PETROLEUM EXPLORATION OF NPRA, 1974-1981
Final Report

VOLUME 2

PETROLEUM EXPLORATION

OF NPRA, 1974-1981

FINAL REPORT

VOLUME 2

Project Manager	J. W. Bruynzeel
Area Geologist	E. C. Guldenzopf
Area Geophysicist	J. E. Pickard

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Tetra Tech Report No. 8200

March 31, 1982

Prepared for:
Husky Oil NPR Operations, Inc.
2525 "C" Street
Anchorage, Alaska 99503

Prepared by:
Tetra Tech, Inc.
Energy Management Division
4544 Post Oak Place
Houston, Texas 77027

FIGURE 29

CORRELATION CROSS SECTION A-A', SOUTH BARROW 13 TO SINCLAIR COLVILLE 1

Cross section A-A' includes South Barrow 13, South Barrow 17, Iko Bay 1, Tulageak 1, West Dease 1, East Simpson 2, East Simpson 1, Drew Point 1, J. W. Dalton 1, W. T. Foran 1, Cape Halkett 1, Atigaru Point 1, and South Harrison Bay 1. Datum is sea level. The main geologic features shown are:

1. Unit M-1 (Endicott Group) overlies unit O-S ("Argillite") at East Simpson 2, W. T. Foran 1, Cape Halkett 1, Atigaru Point 1, and Sinclair Colville 1. M-1 is present questionably at J. W. Dalton 1, based on indeterminate fossils and Late Mississippian tectonics suggested by 18° to 35° dips recorded in basal clastics.

2. The Lisburne Group laps out to the northwest. M-2 (Alapah Limestone) laps out between Cape Halkett 1 and W. T. Foran 1, and P-1 (Wahoo Limestone) laps out between J. W. Dalton 1 and Drew Point 1. The basal Lisburne clastics at J. W. Dalton 1 are probably a part of P-1 and a lateral facies of the Wahoo.

3. P-1 is truncated and unconformably overlain by PR-2 at Sinclair Colville 1, South Harrison Bay 1, and Atigaru Point 1, and by TR-1 at Cape Halkett 1, W. T. Foran 1, and J. W. Dalton 1.

4. TR-2 ("Ivishak sandstone") is only 93 ft (28 m) below the basal "Pebble Shale" unconformity at W. T. Foran 1, and only 139 ft (41 m) below it at J. W. Dalton 1. The subcrop of TR-2 below the "Pebble Shale" is located under the Beaufort Sea, 4 to 6 mi (6 to 10 km) north of W. T. Foran 1 and J. W. Dalton 1.

5. Triassic rocks lap onto the Barrow High. TR-3a (Shublik Formation) laps out between Iko Bay 1 and South Barrow 17. TR-3b (Sag River Sandstone) is present at South Barrow 13, but grades into shale to the northwest between East Simpson 2 and West Dease 1.

6. Unit J-1 ("Lower Kingak") is present in all wells except J. W. Dalton 1 and W. T. Foran 1. J-1c is below the basal "Pebble Shale" unconformity at Sinclair Colville 1, South Harrison Bay 1, Atigaru Point 1, Tulageak 1, and Iko Bay 1. J-1 is truncated more deeply by the basal "Pebble Shale" unconformity toward the Barrow High; J-1b underlies it at Cape Halkett 1, East Simpson 1, West Dease 1, South Barrow 17, and South Barrow 13. At East Simpson 2, J-1a ("Barrow sandstone") is all that remains of J-1.

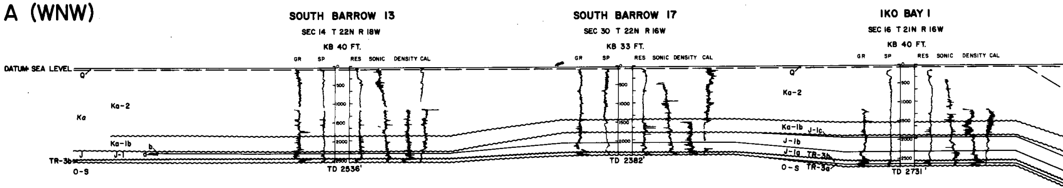
7. Unit J-3 is only in the wells farthest from the Barrow High: Atigaru Point 1, South Harrison Bay 1, and Sinclair Colville 1.

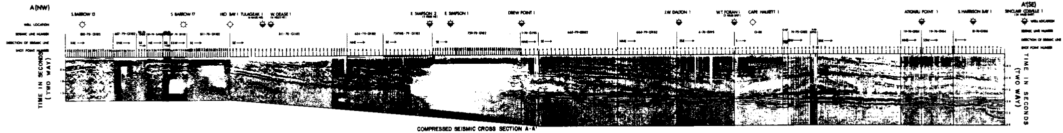
8. Ka-1b ("Pebble Shale") is present in all wells except South Harrison Bay 1 on the edge of the Fish Creek Platform.

9. Ka-2 and Ka-3 (Torok Formation and Nanushuk Group) are time-transgressive units that overlie unit Ka-1b. The rocks become younger from the southwest to the northeast, and have an initial regional dip to the northeast.

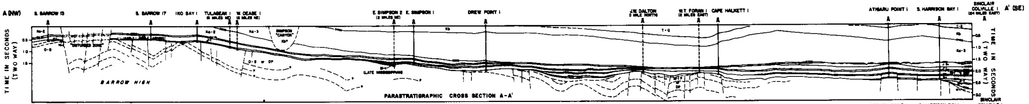
10. The Torok clinothem (foreset) beds in unit Ka-2 are immediately below the surface deposits in South Barrow 13 and South Barrow 17.

11. Progressively younger strata underlie the Quaternary surface materials to the southeast. The Torok undathem (topset) beds in unit Ka-2 are present at Iko Bay 1. At Tulageak 1 and West Dease 1, unit Ka-3 underlies unit Q and consists of mainly marine Nanushuk strata. Unit Kb (Colville Group) is present at East Simpson 2 and East Simpson 1. Unit T (Sagavanirktok Formation) underlies the surface beds in all other wells except Sinclair Colville 1 where unit Kb is on the surface.

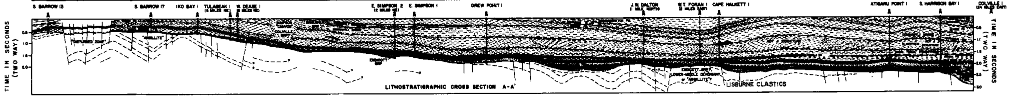

A (WNW)
SOUTH BARROW 13
SEC 14 T 22N R 18W
KB 40 FT.
SOUTH BARROW 17
SEC 30 T 22N R 16W
KB 33 FT.
IKO BAY I
SEC 16 T 21N R 16W
KB 40 FT.
GR
SP
RES
SONIC
DENSITY
CAL
DATUM: SEA LEVEL
Q
Ka
Ka-2
Ka-1b
J
J-1
a
b
TR-3b
O-S
TD 2536'
TD 2382'
J-1c
J-1b
J-1a
TR-3b
TR-3a
TD 2731'
500
1000
1500
2000
2500



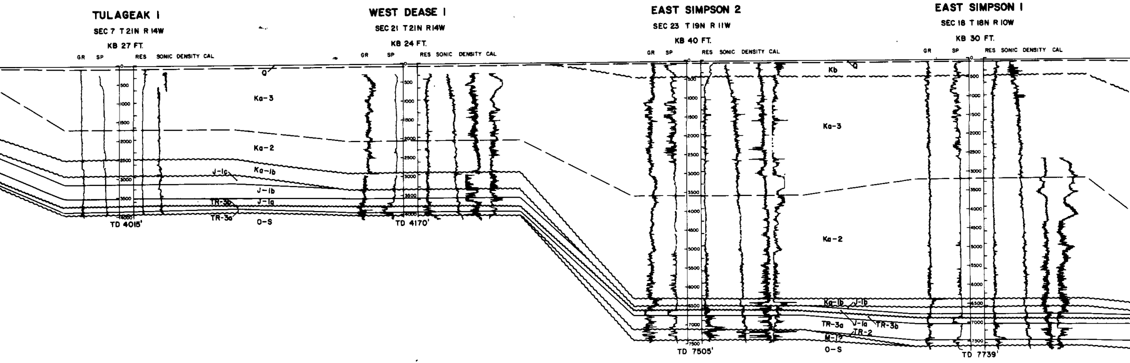
COMPRESSED SEISMIC CROSS SECTION A-A'

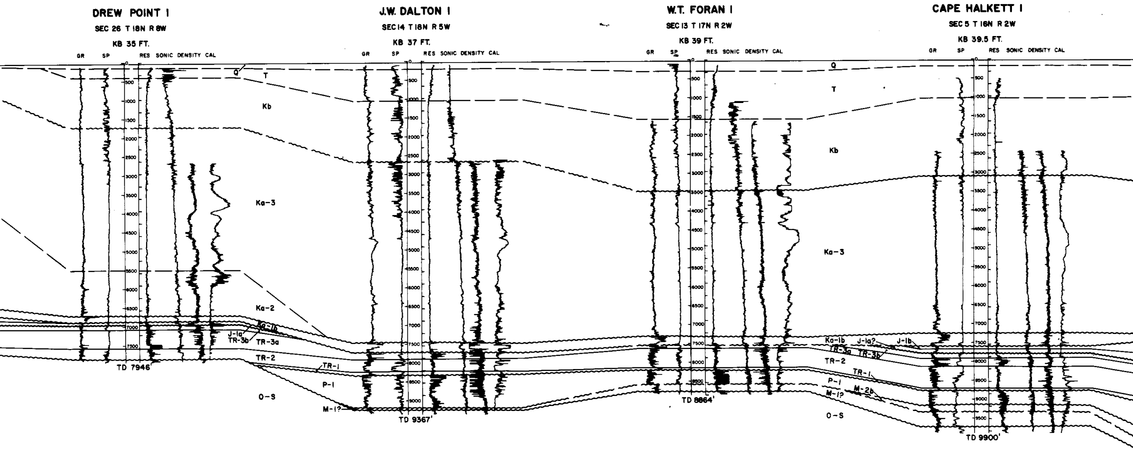

A (NW)
A' (SE)
S. BARROW 13
S. BARROW 17
IKO BAY I
TULAGEAK I (6 MILES NE)
W. DEASE I (6 MILES NE)
E. SIMPSON 2 (2 MILES NE)
E. SIMPSON 1
DREW POINT I
J.W. DALTON (1 MILE NORTH)
W.T. FORAN I (2 MILES EAST)
CAPE HALKETT I
ATIGARU POINT I
S. HARRISON BAY I
SINCLAIR COLVILLE I (24 MILES EAST)
Ka-2
Ka-3
Kb
T-Q
"DISTURBED ZONE"
O-S
SIMPSON "CANYON"
O-S or D?
M-1 (LATE MISSISSIPPIAN)
BARROW HIGH
TIME IN SECONDS (TWO WAY)
0.5
1.0
1.5
2.0
2.5
3.0

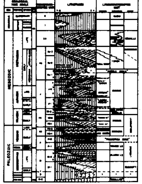
PARASTRATIGRAPHIC CROSS SECTION A-A'

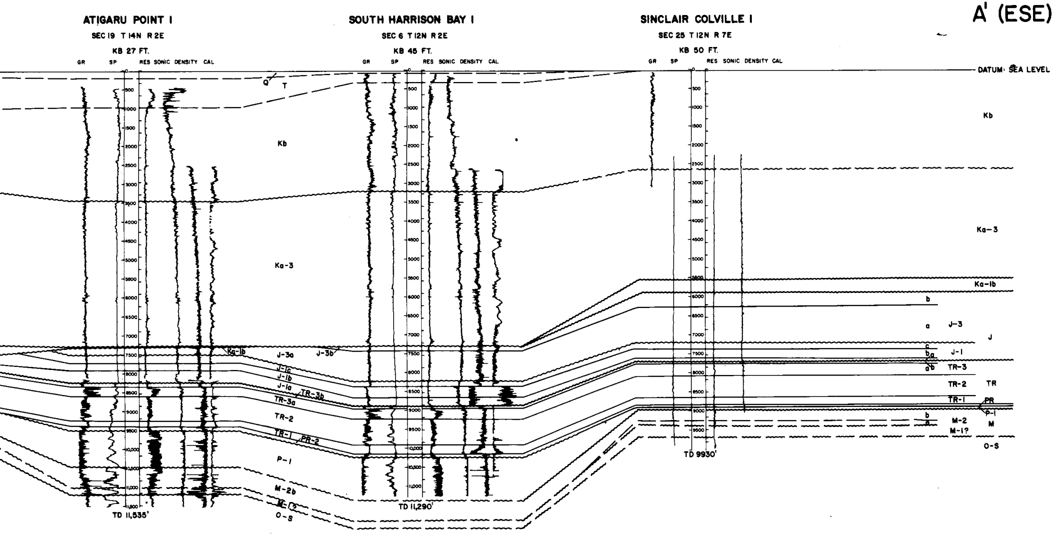

S. BARROW 13
S. BARROW 17
IKO BAY I
TULAGEAK I (6 MILES NE)
W. DEASE I (6 MILES NE)
E. SIMPSON 2 (2 MILES NE)
E. SIMPSON 1
DREW POINT I
J.W. DALTON (1 MILE NORTH)
W.T. FORAN I (2 MILES EAST)
CAPE HALKETT I
ATIGARU POINT I
S. HARRISON BAY I
SINCLAIR COLVILLE I (24 MILES EAST)
"DISTURBED ZONE"
"ARGILLITE"
SIMPSON "CANYON"
COLVILLE GRP
ENDICOTT GRP
ENDICOTT GRP?, (LOWER-MIDDLE DEVONIAN?, or "ARGILLITE"?)
NOT A STRUCTURE
LISBURNE CLASTICS
TIME IN SECONDS (TWO WAY)
0.5
1.0
1.5
2.0
2.5
3.0

LITHOSTRATIGRAPHIC CROSS SECTION A-A'

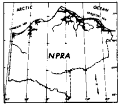

TULAGEAK I
SEC 7 T 21N R 14W
KB 27 FT.
GR SP RES SONIC DENSITY CAL
TD 4015'
WEST DEASE I
SEC 21 T 21N R 14W
KB 24 FT.
GR SP RES SONIC DENSITY CAL
TD 4170'
EAST SIMPSON 2
SEC 23 T 19N R 11W
KB 40 FT.
GR SP RES SONIC DENSITY CAL
TD 7505'
EAST SIMPSON I
SEC 18 T 18N R 10W
KB 30 FT.
GR SP RES SONIC DENSITY CAL
TD 7739'
Q
Kb
Ka-3
Ka-2
Ka-1b
J-1c
J-1b
J-1a
TR-3b
TR-3a
TR-2
M-1?
O-S
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
7000
7500


DREW POINT 1
SEC 26 T 18N R 8W
KB 35 FT.
GR SP RES SONIC DENSITY CAL
TD 7946'
J.W. DALTON 1
SEC 14 T 18N R 5W
KB 37 FT.
GR SP RES SONIC DENSITY CAL
TD 9367'
W.T. FORAN 1
SEC 13 T 17N R 2W
KB 39 FT.
GR SP RES SONIC DENSITY CAL
TD 8864'
CAPE HALKETT 1
SEC 5 T 16N R 2W
KB 39.5 FT.
GR SP RES SONIC DENSITY CAL
TD 9900'
Q
T
Kb
Ka-3
Ka-2
Ka-1b
J-1a
TR-3b
TR-3a
TR-2
TR-1
P-1
O-S
M-1?
J-1a?
J-1b
M-2b
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
7000
7500
8000
8500
9000
9500




A' (ESE)
ATIGARU POINT I
SEC 19 T 14N R 2E
KB 27 FT.
SOUTH HARRISON BAY I
SEC 6 T 12N R 2E
KB 45 FT.
SINCLAIR COLVILLE I
SEC 25 T 12N R 7E
KB 50 FT.
GR
SP
RES
SONIC
DENSITY
CAL
DATUM: SEA LEVEL
Q
T
Kb
Ka-3
Ka-Ib
J-3a
J-3b
J-Ic
J-Ib
J-Ia
TR-3b
TR-3a
TR-2
TR-I
PR-2
P-I
M-2b
M-2
O-S
b
a
J-3
J
c
b
a
J-I
TR-3
TR-2
TR
TR-I
PR
P-I
M-2
M-I?
M
O-S
TD 11,535'
TD 11,290'
TD 9930'
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
7000
7500
8000
8500
9000
9500
10,000
10,500
11,000
11,500

NO HORIZONTAL SCALE


ARCTIC
OCEAN
NPRA

INDEX MAP

TETRA TECH, INC
HOUSTON, TEXAS
ENERGY MANAGEMENT DIVISION
PASADENA, CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

CORRELATION CROSS SECTION A-A'
SOUTH BARROW 13 - SINCLAIR COLVILLE 1

NPR	ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J. W. BRUYNZEEL		PROJECT NO. TC-7174	
INTERPRETATION BY: V. BERGER, D. HIGGS		REVISED	
		DATE	INITIAL
DATE: JUNE, 1981	DATUM: SEA LEVEL		
CONTOUR INT:	SCALE:	DWG NO.	

TETRA TECH REPORT NO. 8200

TGZ-0170

FIGURE 29

FIGURE 30

LITHOSTRATIGRAPHIC CROSS SECTION A-A', SOUTH BARROW 13 TO SOUTH HARRISON BAY 1

Features of interest, from the bottom upward and from northwest (left) to southeast (right) of the section, are:

1. The "Acoustic basement" is composed of "Argillite" (phyllite and quartzite) in the Barrow area. Farther to the southeast, rocks lithologically comparable to the Endicott Group probably are downfaulted erosional remnants lodged in basement rocks.

2. The Endicott Group is time-transgressive onto the Barrow Arch. Pennsylvanian clastics below Lisburne Group carbonates at J. W. Dalton 1 are classed lithologically as Lisburne clastics (unit P-1).

3. Within the Lisburne Group, the Wahoo Limestone truncates the Alapah Limestone east of South Harrison Bay 1. The Wahoo laps out between J. W. Dalton 1 and Drew Point 1.

4. The Echooka Formation (Ikiakpaurak Member) and the upper part of the Wahoo Limestone are truncated and overlain by the Ivishak Formation just east of Drew Point 1.

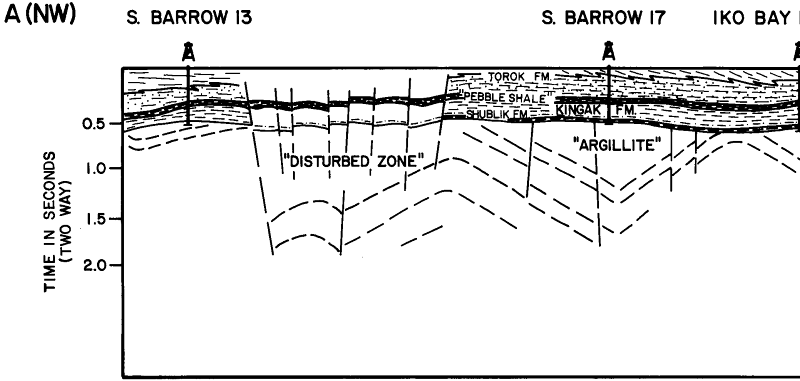
5. The Shublik Formation and Sag River Sandstone lap out on the Barrow High. The Sag River is represented by an unnamed siltstone equivalent in the Barrow area.

