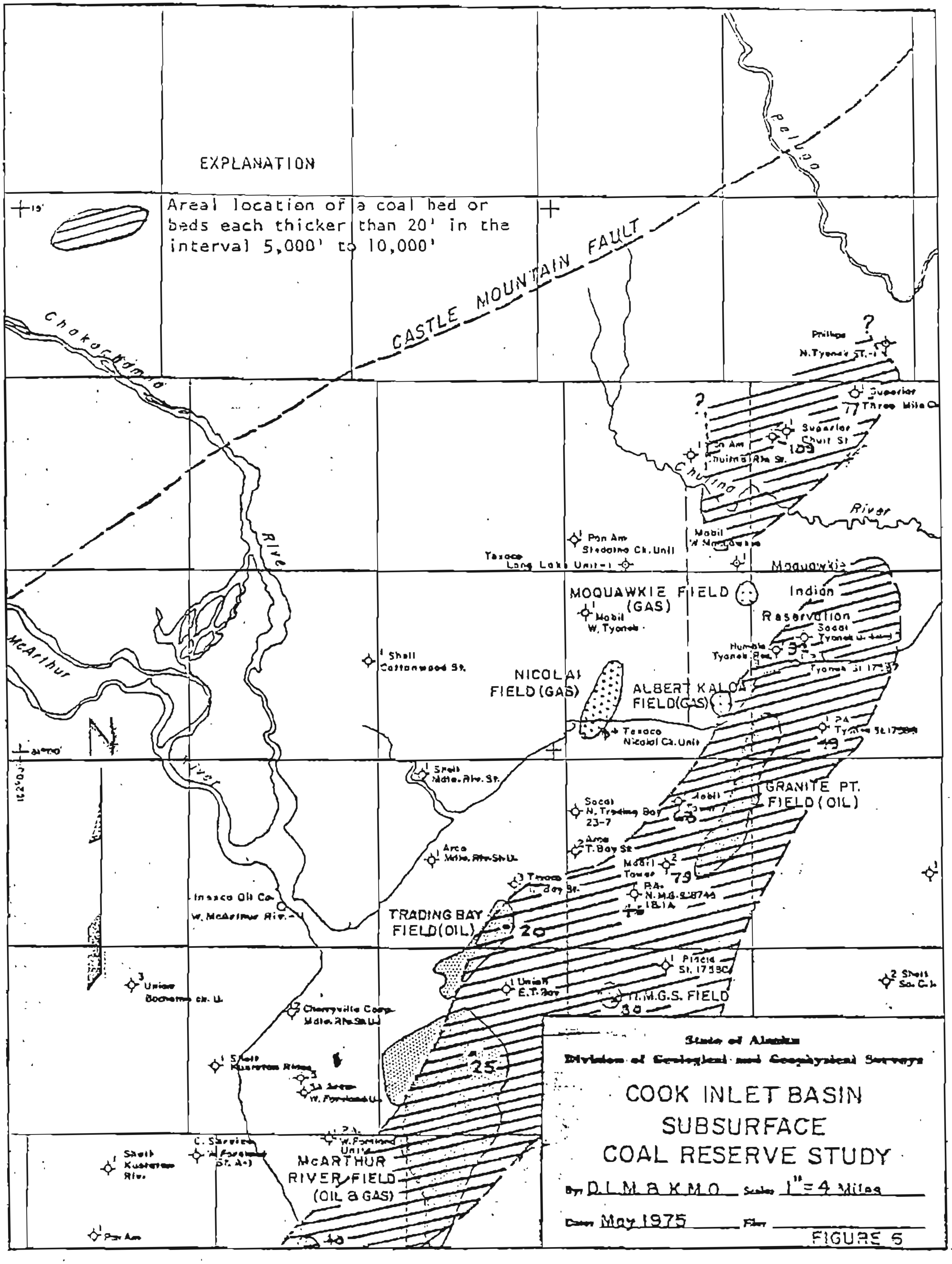
State of Alaska
Division of Geological and Geophysical Surveys

COOK INLET BASIN SUBSURFACE COAL RESERVE STUDY

By: D.L.M. & K.M.O. Scale: 1"=4 Miles

Date: May 1975 Files:

FIGURE 5


EXPLANATION
Areal location of a coal bed or beds each thicker than 20' in the interval 5,000' to 10,000'
CASTLE MOUNTAIN FAULT
Chakachamna
McArthur
River
Chuitna
River
Beluga
MOQUAWKIE FIELD (GAS)
Moquawkie Indian Reservation
NICOLAI FIELD (GAS)
ALBERT KALOA FIELD (GAS)
GRANITE PT. FIELD (OIL)
TRADING BAY FIELD (OIL)
N.M.G.S. FIELD
McARTHUR RIVER FIELD (OIL & GAS)
Phillips N. Tyonek St.-1
Superior Three Mile Cr.
Superior Chuit St.
Pan Am Chuitna Rv. St.
Pan Am Stedatna Ck. Unit
Texaco Long Lake Unit-1
Mobil W. Tyonek
Shell Cottonwood St.
Texaco Nicolai Ck. Unit
Shell Mdle. Rv. St.
Socal N. Trading Bay 23-7
Arco T. Bay St.
Arco Mdle. Rv. St. U.
Mobil Tower
Inexco Oil Co. W. McArthur Riv.-1
Union E.T. Bay
Union Bachatna Ck. U.
Shell Kustatan Riv.
Pan Am
Shell So. C.I.
109
77
79
49
20
30
25
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