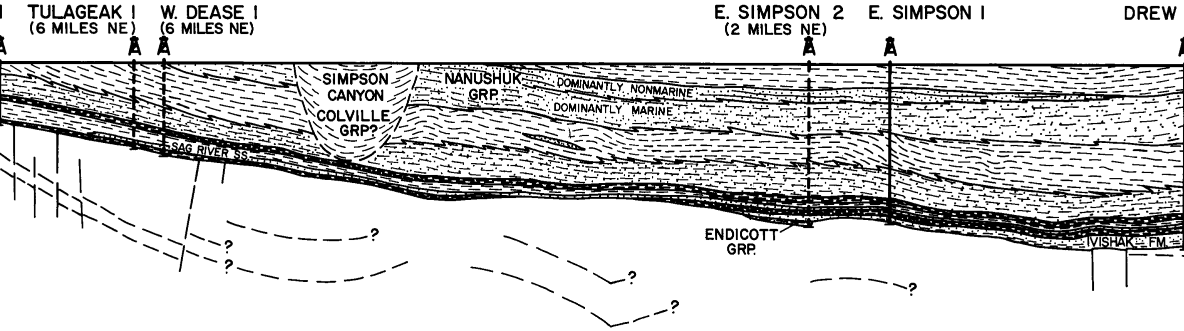
6. The "Pebble Shale" truncates Paleozoic and early Mesozoic rocks over the Barrow Arch.

7. The source of the Torok Formation and the Nanushuk and Colville Groups seems to be to the west. The Torok-Nanushuk sequence progrades toward the east. First, the Torok fondothem, clinothem, and undathem, and then the Nanushuk marine and nonmarine occur upward in the section. The great thickness of the sequence indicates very rapid deposition.

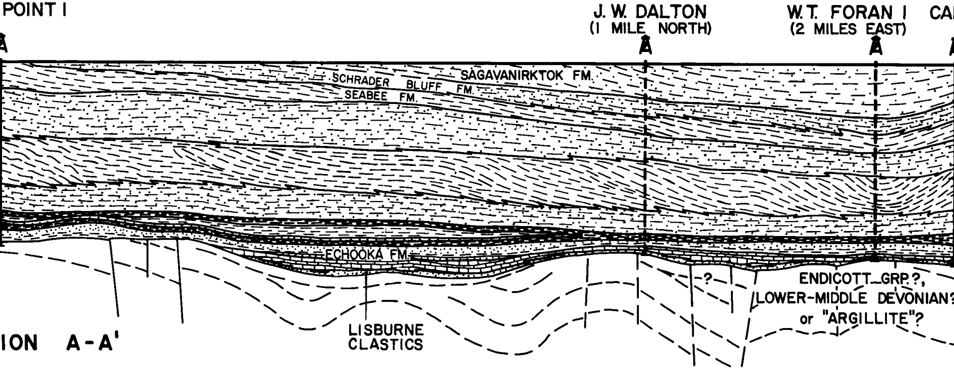
8. The Colville Group is a thinner replica of the underlying Torok-Nanushuk sequence. The basin-slope sequence of the Seabee Formation, which is similar to the Torok, is succeeded by the shallow marine Schrader Bluff Formation, which is similar to the Nanushuk marine. The Colville progrades toward the east.

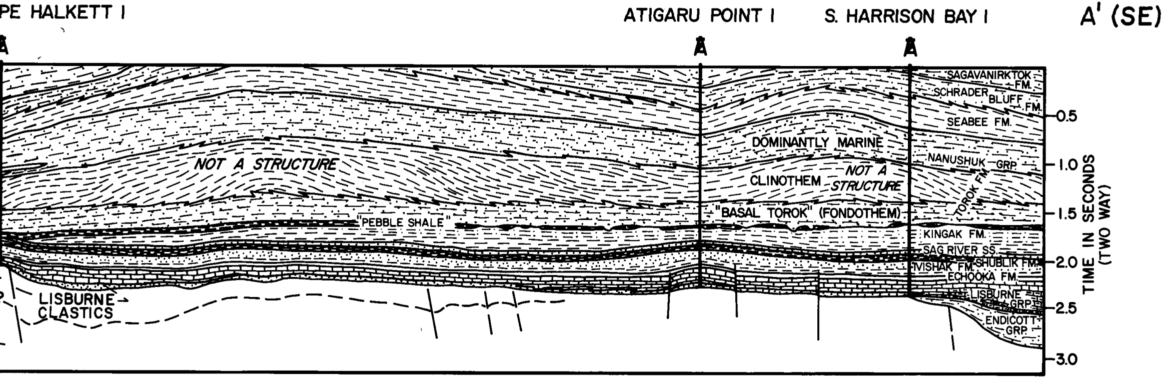
9. The Sagavanirktok Formation is a shallow marine Tertiary unit. The thickest Tertiary section on the Reserve occurs in the northeast corner between J. W. Dalton 1 and Atigaru Point 1.


A (NW)
S. BARROW 13
S. BARROW 17
IKO BAY
TOROK FM.
"PEBBLE SHALE"
SHUBLIK FM.
KINGAK FM.
"DISTURBED ZONE"
"ARGILLITE"
TIME IN SECONDS (TWO WAY)
0.5
1.0
1.5
2.0

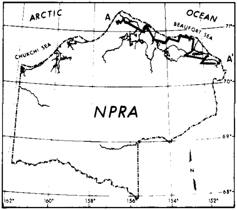

TULAGEAK 1
(6 MILES NE)
W. DEASE 1
(6 MILES NE)
E. SIMPSON 2
(2 MILES NE)
E. SIMPSON 1
DREW
SIMPSON
CANYON
COLVILLE
GRP?
NANUSHUK
GRP.
DOMINANTLY NONMARINE
DOMINANTLY MARINE
SAG RIVER SS.
ENDICOTT
GRP.
IVISHAK FM.
?
?
?
?
?
?

LITHOSTRATIGRAPHIC CROSS SECT


POINT I
J. W. DALTON
(1 MILE NORTH)
W.T. FORAN I
(2 MILES EAST)
CA
SAGAVANIRKTOK FM.
SCHRADER BLUFF FM.
SEABEE FM.
ECHOOKA FM.
?
ENDICOTT GRP.?,
LOWER-MIDDLE DEVONIAN?
or "ARGILLITE"?
LISBURNE
CLASTICS
ION A-A'



PE HALKETT I
ATIGARU POINT I
S. HARRISON BAY I
A' (SE)
NOT A STRUCTURE
DOMINANTLY MARINE
CLINOTHEM
NOT A STRUCTURE
"BASAL TOROK" (FONDOTHEM)
"PEBBLE SHALE"
LISBURNE CLASTICS
?
SAGAVANIRKTOK FM.
SCHRADER BLUFF FM.
SEABEE FM.
NANUSHUK GRP.
TOROK FM.
KINGAK FM.
SAG RIVER SS.
SHUBLIK FM.
IVISHAK FM.
ECHOOKA FM.
LISBURNE GRP.
ENDICOTT GRP.
0.5
1.0
1.5
2.0
2.5
3.0
TIME IN SECONDS (TWO WAY)


ARCTIC
OCEAN
A
BEAUFORT SEA
CHUKCHI SEA
A'
71°
70°
69°
68°
NPRA
N
162°
160°
158°
156°
154°
152°

INDEX MAP

TETRA TECH, INC

HOUSTON, TEXAS

ENERGY MANAGEMENT DIVISION

PASADENA, CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

LITHOSTRATIGRAPHIC CROSS SECTION A-A'

SOUTH BARROW 13-S. HARRISON BAY 1

NPR ALASKA

FOR

ONPRA

HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J.W. BRUYNZEEL		**PROJECT NO.** TC-7174	
INTERPRETATION BY: C. GULDENZOPF		**REVISED**	
		DATE	**INITIAL**
DATE: JUNE, 1981	**DATUM:** SEA LEVEL		
CONTOUR INT:	**SCALE:**	**DWG NO.**	

TETRA TECH REPORT NO. 8200

FIGURE 30

TGZ-0170

FIGURE 31

PARASTRATIGRAPHIC CROSS SECTION A-A', SOUTH BARROW 13 TO SOUTH HARRISON BAY 1

Features of interest, from the bottom upward and from northwest (left) of the section to the southeast (right), are:

1. Structures below horizon 1500 in the "Acoustic basement" are inferred. According to Carter and Laufeld (1975), the basement is Ordovician-Silurian in the Barrow area. Inferred bedding and dip changes indicate that, from J. W. Dalton 1 to Cape Halkett 1, some of the metasedimentary rocks comprising the "Acoustic basement" may be younger than Ordovician-Silurian.

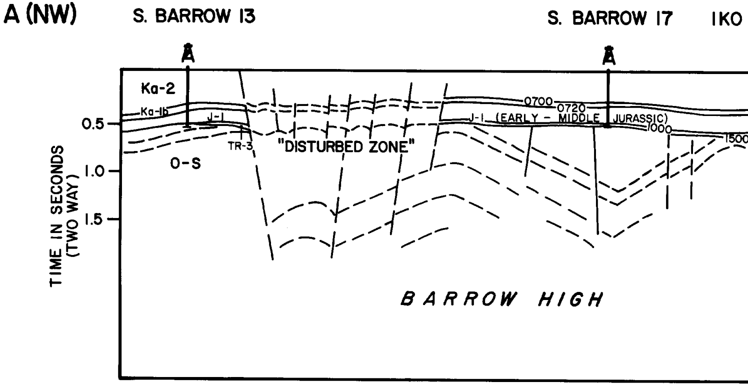
2. Progressively younger rocks lap onto the Barrow Arch from the southeast toward the northwest. The M-1(?), M-2, P-1, PR, TR-1, TR-3, and J-1 units progressively overlap the "Acoustic basement."

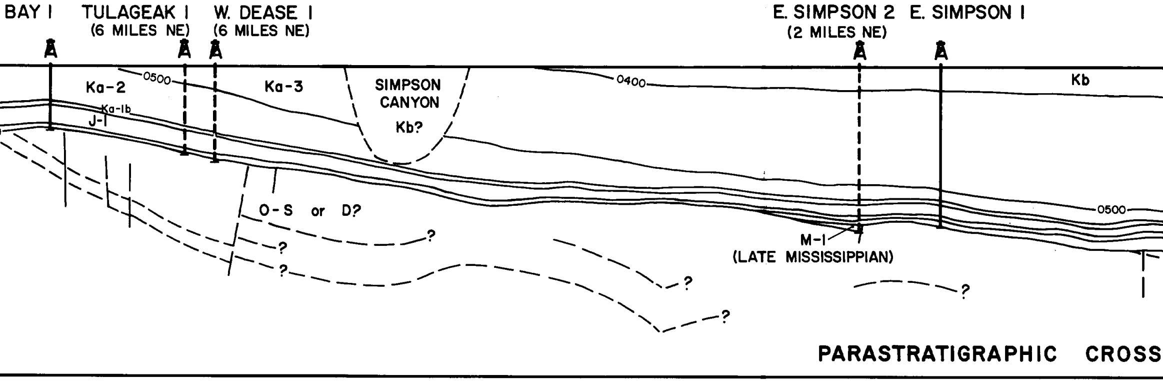
3. Horizons 0700 and 0720 form a reflector doublet that is near the top and bottom, respectively, of unit Ka-1b (Late Neocomian). Ka-1b truncates progressively older rocks toward the north, and lies directly on TR-2 between J. W. Dalton 1 and Cape Halkett 1.

4. Horizon 0500 (mid-Aptian(?)) downlaps onto horizon 0700 (top of Ka-1b) and is near the top of unit Ka-2. East of Drew Point 1, unit Ka-3 (Late Aptian to early Cenomanian) directly overlies Ka-1b.

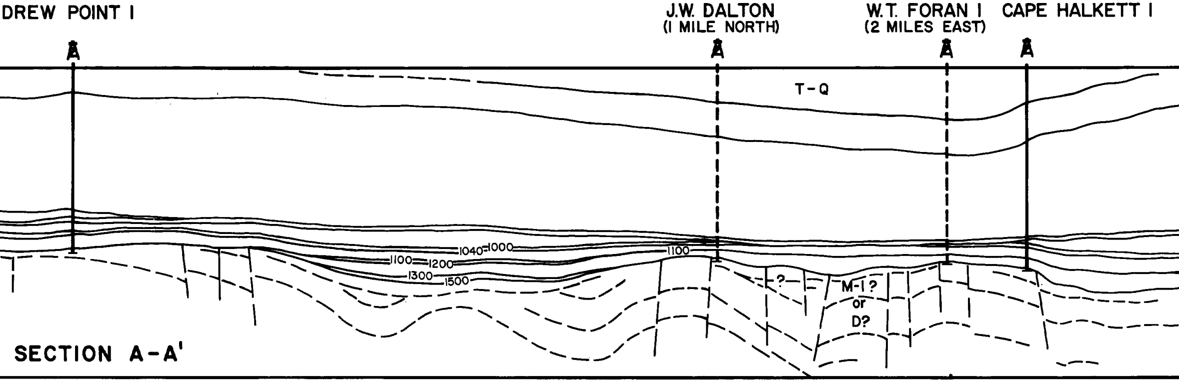
5. The Barrow High was uplifted in post-Cretaceous time. Progressively younger strata occur below surface deposits from the crest of the Barrow High toward the southeast. Ka-2 is near the surface on the Barrow High, and is overlain toward the southeast by units Ka-3, Kb, T, and Q.

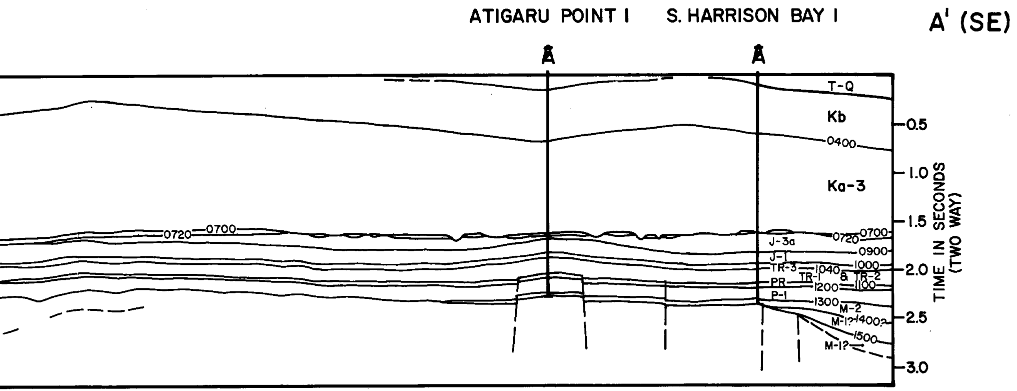
6. The Simpson oil seeps emanate from the edge of the Simpson canyon. This sediment-filled trough is presumed to be a submarine canyon cut during mid-Cretaceous time. According to Robinson (1959), the sediments are Late Cretaceous.

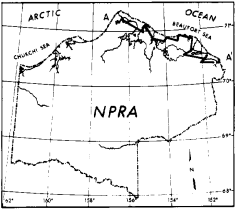

A (NW)
S. BARROW 13
S. BARROW 17
IKO
Ka-2
Ka-1b
J-1
0.5
1.0
1.5
TIME IN SECONDS
(TWO WAY)
TR-3
O-S
"DISTURBED ZONE"
0700
0720
J-1 (EARLY - MIDDLE JURASSIC)
1000
1500
BARROW HIGH


BAY I
TULAGEAK I
(6 MILES NE)
W. DEASE I
(6 MILES NE)
E. SIMPSON 2
(2 MILES NE)
E. SIMPSON I
Ka-2
0500
Ka-3
SIMPSON CANYON
Kb?
0400
Kb
Ka-Ib
J-I
O-S or D?
?
?
?
?
?
?
M-I
(LATE MISSISSIPPIAN)
0500

PARASTRATIGRAPHIC CROSS


DREW POINT I
J.W. DALTON
(I MILE NORTH)
W.T. FORAN I
(2 MILES EAST)
CAPE HALKETT I
T-Q
1040
1000
1100
1200
1300
1500
1100
?
M-I ?
or
D?
SECTION A-A'


ATIGARU POINT 1
S. HARRISON BAY 1
A' (SE)
T-Q
Kb
0400
Ka-3
0720
0700
0720
0700
J-3a
0900
J-1
TR-3
1040
1000
& TR-2
TR-1
PR
1200
1100
P-1
1300
M-2
M-1?
1400?
1500
M-1?
0.5
1.0
1.5
2.0
2.5
3.0
TIME IN SECONDS
(TWO WAY)


ARCTIC
A
OCEAN
BEAUFORT SEA
CHUKCHI SEA
A'
NPRA
71°
70°
69°
68°
N
62°
160°
158°
156°
154°
152°

INDEX MAP

TETRA TECH, INC
HOUSTON, TEXAS
ENERGY MANAGEMENT DIVISION
PASADENA, CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

PARASTRATIGRAPHIC CROSS SECTION A-A'

SOUTH BARROW 13- S. HARRISON BAY 1

NPR ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J.W. BRUYNZEEL		**PROJECT NO.** TC-7174
INTERPRETATION BY: C. GULDENZOPF		**REVISED** **DATE** **INITIAL**
DATE: JUNE, 1981	**DATUM:** SEA LEVEL	
CONTOUR INT:	**SCALE:**	**DWG NO.**

TETRA TECH REPORT NO. 8200

FIGURE 31

TG2-0170

FIGURE 32

COMPRESSED SEISMIC CROSS SECTION A-A', SOUTH BARROW 13 to SOUTH HARRISON BAY 1

Features of interest are:

1. Right-angle seismic line intersections are responsible for several "pseudostructures." For example, within the Torok clinothem, there are several apparent anticlines and synclines mostly caused by dip direction changes because of changes in the direction of the lines. This is also true for an apparent basin at the intersection of lines 665-79 and 684-79.

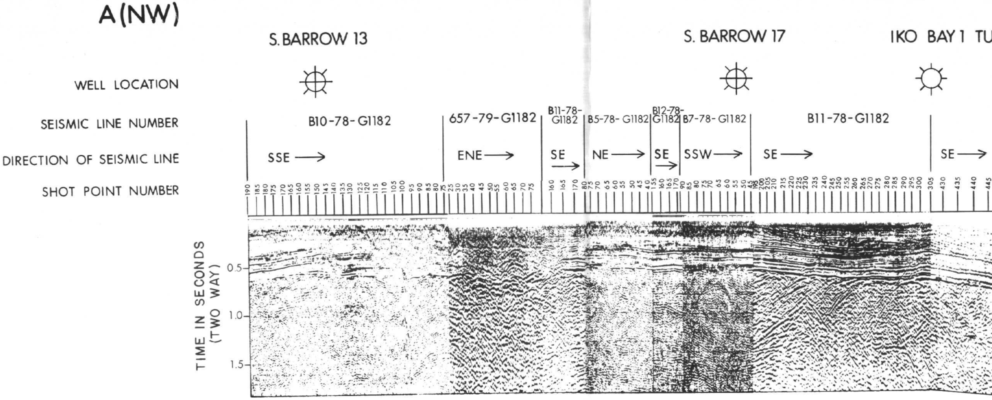
2. Below "Acoustic basement," there is an indication of structure in the O-S, D(?), or younger strata. Some of these features are refractions, probably from faults. Some apparent bedding is probably due to multiples from higher strata. Therefore, all interpreted structures below "Acoustic basement" are conjectural.

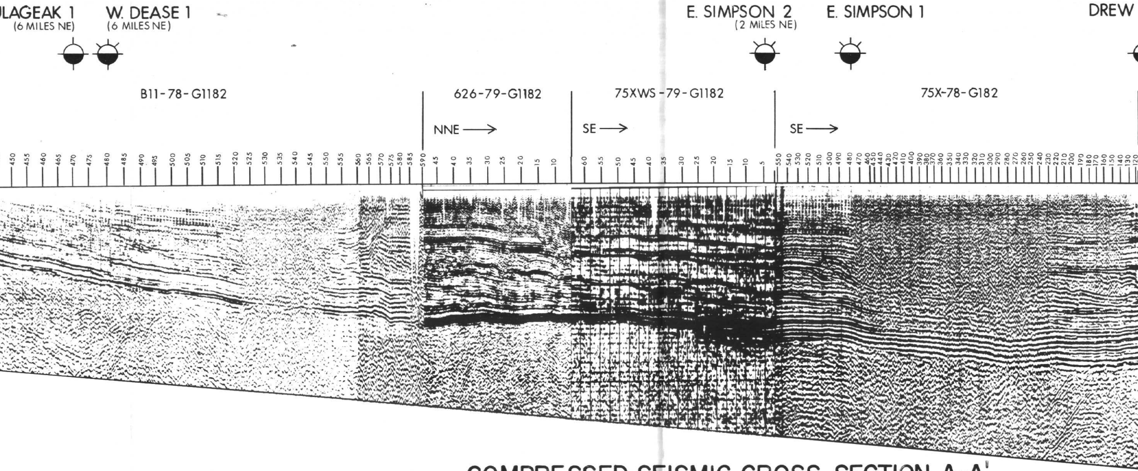
3. Mud-gun data are represented by "washed-out" zones over Dease Inlet and Smith Bay. These zones are found at the southeast end of seismic line B-11, and between East Simpson 1 and Drew Point 1 on line 75X-78. Although the data are poor, some of the continuous reflectors are more obvious on this compressed section than on the conventional seismic sections, especially in the deeper horizons.

4. The "Disturbed Zone" is crossed just east of South Barrow 13, beginning on line B10-78 and ending on line B11-78. Very few reflectors can be traced across this feature.

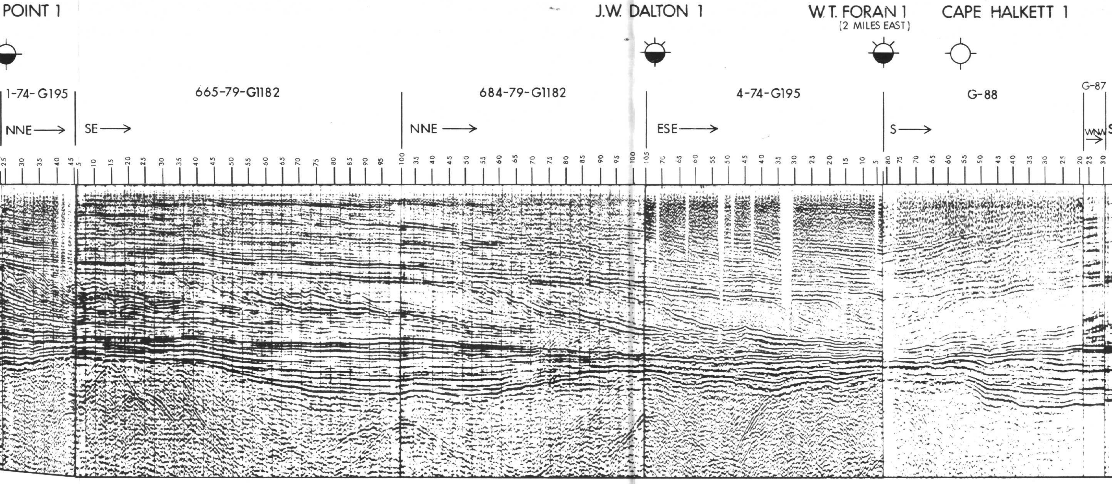
5. Basement tectonic elements are seen in the Barrow High to the northwest. The rest of this section is just to the south of and subparallel to the Barrow Arch. Minor flexures that are apparent in the basement are caused by line direction changes.

FIGURE 32

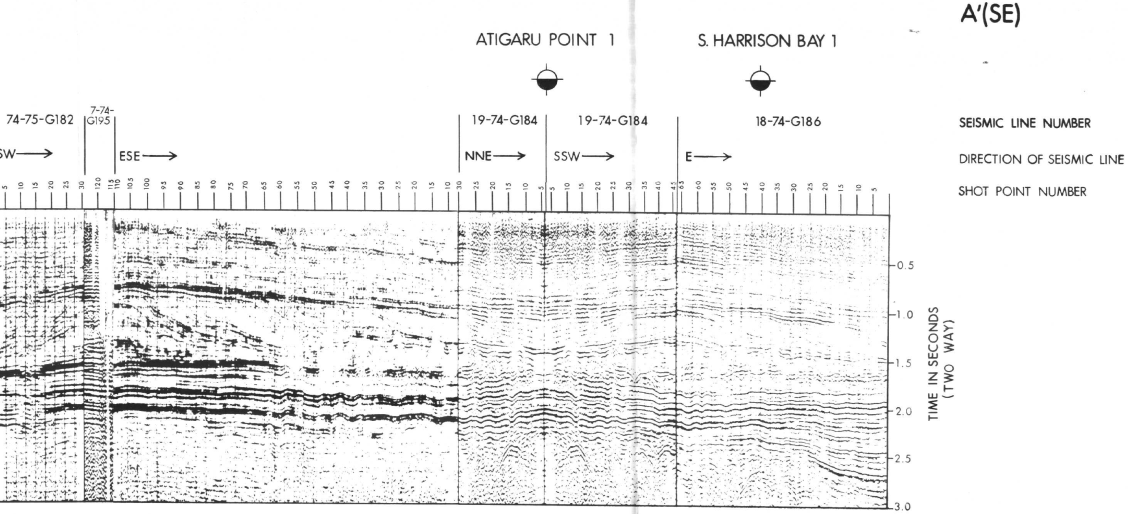

A(NW)
S. BARROW 13
S. BARROW 17
IKO BAY 1 TU
WELL LOCATION
SEISMIC LINE NUMBER
DIRECTION OF SEISMIC LINE
SHOT POINT NUMBER
B10-78-G1182
657-79-G1182
B11-78-G1182
B5-78-G1182
B12-78-G1182
B7-78-G1182
B11-78-G1182
SSE →
ENE →
SE →
NE →
SE →
SSW →
SE →
SE →
190 185 180 175 170 165 160 155 150 145 140 135 130 125 120 115 110 105 100 95 90 85 80 75
25 30 35 40 45 50 55 60 65 70 75
160 165 170
80 75 70 65 60 55 50 45 40
155 160 165 170
90 85 80 75 70 65 60 55 50 45
195 200 205 210 215 220 225 230 235 240 245 250 255 260 265 270 275 280 285 290 295 300 305
430 435 440 445
TIME IN SECONDS (TWO WAY)
0.5
1.0
1.5

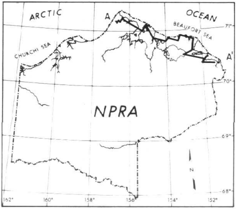

LAGEAK 1
(6 MILES NE)
W. DEASE 1
(6 MILES NE)
E. SIMPSON 2
(2 MILES NE)
E. SIMPSON 1
DREW
B11-78-G1182
626-79-G1182
75XWS-79-G1182
75X-78-G182
NNE ⟶
SE ⟶
SE ⟶
450 455 460 465 470 475 480 485 490 495 500 505 510 515 520 525 530 535 540 545 550 555 560 565 570 575 580 585 590
45 40 35 30 25 20 15 10
60 55 50 45 40 35 30 25 20 15 10 5
550 540 530 520 510 500 490 480 470 460 450 440 430 420 410 400 390 380 370 360 350 340 330 320 310 300 290 280 270 260 250 240 230 220 210 200 190 180 170 160 150 140 130 120

COMPRESSED SEISMIC CROSS SECTION A-A'



POINT 1
J.W. DALTON 1
W.T. FORAN 1
(2 MILES EAST)
CAPE HALKETT 1
1-74-G195
665-79-G1182
684-79-G1182
4-74-G195
G-88
G-87
NNE ⟶
SE ⟶
NNE ⟶
ESE ⟶
S ⟶
WNW




ARCTIC
OCEAN
A
BEAUFORT SEA
CHUKCHI SEA
A'
71°
70°
NPRA
69°
N
68°
162°
160°
158°
156°
154°
152°

INDEX MAP

TETRA TECH, INC

HOUSTON, TEXAS
ENERGY MANAGEMENT DIVISION
PASADENA, CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

COMPRESSED SEISMIC CROSS SECTION A-A'

SOUTH BARROW 13 - S. HARRISON BAY I

NPR ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J. W. BRUYNZEEL	**PROJECT NO.** TC-7174	
INTERPRETATION BY: C. GULDENZOPF, K. CLARY	REVISED	
	DATE	INITIAL
DATE: JUNE, 1981 **DATUM:** SEA LEVEL		
CONTOUR INT: **SCALE:**	**DWG NO.**	

TETRA TECH REPORT NO. 8200

TGZ-0170

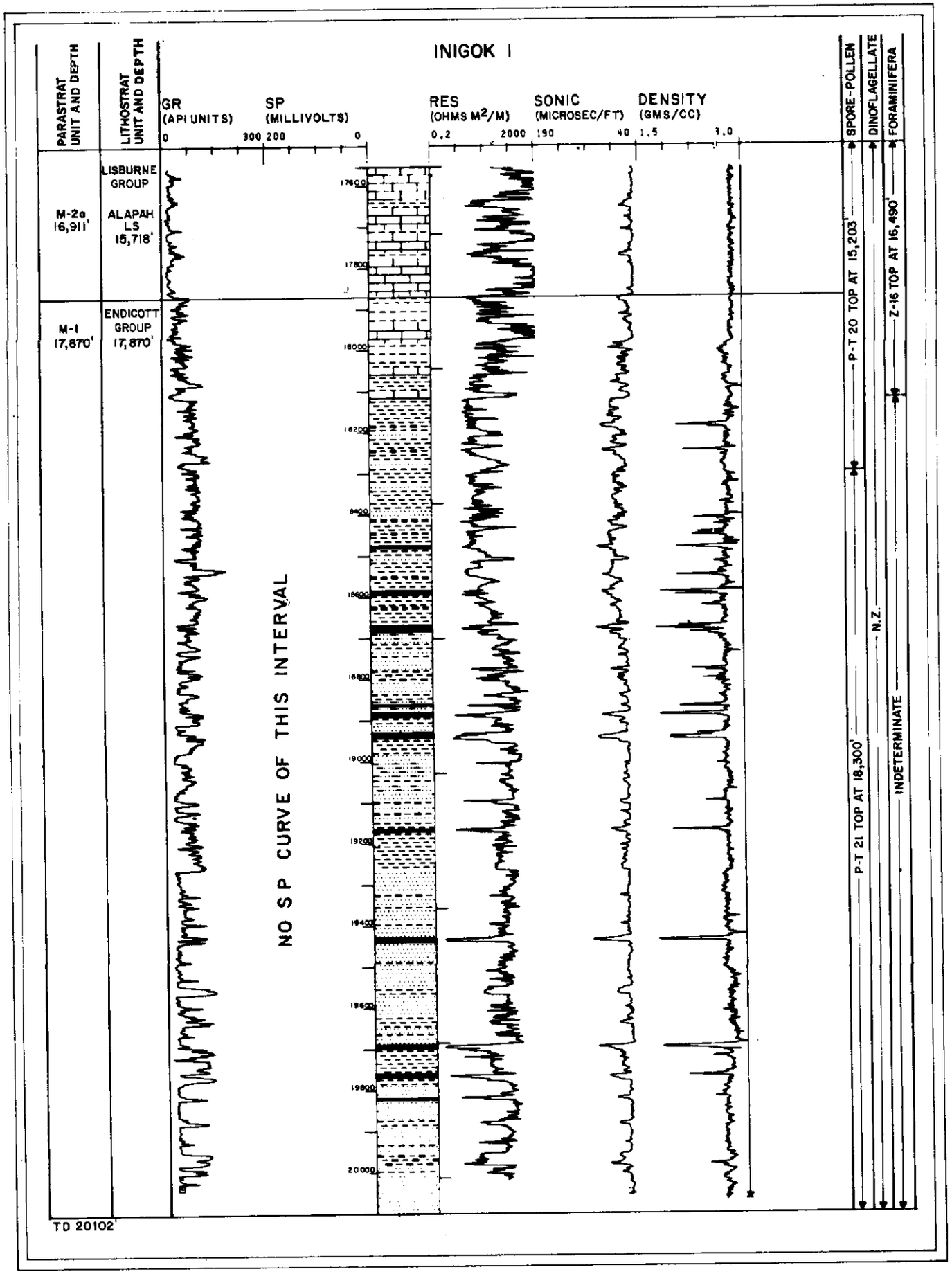
FIGURE 32

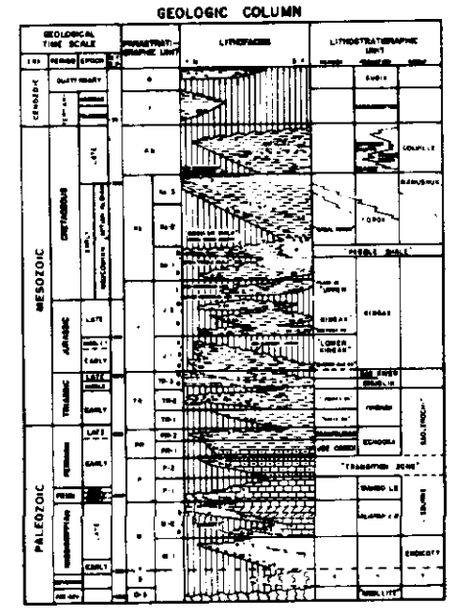
FIGURE 33

TYPE LOG OF M-1 PARASTRATIGRAPHIC UNIT, INIGOK 1

At Inigok 1, the top of unit M-1 is picked at 17,870 ft (5,448 m). This depth coincides with the correlated lithostratigraphic top of the Endicott Group. Inigok 1 bottomed at a total depth of 20,102 ft (6,127 m) in the M-1 unit. The unit consists of interbedded fine- to medium-grained clastics and coal beds between 18,300 ft (5,578 m) and total depth. Between 17,870 and 18,300 ft (5,448 and 5,578 m), it consists of interbedded fine- to medium-grained clastics and carbonates. On electric logs, cyclical segments with a period of 20 to 60 ft (6 to 18 m) are typical in this unit. The log curves are characterized by numerous wide curve fluctuations producing a distinct "jagged" appearance.

FIGURE 33





TETRA TECH, INC
HOUSTON, TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA, CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

TYPE LOG OF M-I PARASTRATIGRAPHIC UNIT
INIGOK I

NPR — ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J. W. BRUYNZEEL		PROJECT NO. TC-7174
INTERPRETATION BY: STAFF		REVISED — DATE / INITIAL
DATE: SEPT., 1981	DATUM:	
CONTOUR INT:	SCALE:	DWG NO.

TETRA TECH REPORT NO.8200

TGZ-0130

FIGURE 33

FIGURE 34

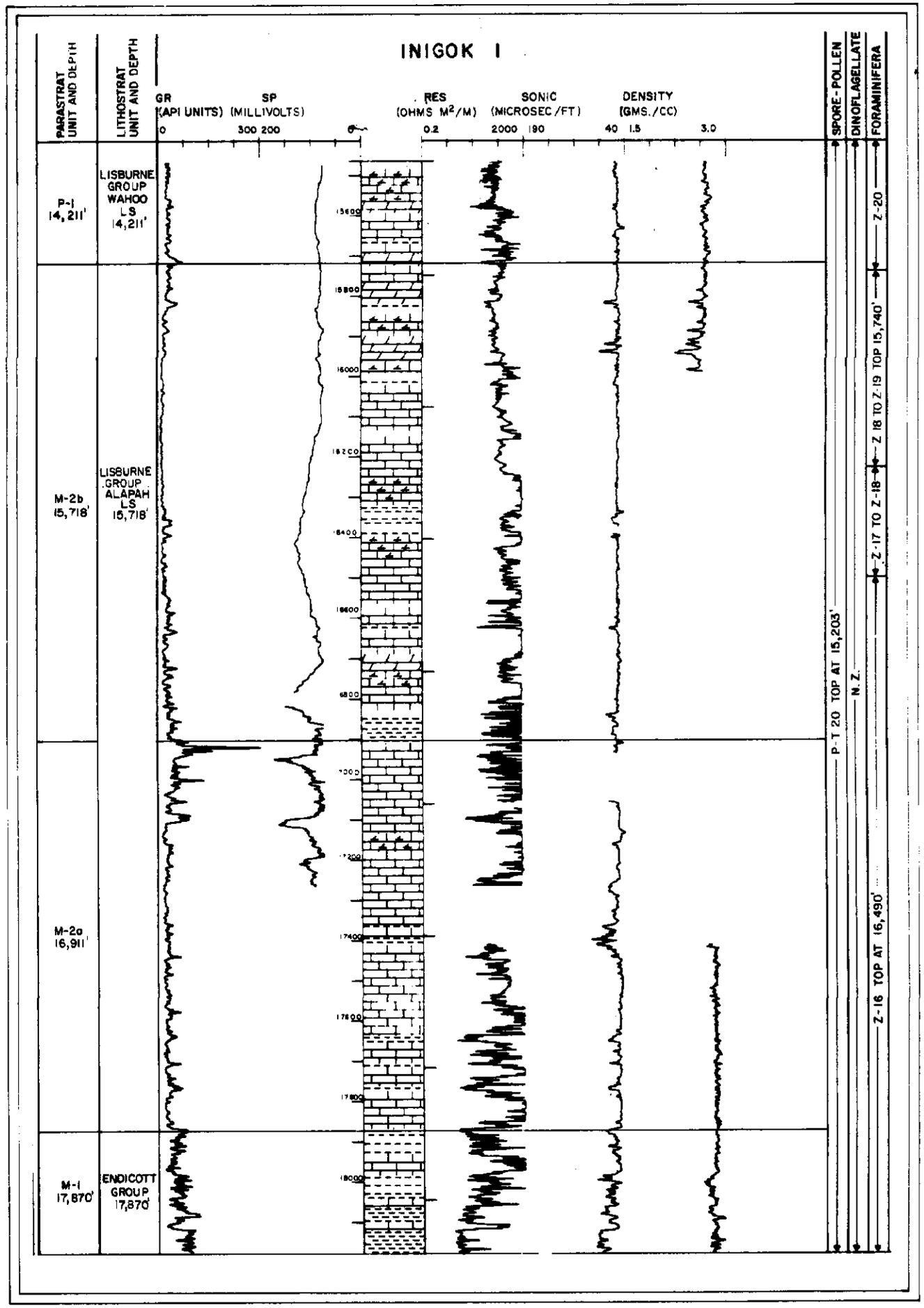
TYPE LOG OF M-2 PARASTRATIGRAPHIC UNIT, INIGOK 1

At Inigok 1, the top of M-2 is picked at 15,718 ft (4,791 m), which coincides with the lithostratigraphic top of the Alapah Formation. On electric logs, cyclical segments with a period of 50 to 150 ft (15 to 46 m) are typical of the M-2 unit. The cycles characteristically are funnel-shaped segments that probably represent "shoaling" or "shallowing-upward" carbonate depositional cycles (James, 1979, p. 110).

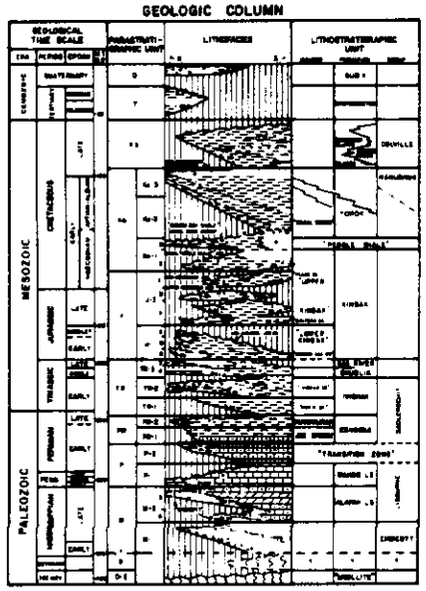
By contrast, a bell-shaped segment probably represents a "deepening-upward" carbonate depositional cycle during which eustatic sea-level rise or shelf subsidence outpaced carbonate sedimentation. Such a cycle is characterized by more numerous shale breaks and argillaceous carbonates.

The boundary between Mamet's foraminiferal zones 18, 19, and 20 is the marker selected to separate M-2 from the overlying P unit. This boundary occurs at 15,740 ft (4,799 m) at Inigok 1.

FIGURE 34



GEOLOGIC COLUMN



TETRA TECH, INC
HOUSTON, TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA, CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

TYPE LOG OF M-2 PARASTRATIGRAPHIC UNIT INIGOK I

NPR — ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J. W. BRUYNZEEL	PROJECT NO. TC-7174
INTERPRETATION BY: STAFF	REVISED — DATE / INITIAL
DATE: SEPT., 1981 DATUM:	
CONTOUR INT: SCALE:	DWG NO.

TETRA TECH REPORT NO. 8200
T67-0170

FIGURE 34

FIGURE 35

ISOPACH AND LITHOFACIES MAP, M-1

Well	Thickness Feet	Thickness Meters	Clastic Ratio
Atigaru Point 1	187	57	<1/8
Cape Halkett 1	383	118	<1/8
J. W. Dalton 1	72	22	<1/8
W. T. Foran 1	188	57	<1/8
Ikpikpuk 1	200	61	1/6
Inigok 1	2,232+	680+	1/1.9
East Simpson 2	276	84	<1/12
Sinclair Colville 1	310	94	n.d.*
Arco Itkillik River	930	284	1/15

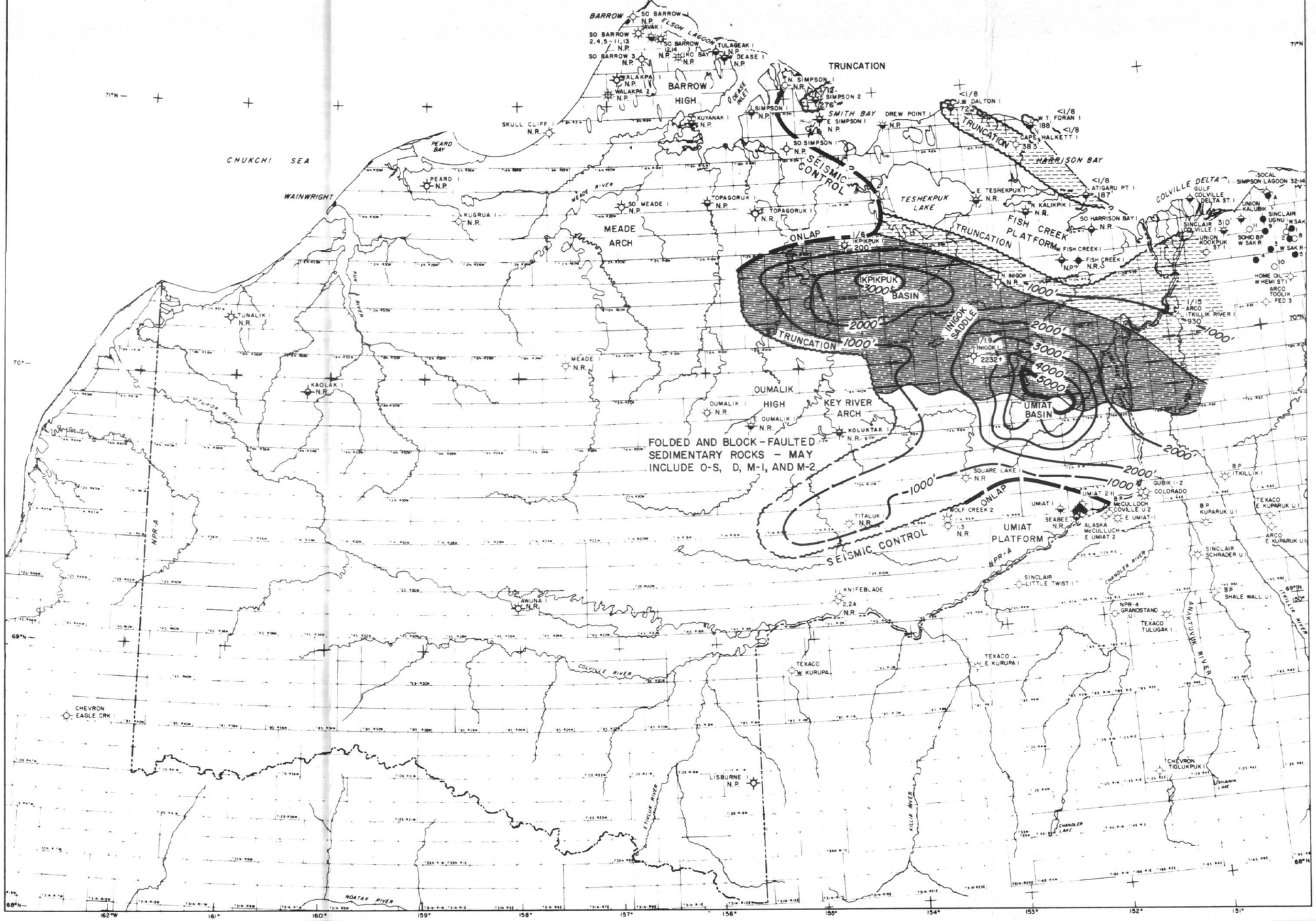
*n.d., not determined

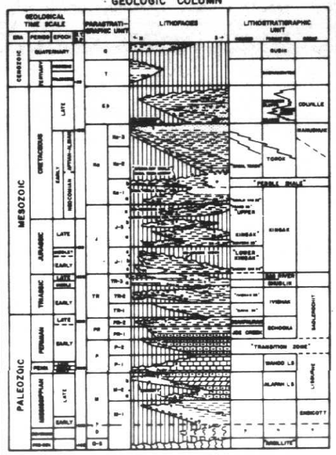
The M-1 unit is defined as pre-mid-Meramecian clastics containing foraminifera of Mamet's zone 12 or older. At Inigok 1, the top of M-1 coincides with the top of the clastic Endicott Group; in the northeastern part of the NPRA, M-1 is restricted to a northwest-trending trough. Steeply to gently dipping remnants of the M-1 overlie unit O-S ("Argillite") at East Simpson 2, and questionably at J. W. Dalton 1, Cape Halkett 1, W. T. Foran 1, and Atigaru Point 1. The unit probably extends farther north, below the Beaufort Sea.

Seismic interpretation delineated the lapout of the western and southern boundaries of unit M-1 onto the Meade Arch and Umiat platform, respectively. Elsewhere, the M-1 unit is truncated and overlain unconformably by younger rocks.

The mid-Meramecian tectonic event locally metamorphosed the clastics of unit M-1 and altered it to quartzite. The M-1 unit is composed mainly of clastics, although interbedded carbonates occur near the top of the unit at Inigok 1; shales and siltstones are more common than sandstones.

Oil shows were found in unit M-1 in a 20-ft (6-m) sandstone at East Simpson 2. However, this sandstone and others like it are probably thin and not extensive. The M-1 unit is mainly composed of shales along the Arctic coast.

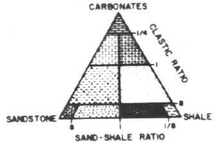




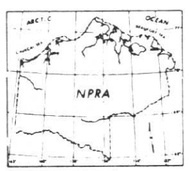
0 10 20 30 40 50
KILOMETERS
0 10 20 30
MILES

EXPLANATION

SAND-SHALE RATIO — CLASTIC RATIO (IF CALCULATED)
1/4 — 1/2, 1/4
ALASKA 1
25' THICKNESS (ISOPACH)
N.R. NOT REACHED
N.R. NOT PRESENT



LOCATION
ABANDONED WELL
ABANDONED WELL (GAS SHOW)
ABANDONED WELL (OIL SHOW)
GAS WELL
OIL WELL
ABANDONED OIL WELL



INDEX MAP

TETRA TECH, INC
HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

ISOPACH & LITHOFACIES MAP
M-1

NPR — ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC

PROJECT MANAGER: J.W. BRUYNZEEL	PROJECT NO. TC-7174
INTERPRETATION BY: E.C. GULDENZOPF	REVISED DATE / INITIAL
DATE: AUGUST 1980 DATUM:	JUN 81 E.C.G.
CONTOUR INT: 1000' SCALE:	DWG NO.

TETRA TECH REPORT NO. 8200

TC2-0120 FIGURE 35

FIGURE 36

FIGURE 36

ISOPACH AND LITHOFACIES MAP, M-2

Wells	Thickness Feet	Thickness Meters	Sand-Shale Ratio	Clastic Ratio
Atigaru Point 1	531	162	1/3.3	1/3.9
Cape Halkett 1	165	50	1/3.5	1/2.1
West Fish Creek 1	309+	94+	1/2.3(?)	1/5.2
Ikpikpuk 1	1,632	497	<1/8	1/7.2
Inigok 1	2,152	656	1/8	1/7
Lisburne 1	1,198(?)	365	n.d.*	n.d.
East Teshekpuk 1	275	84+	1/3(?)	1/3(?)
Sinclair Colville 1	398(?)	121	n.d.	n.d.
Arco Itkillik River 1	1,250	381	n.d.	n.d.

*n.d., not determined

The M-2 parastratigraphic unit coincides with the Alapah Limestone of the Lisburne Group at Inigok 1. Inigok 1 is used as the "type" well for the Lisburne in the NPRA because the thickest Lisburne section drilled was at Inigok 1.

Unit M-2 thins toward the north. Typically, it is less than 500 ft (152 m) thick over the Fish Creek Platform and laps out gradually near the present Arctic coastline. Seismic and well data show that this unit is not present in wells on the Simpson Peninsula.

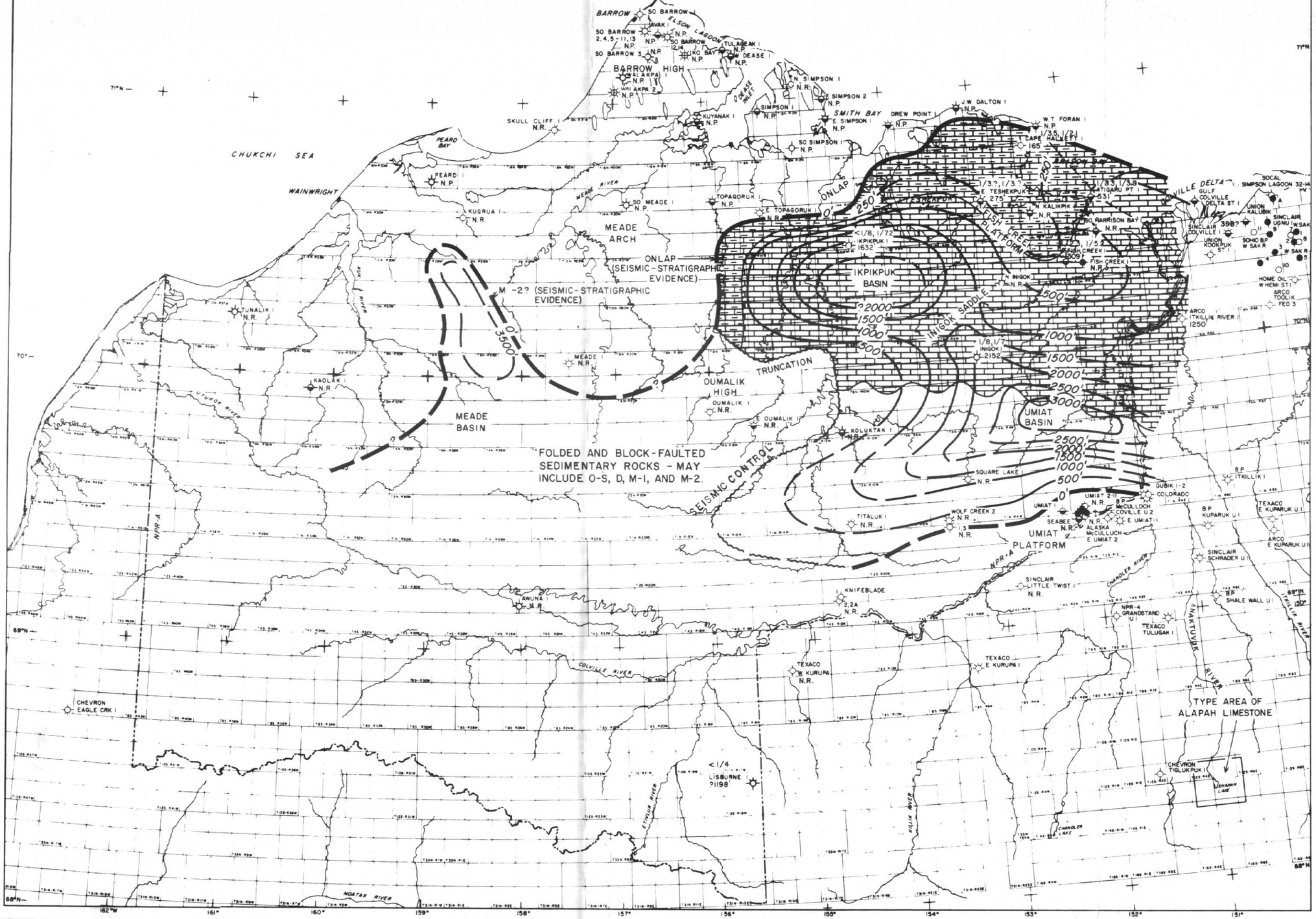
The depositional trend of M-2 in the coastal area departs markedly from that of M-1 (fig. 35). This probably indicates that the Barrow High and the Fish Creek Platform were uplifted at some time late in the deposition of M-1 to early in the deposition of M-2.

Based on seismic stratigraphy, M-2 laps out against the Oumalik High. The unit thickens southward and may thin and lap out in the Umiat area. However, the seismic record quality in this area is poor, and there is no well control to support this conclusion.

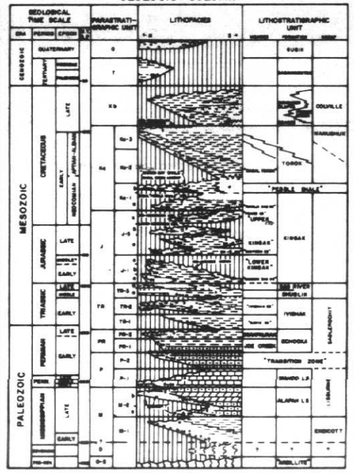
At Lisburne 1, fossils indicate that the Lisburne Group is of late Meramecian to Chesterian age. Thus, these rocks are assigned to unit M-2. The Lisburne is repeated in five plates in Lisburne 1. Its original thickness in this area is not known; the thickness of 1,198 ft (365 m) shown on the map is from plate 1, which probably was deposited 100 mi (160 km) farther to the south.

In the northwestern NPRA, Mississippian rocks were not observed. Tunalik 1 and Kugrua 1 penetrated Pennsylvanian Lisburne carbonates, so the presence of unit M-2 at these locations is questionable. Seismic-stratigraphic interpretation shows that unit M-2 is present in the deeper part of the Meade Basin.

At Ikpikpuk, Inigok 1, and West Fish Creek 1, unit M-2 mainly consists of limestones and dolomites with shale partings. The noncarbonate to carbonate ratio increases with minor amounts of siltstone and sandstone patches at Cape Halkett 1, Atigaru Point 1, and East Teshekpuk 1.



GEOLOGIC COLUMN

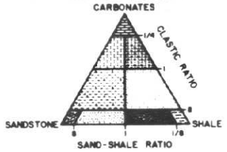


0 10 20 30 40 50 KILOMETERS
0 10 20 30 MILES

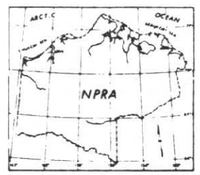
EXPLANATION

SAND-SHALE RATIO — CLASTIC RATIO (IF CALCULATED)
1/2, 1/4
ALASKA 1
251' THICKNESS (ISOPACH)
N.R. NOT REACHED
N.P. NOT PRESENT

CARBONATES



- LOCATION
- ABANDONED WELL
- ABANDONED WELL (GAS SHOW)
- ABANDONED WELL (OIL SHOW)
- GAS WELL
- OIL WELL
- ABANDONED OIL WELL



INDEX MAP

TETRA TECH, INC
HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

ISOPACH & LITHOFACIES MAP M-2

NPR — ALASKA

FOR ONPRA
HUSKY OIL NPR OPERATIONS INC

PROJECT MANAGER: J.W. BRUYNZEEL	PROJECT NO. TC-7174
INTERPRETATION BY: E.C. GULDENZOPF	REVISED: DATE / INITIAL
DATE: 1980 DATUM:	SEPT 81 / E.C.G.
CONTOUR INT.: 250', 500' SCALE:	DWG NO.

TETRA TECH REPORT NO. 8200

TG7-0120

FIGURE 36

FIGURE 37

CORRELATION CROSS SECTION G-G', W. T. FORAN 1 TO ARCO ITKILLIK RIVER 1

Cross section G-G' includes W. T. Foran 1, Cape Halkett 1, Atigaru Point 1, South Harrison Bay 1, West Fish Creek 1, and Arco Itkillik River 1. Datum is sea level. The main geologic features shown are:

1. Unit M-1 (Endicott Group) overlies unit O-S ("Argillite") at W. T. Foran 1, Cape Halkett 1, Atigaru Point 1, and Arco Itkillik River 1. In W. T. Foran 1 and Cape Halkett 1, 18° to 35° dips were recorded in M-1, suggesting Late Mississippian tectonics.

2. Unit M-2b (Alapah Limestone) is overlapped and truncated by P-1 (Wahoo Limestone) toward the north.

3. Unit PR-2 (Ikiakpaurak Member of the Echooka Formation) laps out against the Barrow Arch between Atigaru Point 1 and Cape Halkett 1.

4. TR-2 ("Ivishak sandstone" member of the Ivishak Formation) probably is truncated by the basal "Pebble Shale" unconformity a few miles north of W. T. Foran 1, below the Beaufort Sea. Between Cape Halkett 1 and W. T. Foran 1, the unconformity truncates TR-3b (Sag River Sandstone). The Sag River grades into shale to the southeast between West Fish Creek 1 and Arco Itkillik River 1.

5. J-1 ("Lower Kingak") thins and is truncated by the mid-Jurassic unconformity toward the south.

6. Progressively older strata are truncated to the north by Early Cretaceous rocks. At Arco Itkillik River 1, Ka-1b ("Pebble Shale") unconformably overlies the J-3c (Berriasian-Valanginian) part of the "Upper Kingak." The Torok fondothem (bottomset) beds, within the time-transgressive Ka-3 (Torok-Nanushuk) unit, unconformably overlie J-3c at West Fish Creek 1 and the J-3b (Oxfordian-Kimmeridgian) part of the "Upper Kingak" at South Harrison Bay 1. Unit Ka-1b unconformably overlies the J-3a (Oxfordian) part of the "Upper Kingak" at Atigaru Point 1, unit J-1 at Cape Halkett 1, and unit TR-3a (Shublik) at W. T. Foran 1.

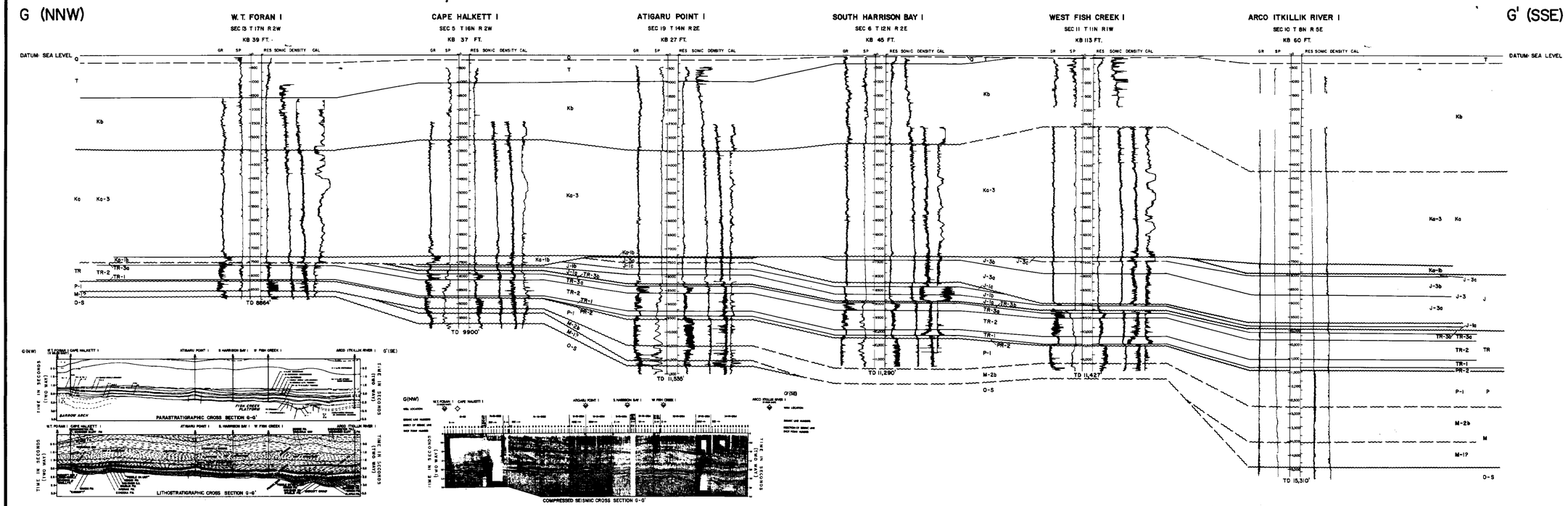
7. Ka-1b is absent over the Fish Creek Platform at South Harrison Bay 1 and West Fish Creek 1, because either the Fish Creek Platform was a positive area where the "Pebble Shale" was never deposited, or the "Pebble Shale" was eroded subsequent to its deposition. Apparent channels through the "Pebble Shale" are evident on compressed seismic sections across the Fish Creek Platform.

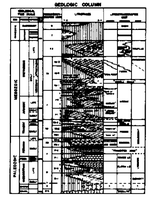
8. The time-transgressive Ka-3 unit unconformably overlies Ka-1b at W. T. Foran 1, Cape Halkett 1, Atigaru Point 1, and Arco Itkillik River 1. At South Harrison Bay 1 and West Fish Creek 1, unit Ka-3 unconformably overlies unit J-3.

9. Unit Kb (Colville Group) unconformably overlies the marine Nanushuk strata within Ka-3.

10. Tertiary (unit T) rocks overlie the Kb unit and underlie the Quaternary (unit Q) surface deposits in all wells except West Fish Creek 1 where Kb is below the Quaternary surface materials.

FIGURE 37





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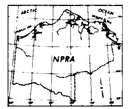


TETRA TECH, INC
ENERGY MANAGEMENT DIVISION

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

CORRELATION CROSS SECTION G-G'
W.T. FORAN I-ARCO ITKILLIK RIVER I

NPR — ALASKA

FOR
ONPRA
NUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J. W. SPUNTZEL — PROJECT NO. TC-7174

INTERPRETATIONS BY: V. NOPMAN, S. HANNA — DRAWN: — CHECKED: — APPR: — REVISED:

DATE: JUNE, 1981 — DATUM: SEA LEVEL

CONTOUR INT: — SCALE: — DWG NO.

TGZ-0170 FIGURE 37

FIGURE 38

LITHOSTRATIGRAPHIC CROSS SECTION G-G', W. T. FORAN 1 TO ARCO ITKILLIK RIVER 1

Features of interest, from the bottom upward and from northwest (left) to southeast (right), are:

1. The "Acoustic basement" in cross section G-G' is probably composed of "Argillite." "Argillite" was identified at the bottom of W. T. Foran 1, Cape Halkett 1, Atigaru Point 1, and Arco Itkillik River 1.

2. The Endicott Group overlies the basement at W. T. Foran 1, Cape Halkett 1, Atigaru Point 1, and Arco Itkillik River 1. The Endicott is probably a time-transgressive clastic magnafacies to the northwest.

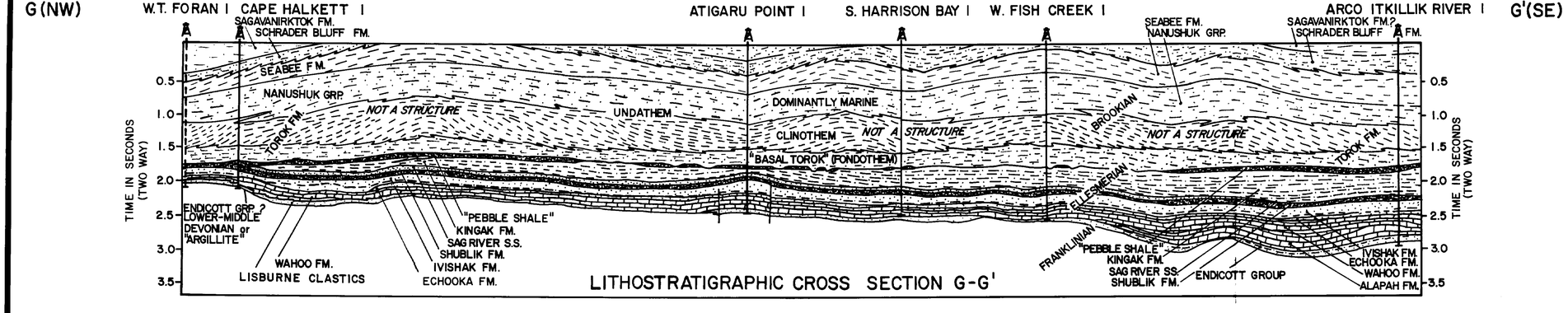
3. The Sag River Sandstone is truncated by the "Pebble Shale" at Cape Halkett 1 and grades into shale between West Fish Creek 1 and Arco Itkillik River 1.

4. The Kingak Formation in this area is composed of siltstone and shale. No significant sandstone bodies were found in any of the wells in this section.

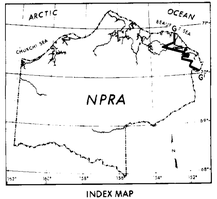
5. The "Pebble Shale," a distinctive seismic marker across the NPRA, is absent in the middle of cross section G-G', presumably removed by erosion. On the northwest (left) side of the section, the "Pebble Shale" truncates the Shublik and Ivishak Formations.

6. The Torok-Nanushuk sequence progrades toward the northeast. The Torok fondothem ("basal Torok"), clinothem, and undathem, and the Nanushuk marine beds succeed one another vertically. The Nanushuk nonmarine formations are absent in this section.

7. The Nanushuk marine Grandstand Formation is overlain by the Seabee Formation of the Colville Group, and the Seabee is succeeded by the Schrader Bluff Formation of the Colville Group. The Tertiary Sagavanirktok Formation overlies the Colville at W. T. Foran 1 and Cape Halkett 1, and is questionably present at Arco Itkillik River 1.



LITHOSTRATIGRAPHIC CROSS SECTION G-G'



INDEX MAP

TETRA TECH, INC.
HOUSTON, TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA, CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

LITHOSTRATIGRAPHIC, CROSS SECTION G-G'
W.T. FORAN I - ARCO ITKILLIK RIVER I

NPR — ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J.W. BRUYNZEEL		PROJECT NO. TC-7174	
INTERPRETATION BY: C. GULDENZOPF		REVISED DATE	INITIAL
DATE: JUNE, 1981	DATUM: SEA LEVEL		
CONTOUR INT:	SCALE:	DWG NO.	

TETRA TECH REPORT NO. 8200 — FIGURE 38

TG2-0170

FIGURE 39

PARASTRATIGRAPHIC CROSS SECTION G-G',
W. T. FORAN 1 TO ARCO ITKILLIK RIVER 1

Features of interest from the bottom upward and from the northwest (left) to the southeast (right), are:

1. Few obvious structures can be seen below horizon 1500 ("Acoustic basement").

2. Unit M-1 overlies "Acoustic basement" at Arco Itkillik River 1, and laps out against the Fish Creek Platform to the northwest. M-1 may be present at W. T. Foran 1 and Cape Halkett 1; clastic rocks dipping 15° to 30° near the bottom of both wells may be erosional remnants of Mississippian rocks.

3. Unit M-2 laps out or is very thin on the crest of the Fish Creek Platform. P-1 truncates M-2 and overlies the Fish Creek Platform.

4. Horizon 1100 is near the top of unit P-1 at W. T. Foran 1 and Cape Halkett 1. To the southeast, horizon 1100 is near the top of unit PR, which is truncated by unit TR-1.

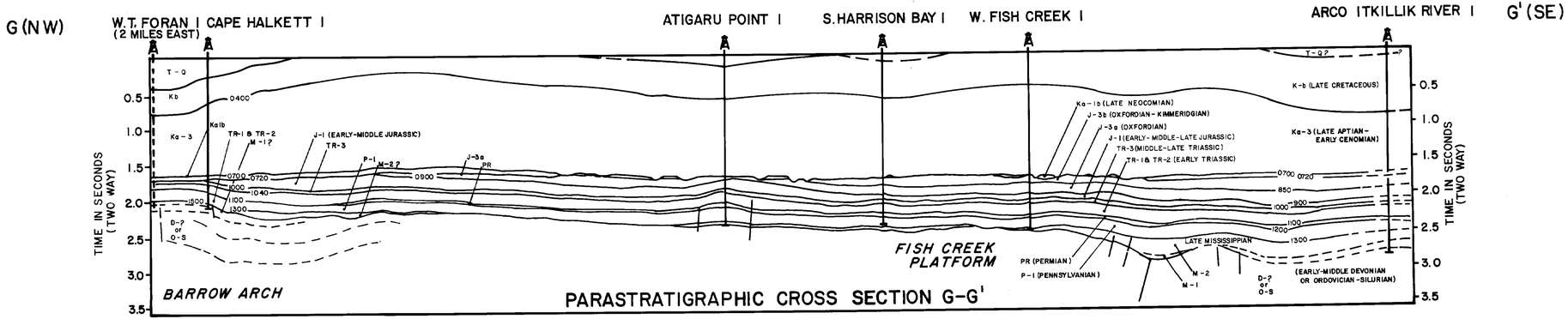
5. Horizons 1000 and 1040 are near the top and bottom, respectively, of unit TR-3. These seismic horizons form a reflector couplet that is traceable across the section.

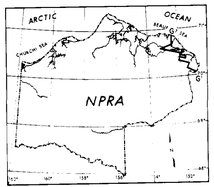
6. Units J-1 and J-3 thin because of truncation by overlying Cretaceous units from the southeast toward the northwest. Horizon 0850 (late Oxfordian) is truncated by horizon 0700 between Atigaru Point 1 and South Harrison Bay 1. Horizon 0900 (mid-Jurassic unconformity) is truncated by horizon 0720 to the southeast of Cape Halkett 1. At W. T. Foran 1, Ka-1b directly overlies TR-3.

7. Horizons 0700 and 0720 form a reflector couplet near the top and bottom, respectively, of unit Ka-1b. Ka-1b and overlying Cretaceous units truncate progressively older rocks toward the northwest. In the middle part of the section, Ka-1b is absent, perhaps because of erosion.

8. Unit Ka-3 (probably late Aptian-early Cenomanian) directly overlies Ka-1b or older rocks. Unit Ka-2, which downlaps on Ka-1b to the southwest, is absent in cross section G-G'.

9. Horizon 0400 (mid-Cenomanian unconformity) is near the boundary between units Ka-3 and Kb. Units T and Q are thickest at W. T. Foran 1 and Cape Halkett 1, and questionably present at Arco Itkillik River 1.





INDEX MAP

TETRA TECH, INC.
HOUSTON, TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA, CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

PARASTRATIGRAPHIC CROSS SECTION G-G'

W.T. FORAN I - ARCO ITKILLIK RIVER I

NPR — ALASKA

FOR

ONPRA

HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J.W. BRUYNZEEL		PROJECT NO. TC-7174
INTERPRETATION BY: C. GULDENZOPF		REVISED: DATE / INITIAL
DATE: JUNE, 1981	DATUM: SEA LEVEL	
CONTOUR INT:	SCALE:	DWG NO.

TETRA TECH REPORT NO. 8200 — FIGURE 39

TG7-0170

FIGURE 40

COMPRESSED SEISMIC CROSS SECTION G-G', W. T. FORAN 1 TO ARCO ITKILLIK RIVER 1

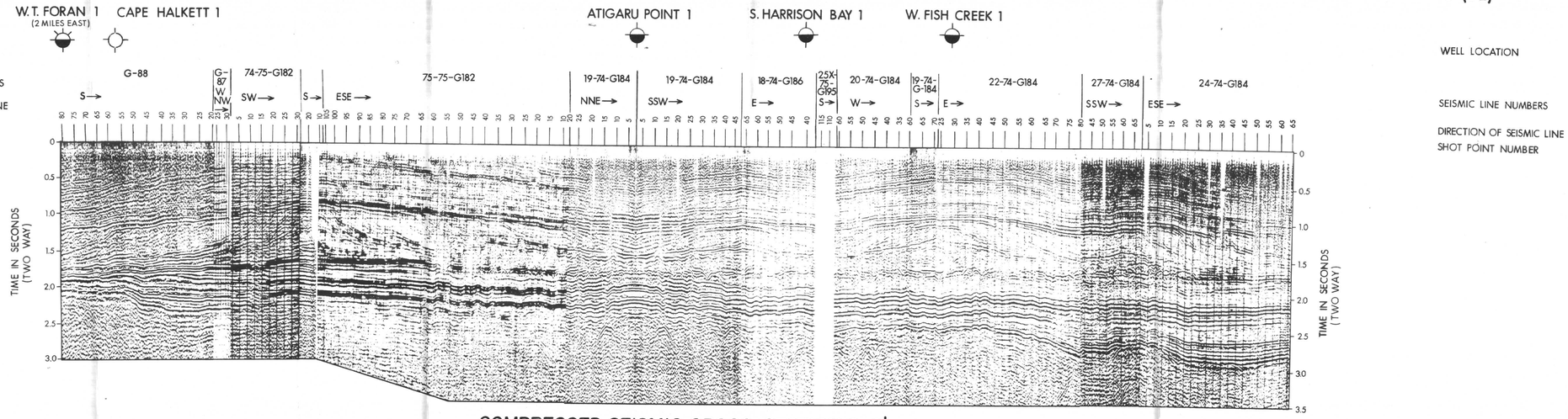
Compressed seismic cross section G-G' connects several of the wells in the northeastern part of the NPRA in the Harrison Bay area. The wells and years they were drilled include W. T. Foran 1, 1977; Cape Halkett 1, 1975; Atigaru Point 1, 1977; South Harrison Bay 1, 1976; and West Fish Creek 1, 1977. Cross section G-G' runs northwest to southeast, starting about 2 mi west of W. T. Foran 1 and ending on the Colville River about 3 mi west of Arco Itkillik River 1. (Segments G-88 through 18-74 of compressed seismic cross section G-G' are repeated in figure 32 on compressed seismic cross section A-A'.) The most direct route between Cape Halkett 1 and Atigaru Point 1 is over Harrison Bay; however, because the mud- or air-gun seismic data obtained in 1970-72 are unsuitable for this compressed seismic section, the section detours around Harrison Bay passing East Teshekpuk 1 at shotpoint 105 and North Kalikpik 1 at shotpoint 50 on line 75-75. Neither of these wells is shown on the section. The route from South Harrison Bay 1 to West Fish Creek 1 is by switchback, or reversal, of direction at line 20-74. Features of interest are:

1. Because of the circuitous nature of this section, a number of dip reversals occur at seismic line intersections 7-74 and 75-75, 19-74 and 18-74, 18-74 and 25X-75, 19-74 and 22-74, 22-74 and 27-74, and 27-74 and 24-74. In addition, line 19-74 is reversed and partly repeated at Atigaru Point 1. Shown between 0.5 and 2.0 seconds at these intersections are a series of "pseudostructures," or northeast-dipping clinoforms, in the Torok Formation.

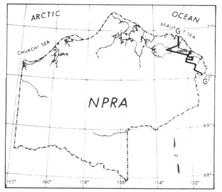
2. There is little indication of structure below "Acoustic basement." Most of the features are probably refractions from faults or multiples from higher strata.

3. A number of sharp "pull-ups" on lines 19-74, 18-74, 20-74, and 22-74 are probably velocity anomalies related to nearsurface permafrost. Seismic interpretation eliminated these irregularities on figures 38 and 39.

4. Basement tectonic elements shown are the Barrow Arch to the northwest and the Fish Creek Platform in the middle of the section.



COMPRESSED SEISMIC CROSS SECTION G-G'



INDEX MAP

TETRA TECH, INC

HOUSTON, TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA, CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

COMPRESSED SEISMIC CROSS SECTION G-G'

W.T. FORAN I - ARCO ITKILLIK RIVER I

NPR — ALASKA

FOR

ONPRA

HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J. W. BRUYNZEEL		PROJECT NO. TC-7174	
INTERPRETATION BY: C. GULDENZOPF, K. CLARY		REVISED DATE	INITIAL
DATE: JUNE, 1981	DATUM: SEA LEVEL		
CONTOUR INT:	SCALE:	DWG NO.	

TETRA TECH REPORT NO. 8200

FIGURE 40

TGZ-0170

FIGURE 41

ISOPACH AND LITHOFACIES MAP, P-1

Wells	Thickness Feet	Thickness Meters	Sand-Shale Ratio	Clastic Ratio
Atigaru Point 1	972	296	1/6	1/4
Cape Halkett 1	385	117	1/3.2	1/2.7
J. W. Dalton 1	879	268	1.2	1.3
West Fish Creek 1	622	190	1/2.1	1/4.2
W. T. Foran 1	377	115	1/8.8	1/2.1
South Harrison Bay 1	1,058	322	<1/8	1/4.4
Ikpikpuk 1	1,667	508	<1/8	1/3.7
Inigok 1	1,507	459	<1/8	1/5.6
Kugrua 1	1,053+	321	1/6	1/4.5
East Teshekpuk 1	740	226	1/8	1/4.3
Tunalik 1	1,240+	378+	1/8	1/4.4
Sinclair Colville 1	32	10	n.d.*	n.d.
Arco Itkillik River 1	1,295	395	n.d.	n.d.

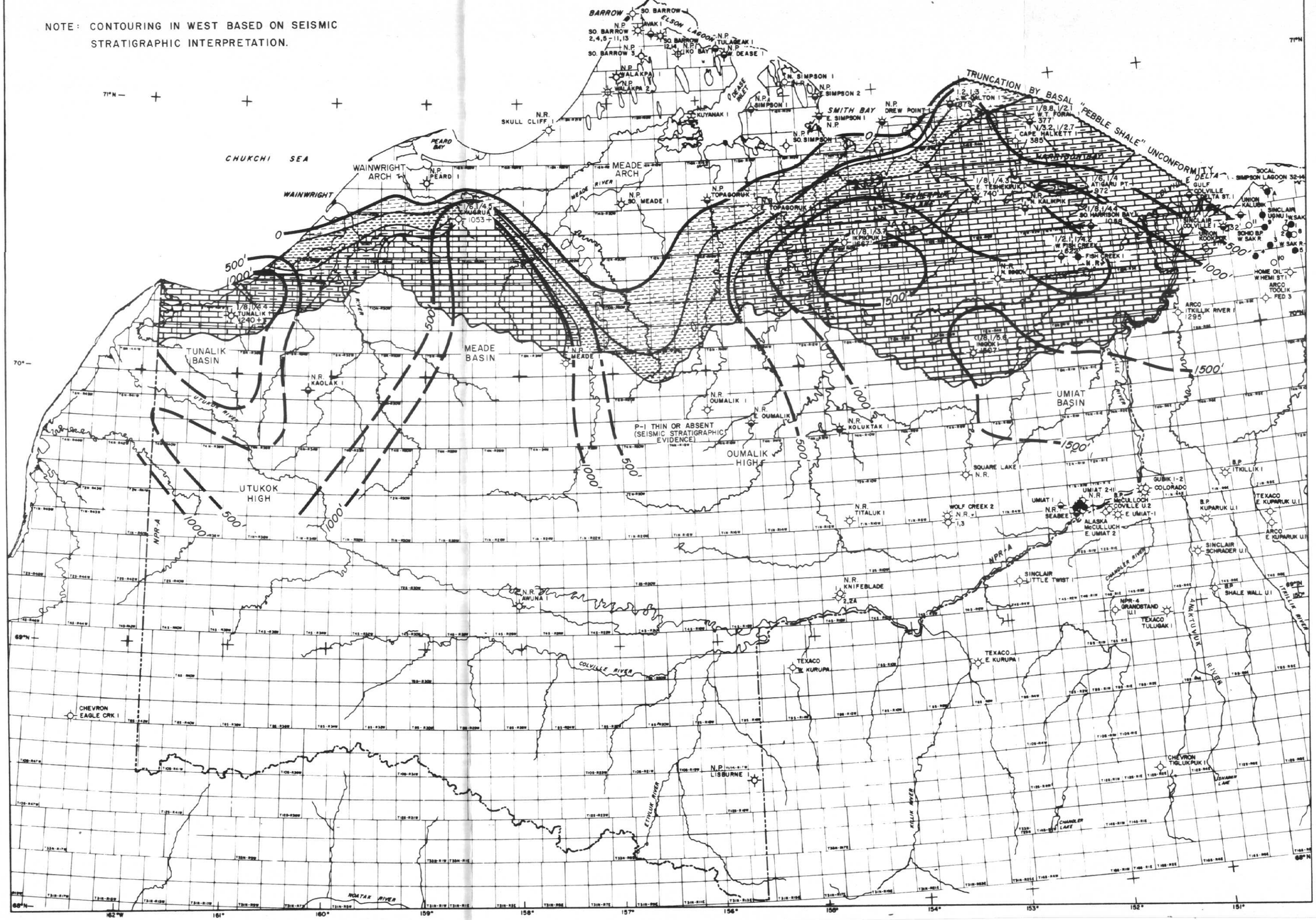
*n.d., not determined.

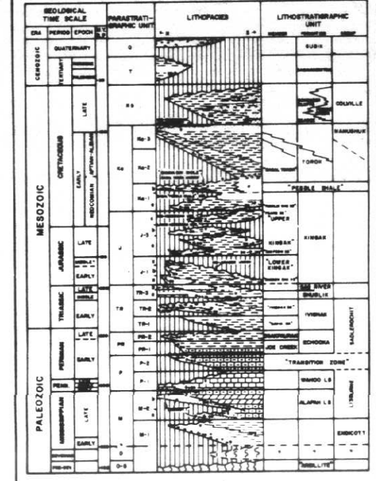
The tectonic elements shown are the Tunalik Basin, Wainwright Arch, Meade Basin, Meade Arch, Oumalik High, and Utukok High.

In the northeastern part of the NPRA, unit P-1 is nearly synonymous with the Wahoo Limestone. P-1 comprises massive Pennsylvanian carbonates containing Mamet's foraminiferal zones 20 through 24.

The P-1 unit is thickest in the vicinity of Ikpikpuk 1 in the Ikpikpuk Basin. It gradually thins to the northwest and laps out toward the Barrow High. East of the Meade Arch, P-1 is overlapped by the TR-1 interval. The unit is truncated beneath the Beaufort Sea by the basal "Pebble Shale" unconformity, and thins toward the south in the direction of the Umiat Platform. Correlation of equivalent foraminiferal zones and seismic stratigraphy show that, west of the Meade Arch-Oumalik High trend, P-1 thickens considerably in local basins, and thins or laps out completely over local highs. The laterally correlative Pennsylvanian carbonates penetrated in both Kugrua 1 and Tunalik 1 probably are not present in the southern part of the Reserve. The P-1 unit becomes coarser as it onlaps the arches to the north. The unit contains sandy basal clastics at J. W. Dalton 1. These clastics are projected to the western side of the Meade Arch.

NOTE: CONTOURING IN WEST BASED ON SEISMIC STRATIGRAPHIC INTERPRETATION.





0 10 20 30 40 50
KILOMETERS
0 10 20 30
MILES

EXPLANATION

SAND-SHALE RATIO — CLASTIC RATIO (IF CALCULATED)

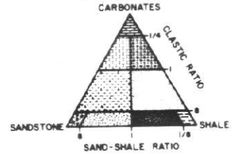
1/2, 1/4

ALASKA I

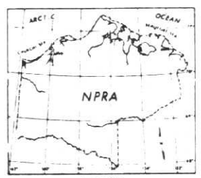
25' THICKNESS (ISOPACH)

N.R. NOT REACHED

N.P. NOT PRESENT



- LOCATION
- ABANDONED WELL
- ABANDONED WELL (GAS SHOW)
- ABANDONED WELL (OIL SHOW)
- GAS WELL
- OIL WELL
- ABANDONED OIL WELL



INDEX MAP

TETRA TECH, INC
HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

ISOPACH & LITHOFACIES MAP
P-1

NPR — ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J. W. BRUYNZEEL		PROJECT NO. T.C 7174
INTERPRETATION BY: E.C. GULDENZOPF		REVISED: DATE / INITIAL
DATE: AUG 1980	DATUM:	AUG 81 / V.E.B.
CONTOUR INT: 500'	SCALE:	DWG NO.

TETRA TECH REPORT NO. 8200

TGC0170

FIGURE 41

FIGURE 42

ISOPACH AND LITHOFACIES MAP, P-2

Wells	Thickness		Sand-Shale Ratio	Clastic Ratio
	Feet	Meters		
Ikpikpuk 1	212	65	1/8	1/1.7
Inigok 1	185	56	1/8	1/3.2
Kugrua 1	357	109	1/8	1/2.9
Tunalik 1	1,997*	486	1/8	1/2.8
Arco Itkillik River 1	(?)	-	-	-

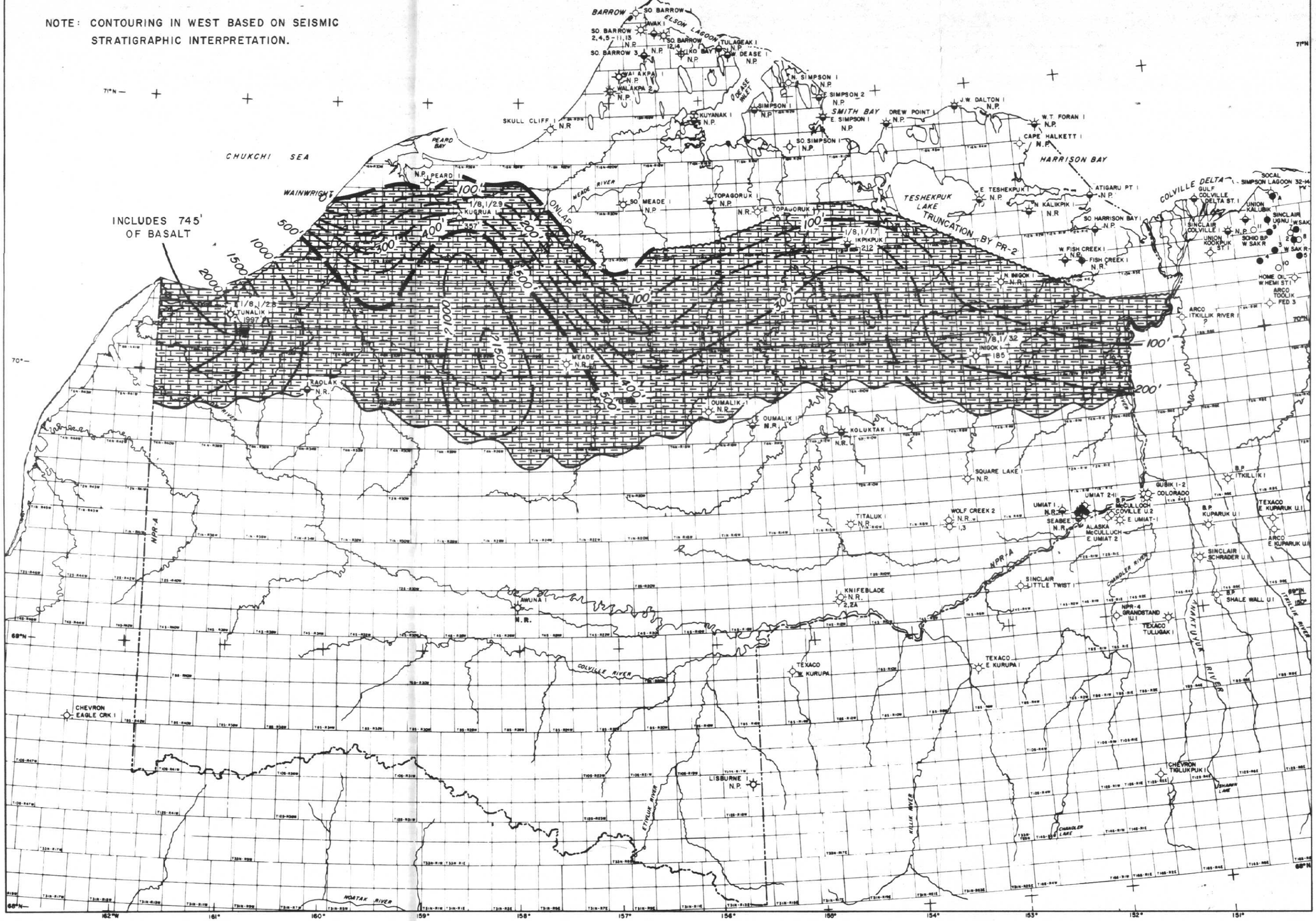
*Includes 745 ft (227 m) of interbedded basalt.

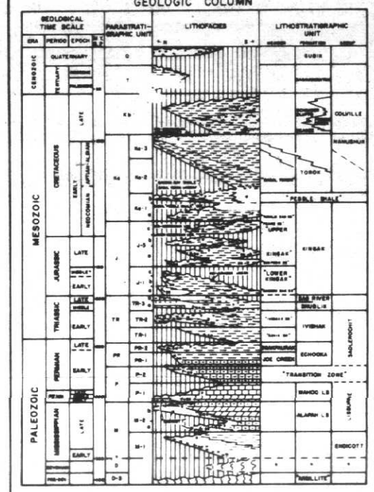
The P-2 parastratigraphic unit mostly coincides with the "Transition Zone" between the Wahoo Limestone and the Joe Creek Member of the Echooka Formation.

The northern boundary of P-2 runs roughly east-west. West of the Meade Arch, and farther to the north, the unit unconformably overlaps the P-1 unit. East of the Meade Arch, P-2 is truncated by the PR-2 unit in the north. Unit P-2 is thickest in the Ikpikpuk Basin, and wedges out to the northeast.

At Tunalik 1, unit P-2 is 1,997 ft (609 m) thick and includes 745 ft (227 m) of interbedded basalt. In the Meade Basin, seismic-stratigraphic interpretation indicates P-2 is fairly thick. Relatively thin P-2 sediments are present over the positive tectonic elements in the northwestern NPRA.

NOTE: CONTOURING IN WEST BASED ON SEISMIC STRATIGRAPHIC INTERPRETATION.





0 10 20 30 40 50 KILOMETERS

0 10 20 30 MILES

EXPLANATION

SAND-SHALE RATIO — CLASTIC RATIO (IF CALCULATED)

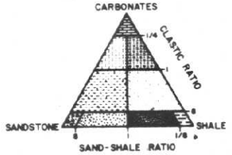
1/2 , 1/4

ALASKA 1 — 25' THICKNESS (ISOPACH)

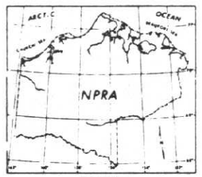
N.R. NOT REACHED

N.P. NOT PRESENT

CARBONATES



- LOCATION
- ABANDONED WELL
- ABANDONED WELL (GAS SHOW)
- ABANDONED WELL (OIL SHOW)
- GAS WELL
- OIL WELL
- ABANDONED OIL WELL



INDEX MAP

TETRA TECH, INC

HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA, CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

ISOPACH & LITHOFACIES MAP P-2

NPR — ALASKA

FOR ONPRA

HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J.W. BRUYNZEEL	PROJECT NO. TC-7174
INTERPRETATION BY: E.C. GULDENZOPF	REVISED: DATE / INITIAL
DATE: AUG 1980 DATUM:	AUG 1981 / V.F.R.
CONTOUR INT: 100, 500' SCALE:	DWG NO.

TETRA TECH REPORT NO. 8200

FIGURE 42

TG2-0170

FIGURE 43

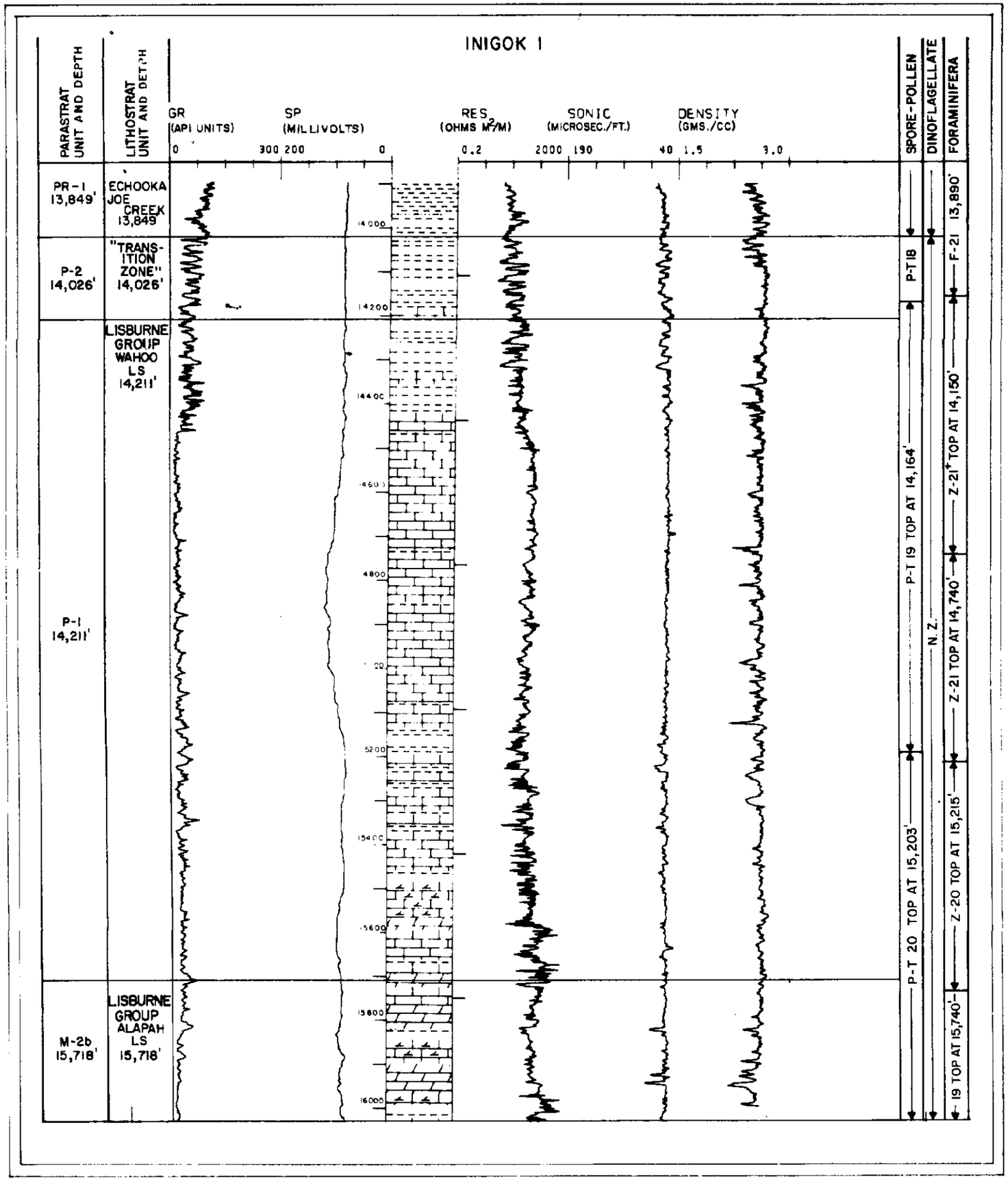
FIGURE 43

TYPE LOG OF P-1 PARASTRATIGRAPHIC UNIT, INIGOK 1

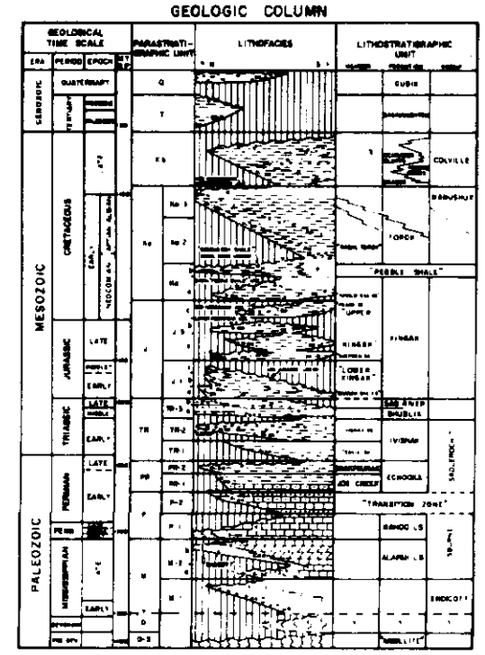
At Inigok 1, the top of the P-1 unit is at 14,211 ft (4,332 m). On electrical logs, the unit is characterized mainly by funnel-shaped cyclical segments with a period of 30 to 100 ft (9 to 30 m). The gamma-ray curve indicates relatively fewer, thinner shale breaks in the P-1 unit than in underlying units. The P-2 unit consists mainly of funnel-shaped cyclical segments with a period of 20 to 40 ft (6 to 12 m).

In most wells, the lower two-thirds of P-1 consists of massive carbonates with relatively few shale breaks; on logs, the gamma-ray and sonic curves are relatively straight. The lithologic boundary between the more massive carbonates and the interbedded carbonates and shales occurs at different levels in different wells.

In the various NPRA wells, the boundary between Mamet's 20-21 or 22-24 (21+) foraminiferal zones and all younger foraminiferal assemblages is picked as the top of the P-1 unit.



GEOLOGIC COLUMN



TETRA TECH, INC

HOUSTON, TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA, CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

TYPE LOG OF
P-1 PARASTRATIGRAPHIC UNIT
INIGOK 1

NPR — ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J.W. BRUYNZEEL		PROJECT NO. TC-7174
INTERPRETATION BY: STAFF		REVISED: DATE / INITIAL
DATE: SEPT., 1981	DATUM:	
CONTOUR INT:	SCALE:	DWG NO.

TETRA TECH REPORT NO. 8200

TGZ-0170

FIGURE 43

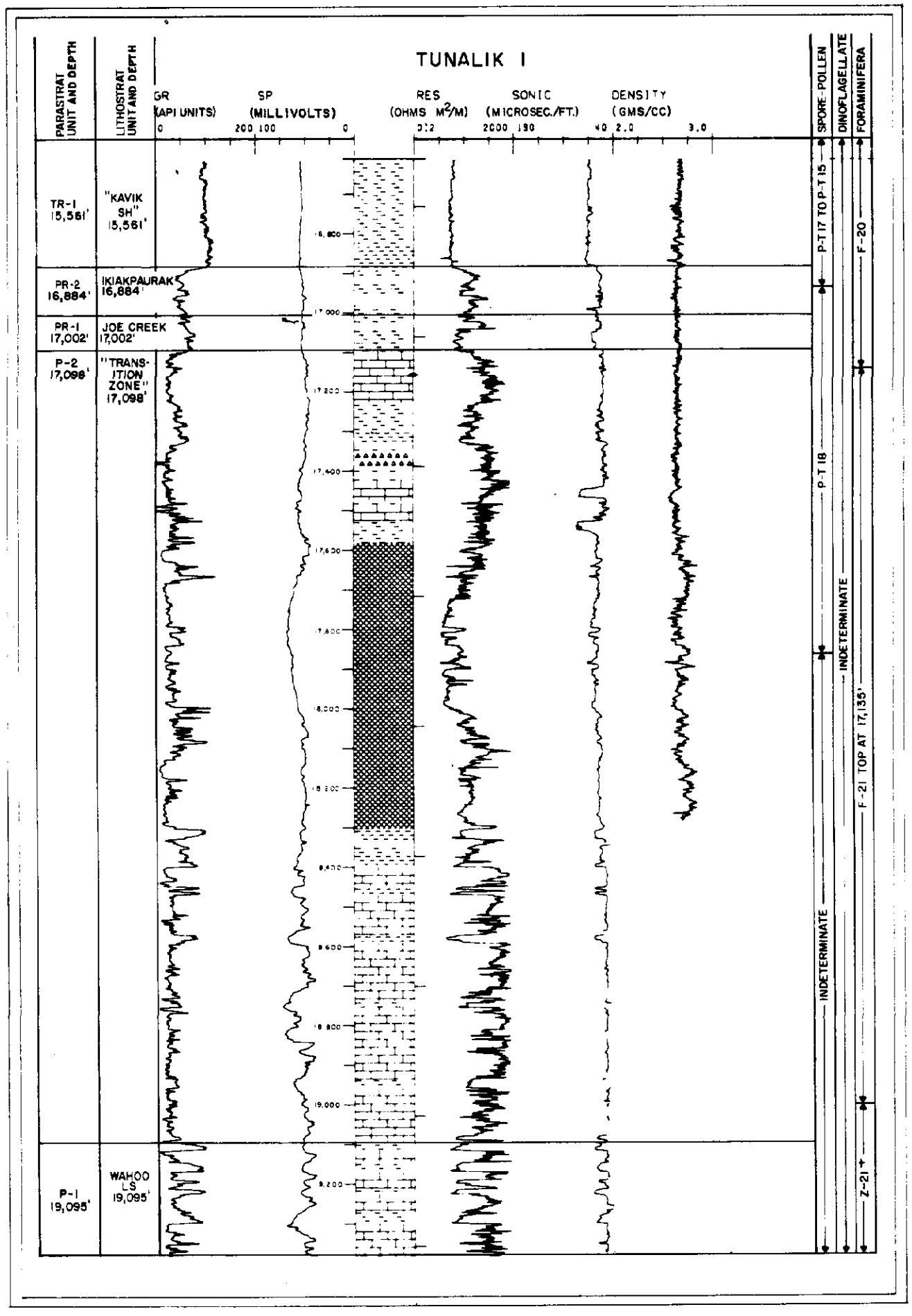
FIGURE 44

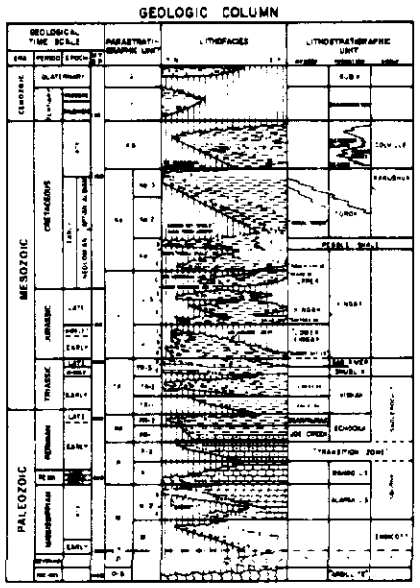
TYPE LOG OF P-2, PR-1, AND PR-2 PARASTRATIGRAPHIC UNITS, TUNALIK 1

FIGURE 44

At Tunalik 1, the P-2 unit is 1,997 ft (609 m) thick. The top of the unit is at 17,098 ft (5,211 m) and the base is at 19,095 ft (5,820 m). This is the thickest occurrence of the unit that was drilled in the NPRA; hence, Tunalik 1 is the "type" well for definition of unit P-2. A 745-ft (227-m) basalt layer is contained in P-2 at Tunalik 1; core and cuttings descriptions define this layer as a volcanic flow.

The PR unit is recognizable from pronounced log deflections at the base of the relatively featureless TR-1 unit. PR is subdivided into a lower calcareous, fine clastic unit designated PR-1 and an upper coarse clastic unit designated PR-2. The lower unit appears shaly on the electric logs with several pronounced carbonate "spikes" near the base of the unit. The upper unit is characterized by pronounced deflections on all curves. PR is 300 to 400 ft (91 to 122 m) thick in most places.





TETRA TECH, INC
HOUSTON, TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA, CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974–1981 (FINAL REPORT)

TYPE LOG OF P-2, PR-1 AND PR-2 PARASTRATIGRAPHIC UNITS TUNALIK I

NPR — ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J. W. BRUYNZEEL		PROJECT NO. TC-7 74
INTERPRETATION BY: STAFF		REVISED: DATE / INITIAL
DATE: SEPT., 1981	DATUM:	
CONTOUR INT:	SCALE:	DWG NO.

TETRA TECH REPORT NO. 8200

FIGURE 44

TGZ-0170

FIGURE 45

ISOPACH AND LITHOFACIES MAP, PR-1

Well	Thickness		Sand-Shale Ratio
	Feet	Meters	
Ikpikpuk 1	77	23	<1/8
Inigok 1	177	61	<1/8
Tunalik 1	96	29	<1/8
Topagoruk	201	62	<1/8
Sinclair Colville 1	47	14	n.d.*

*n.d., not determined.

The PR-1 unit coincides with the Joe Creek Member of the Echooka Formation and consists mainly of shale and siltstone with some interbedded limestone near the base. A relatively thin unit, PR-1 overlies the shaly P-2 and underlies the coarser clastics of the PR-2 unit.

The PR-1 unit onlaps the underlying P-2 interval toward the north. Unit PR-2 extends farther to the north than PR-1 before terminating by onlap onto the Barrow High.

NOTE: CONTOURING IN WEST BASED ON SEISMIC STRATIGRAPHIC INTERPRETATION.

CHUKCHI SEA

WAINWRIGHT

BARROW

ELSON LAGOON

PEARD BAY

MEADE RIVER

ONLAP ONTO BARROW HIGH (PROJECTED)

TESHEKPUK LAKE

HARRISON BAY

COLVILLE DELTA

SMITH BAY

DEASE INLET

COLVILLE RIVER

KUPARUK RIVER

ITKILLIK RIVER

ETIVLUK RIVER

KILLIK RIVER

CHANDLER RIVER

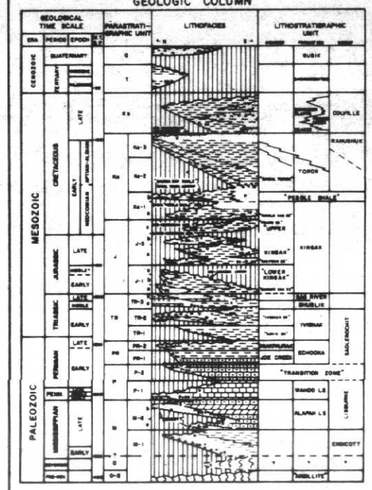
NPR-A

NOATAK RIVER

0' 50' 100' 150' 200' 250'

N.P. SO BARROW 2,4,5-11,13 | N.P. SO BARROW 12,14 | N.P. SO BARROW 3 | N.P. AVAK I | N.P. CIKO BAY | N.P. TULAGEAK I | N.P. W DEASE I | N.P. WALAKPA I | N.P. WALAKPA 2 | N.P. N. SIMPSON I | N.P. E SIMPSON 2 | N.P. SIMPSON I | N.P. E SIMPSON I | N.P. SO SIMPSON I | N.P. KUYANAK I | N.P. DREW POINT | N.P. J.W DALTON I | N.P. W.T FORAN I | N.P. CAPE HALKETT I | SKULL CLIFF I N.R. | N.P. PEARD I | N.P. KUGRUA I | N.P. SO MEADE I | K1/8 TOPAGORUK 201 | E TOPAGORUK I N.R. | K1/8 IKPIKPUK I | N.P. E TESHEKPUK I | N.R. N KALIKPIK I | N.P. ATIGARU PT I | N.P. SO HARRISON BAY | SOCAL SIMPSON LAGOON 32-14 | GULF COLVILLE DELTA ST I | UNION KALUBIK | SINCLAIR COLVILLE | SINCLAIR UGNU I | W SAK | UNION KOOKPUK | SOHIO BP W SAK R | W SAK R | N.P. W FISH CREEK I | FISH CREEK I N.R. | N.P. N INIGOK | HOME OIL W HEMI ST I | ARCO TOOLIK FED 3 | N.P. ARCO ITKILLIK RIVER I | K1/8 TUNALIK I 96 | N.R. KAOLAK I | MEADE I N.R. | OUMALIK I N.R. | E OUMALIK I N.R. | KOLUKTAK I N.R. | K1/8 INIGOK I 73 | SQUARE LAKE I N.R. | GUBIK I-2 COLORADO | B.P. ITKILLIK I | UMIAT 2-11 | B.P. McCULLOCH COVILLE U 2 | E UMIAT-1 | UMIAT I N.R. | SEABEE N.R. | ALASKA McCULLUCH E UMIAT 2 | B.P. KUPARUK U I | TEXACO E KUPARUK U I | ARCO E KUPARUK U I | TITALUK I N.R. | WOLF CREEK 2 N.R. 1,3 | SINCLAIR SCHRADER U I | SINCLAIR LITTLE TWIST I | KNIFEBLADE N.R. 2,2A | B.P. SHALE WALL U I | NPR-4 GRANDSTAND U I | TEXACO TULUGAK I | AWUNA I N.R. | TEXACO W KURUPA | TEXACO E KURUPA I | CHEVRON EAGLE CRK I | LISBURNE N.P. | CHEVRON TIGLUKPUK I | CHANDLER LAKE | SHADHIN LAKE

GEOLOGIC COLUMN



0 10 20 30 40 50 KILOMETERS

0 10 20 30 MILES

EXPLANATION

SAND-SHALE RATIO — CLASTIC RATIO (IF CALCULATED)

1/2, 1/4

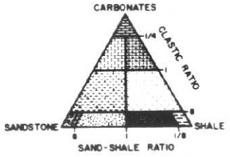
ALASKA I

251 THICKNESS (ISOPACH)

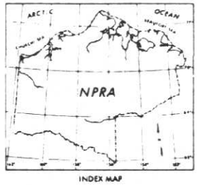
N.R. NOT REACHED

N.P. NOT PRESENT

CARBONATES



- LOCATION
- ABANDONED WELL
- ABANDONED WELL (GAS SHOW)
- ABANDONED WELL (OIL SHOW)
- GAS WELL
- OIL WELL
- ABANDONED OIL WELL



INDEX MAP

TETRA TECH, INC.
HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

ISOPACH & LITHOFACIES MAP PR-1

NPR — ALASKA

FOR ONPRA

HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J.W. BRUYNZEEL		PROJECT NO. TC 7174	
INTERPRETATION BY: E.C. GULDENZOPF		REVISED DATE	INITIAL
DATE: OCT 1978	DATUM:	AUG 1981	A.C.
CONTOUR INT: 50'	SCALE:	DWG NO.	

TETRA TECH REPORT NO. 8200

0710-38

FIGURE 45

FIGURE 46

ISOPACH AND LITHOFACIES MAP, PR-2

Well	Thickness Feet	Thickness Meters	Sand-Shale Ratio
Atigaru Point 1	111	39	1/1.3
West Fish Creek 1	55	17	1.8
South Harrison Bay 1	99	30	1.7
Ikpikpuk 1	241	73	1/2.3
Inigok 1	193	59	1/2.8
Kugrua 1	188	57	3.0
Peard 1	164	50	100
South Simpson 1	162	49	1.8
East Teshekpuk 1	38	12	1/1.2
Topagoruk 1	68	22	1/2.5
Tunalik 1	118	36	3.2
Sinclair Colville 1	78	24	n.d.*
Arco Itkillik River 1	105	32	1.3

*n.d., not determined.

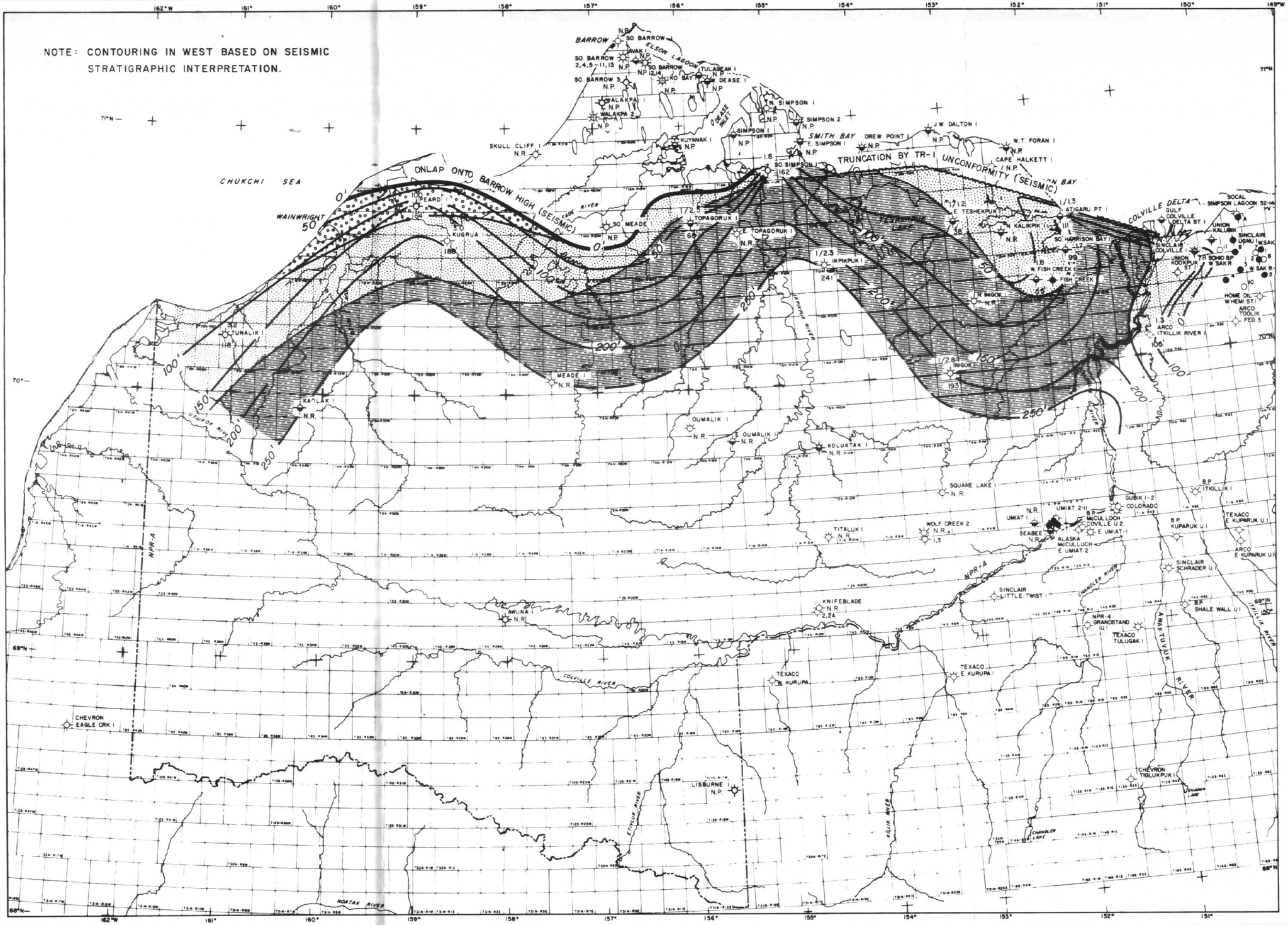
FIGURE 46

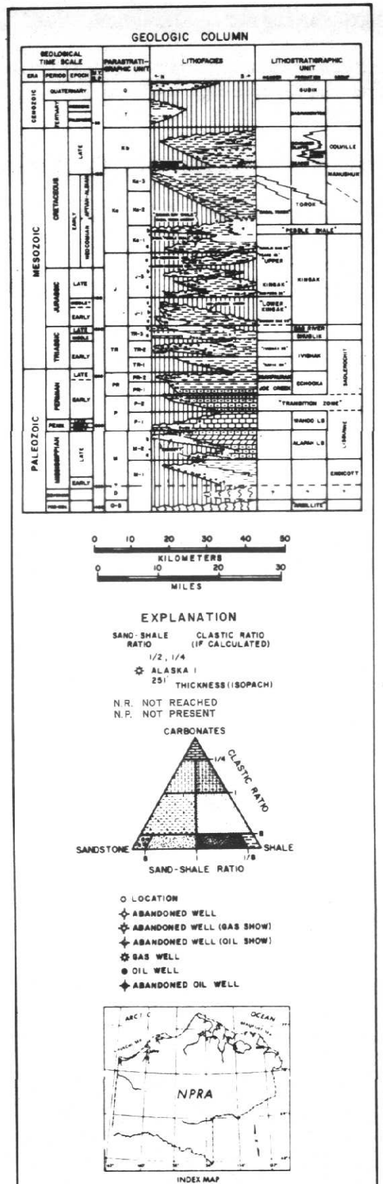
The PR-2 parastratigraphic unit coincides with the Ikiakpaurak Member of the Echooka Formation. PR-2 laps onto the tectonically positive Barrow High to the north. The unit thickens toward the south to a maximum of 241 ft (73 m) at Ikpikpuk 1.

In the west, the PR-2 unit laps onto the Wainwright and the Meade Arches. East of the Meade Arch, the unit is truncated by the overlying TR-1 unit.

PR-2 becomes increasingly sandy toward the north. The area of greatest sand development is at Peard 1 where the unit consists entirely of sandstone. PR-2 also is sandy over the Fish Creek Platform.

NOTE: CONTOURING IN WEST BASED ON SEISMIC STRATIGRAPHIC INTERPRETATION.





TETRA TECH, INC
HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

ISOPACH & LITHOFACIES MAP PR-2

NPR — ALASKA

FOR

ONPRA

HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J. W. BRUYNZEEL		PROJECT NO.T.C.7174	
INTERPRETATION BY: D.H. HIGGS		REVISED DATE	INITIAL
DATE: SEPT. 1980	DATUM:		
CONTOUR INT: 50'	SCALE:	DWG NO.	

TETRA TECH REPORT NO. 8200

TG7-0170

FIGURE 46

FIGURE 47

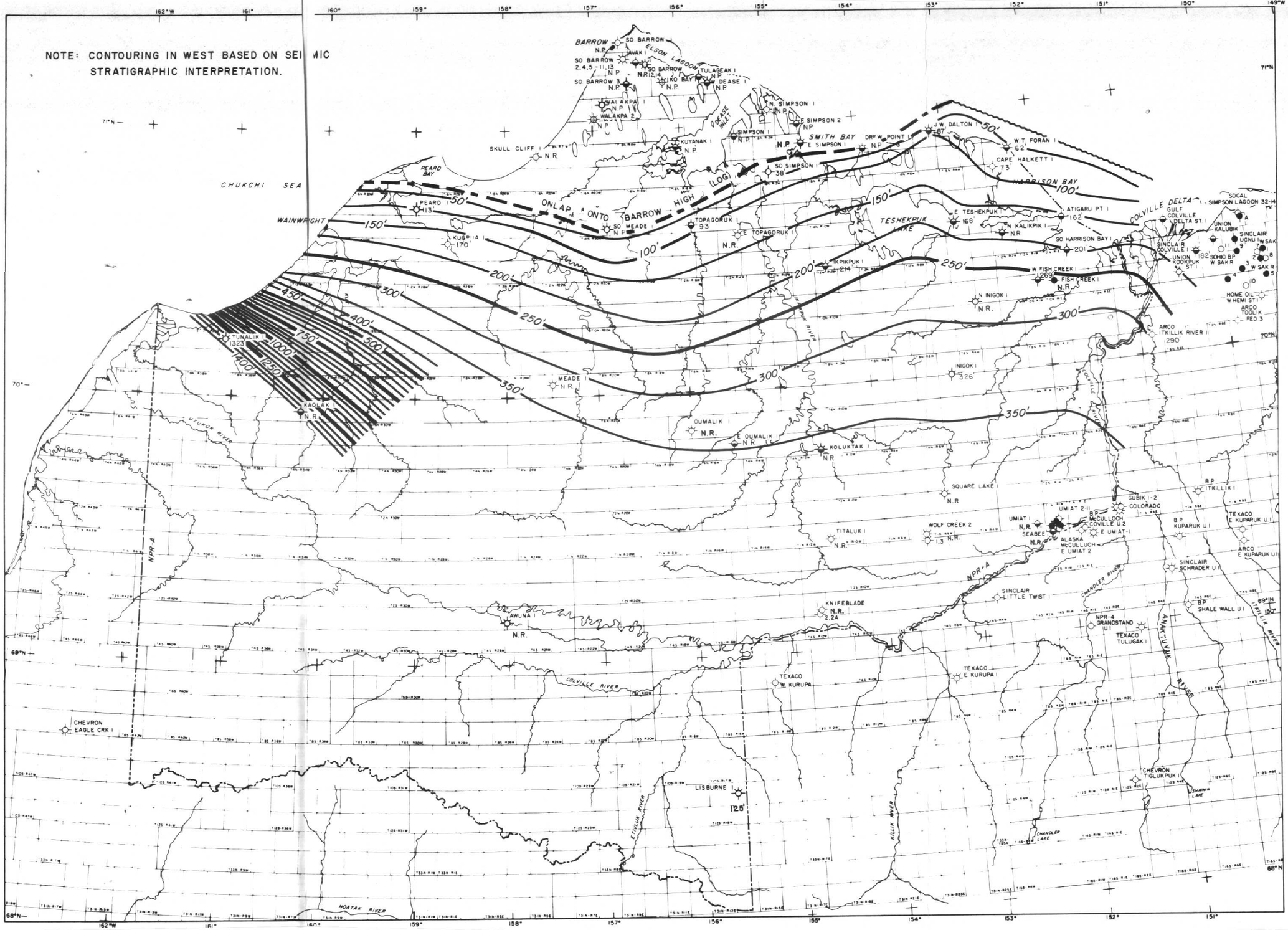
ISOPACH MAP, TR-1

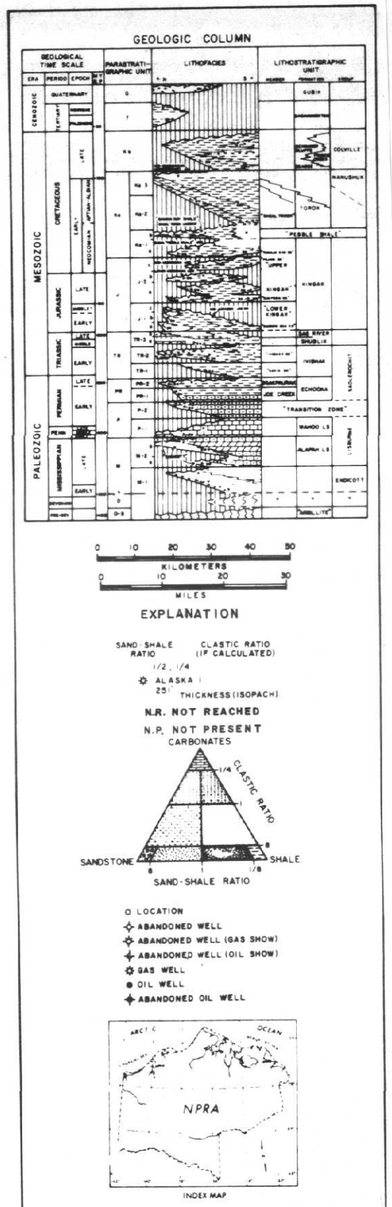
Well	Thickness Feet	Meters
Atigaru Point 1	162	49
Cape Halkett 1	73	22
J. W. Dalton 1	87	27
West Fish Creek 1	269	82
W. T. Foran 1	62	19
South Harrison Bay 1	201	61
Ikpikpuk 1	214	61
Inigok 1	326	99
Kugrua 1	170	52
Lisburne 1	125	38
Peard 1	113	34
South Simpson 1	38	12
East Teshekpuk 1	168	51
Topagoruk 1	93	28
Tunalik 1	1,323	407
Sinclair Colville 1	182	55
Arco Itkillik River 1	290	89

The TR-1 interval coincides with the "Kavik shale," and parts may be equivalent to parts of the overlying TR-2 unit.

The TR-1 unit laps onto the Barrow High and probably is truncated to the north by the basal "Pebble Shale" unconformity. In the northeastern NPRA, TR-1 thickens gradually toward the south to a maximum thickness of 326 ft (99 m) at Inigok 1. In the northwestern NPRA, the unit thickens toward the Tunalik Basin. The thickest "Kavik shale" interval penetrated in the NPRA is at Tunalik 1 where TR-1 is 1,323 ft (403 m) thick.

The TR-1 unit consists of shale and siltstone. All sand-shale ratios are less than 1/8. No limestone was identified in this unit, so no clastic ratios were calculated. Lithofacies patterns were not plotted.





TETRA TECH, INC
HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

ISOPACH MAP
TR-1

NPR — ALASKA

ONPRA

PROJECT MANAGER: J. W. BRUYNZEEL	PROJECT NO. TC-7174
INTERPRETATION BY: D. A. HIGGS	REVISED: DATE / INITIAL
DATE: OCT. 1980 — DATUM:	AUG. 1981 / V.E.B.
CONTOUR INT: 50' — SCALE:	DWG NO.

TETRA TECH REPORT NO. 8022

T62 0170

FIGURE 47

FIGURE 48

ISOPACH AND LITHOFACIES MAP, TR-2

Well	Thickness Feet	Thickness Meters	Sand-Shale Ratio
Atigaru Point 1	644	196	1.7
Cape Halkett 1	574	175	1.1
J. W. Dalton 1	337	103	1.1
Drew Point 1	278	88	1.1
West Fish Creek 1	657	200	1/4
W. T. Foran 1	498	152	1.6
South Harrison Bay 1	692	211	1/2.4
Ikpikpuk 1	699	211	1/2.4
Inigok 1	830	253	1/1.6
Kugrua 1	802	244	1/16
South Meade 1	407	124	1/4
Peard 1	617	188	1/4.3
Simpson 1	5	2	n.d.*
East Simpson 1	168	51	2.1
South Simpson 1	353	108	1/1.6
East Teshekpuk 1	588	179	1/5.5
Topagoruk 1	449	127	1/2.4
Tunalik 1	741	226	1/16
Sinclair Colville 1	573	175	n.d.
Arco Itkillik River 1	700	213	n.d.

*n.d., not determined.

The TR-2 unit contains the "Ivishak sandstone," which is the main reservoir at Prudhoe Bay. TR-2 laps onto the Barrow High westward from J. W. Dalton 1. East of J. W. Dalton 1, TR-2 is truncated by the basal "Pebble Shale" unconformity.

The sand-shale ratios for this unit become progressively smaller toward the southwest. The highest sand counts occur along the Arctic coast and south of the Barrow High.

The TR-2 interval is very sandy in the northeastern part of the NPRA. West of the Meade Arch, TR-2 consists mainly of siltstones, shales, and thin silty sands.

NOTE: CONTOURING IN WEST BASED ON SEISMIC STRATIGRAPHIC INTERPRETATION.

TRUNCATION AT BASAL "PEBBLE SHALE" UNCONFORMITY (PROJECTED)

CHUKCHI SEA

BARROW

WAINWRIGHT

TESHEKPUK LAKE

HARRISON BAY

COLVILLE DELTA

NPR-A

GEOLOGIC COLUMN

GEOLOGICAL TIME SCALE: ERA	PERIOD	EPOCH	PARASTRATIGRAPHIC UNIT	LITHOFACIES	LITHOSTRATIGRAPHIC UNIT
CENOZOIC	QUATERNARY				BUDIN
MESOZOIC	CRETACEOUS	LATE			COLVILLE, NANUSHUK, TORopen
		EARLY			"PEBBLE SHALE"
	JURASSIC	LATE			KINGAK
		EARLY			LOWER KINGAK
	TRIASSIC	LATE			SHUBLIK
		EARLY			SADLEROCHIT
PALEOZOIC	PERMIAN	LATE			SCHRADER BLUFF
		EARLY			TRANSITION ZONE
	PENN				WAHOO LS
	MISSISSIPPIAN	LATE			ALAPAH LS
		EARLY			LISBURNE, ENDICOTT
	DEVONIAN				NOATAK

0 10 20 30 40 50 KILOMETERS

0 10 20 30 MILES

EXPLANATION

SAND-SHALE RATIO — CLASTIC RATIO (IF CALCULATED)

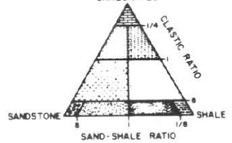
1/2, 1/4

ALASKA 1
251' THICKNESS (ISOPACH)

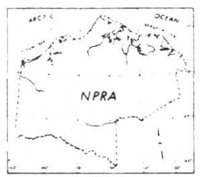
N.R. NOT REACHED

N.P. NOT PRESENT

CARBONATES



○ LOCATION
ABANDONED WELL
ABANDONED WELL (GAS SHOW)
ABANDONED WELL (OIL SHOW)
GAS WELL
OIL WELL
ABANDONED OIL WELL



INDEX MAP

TETRA TECH, INC
HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974 1981 (FINAL REPORT)

ISOPACH & LITHOFACIES MAP
TR-2

NPR — ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J. W. BRUYNZEEL	PROJECT NO. T.C.7174
INTERPRETATION BY: R.M. PRATT	REVISED DATE / INITIAL
DATE: OCT 1978 DATUM:	SEPT 1979 EC/JWB; AUG 1980 MAH/JWB
CONTOUR INT: 100' SCALE:	AUG 1981 VEB

TGZ0170

FIGURE 48

FIGURE 49

ISOPACH AND LITHOFACIES MAP, TR-3a

Wells	Thickness Feet	Thickness Meters	Sand-Shale Ratio	Clastic Ratio
Atigaru Point 1	255	78	1/1.4	3.8
South Barrow 3	165	50	n.d.*	n.d.
Cape Halkett 1	215	66	1/1.4	3.1
J. W. Dalton 1	139	43	1/1.2	0
W. Dease 1	67	21	1/1.2	0
Drew Point 1	510	155	1.2	9
West Fish Creek 1	231	70	<1/8	1.8
W. T. Foran 1	93	28	1/2.5	14
South Harrison Bay 1	284	87	1/10	1/6
Iko Bay 1	58	18	2.4	13.5
Ikpikpuk 1	480	146	1/7	6.4
Inigok 1	343	105	1/6	18
North Inigok 1	152+	46+	n.d.	n.d.
Kugrua 1	372	113	<1/8	1.9
Kuyanak 1	184	56	1.1	0
Lisburne 1	250(?)	76	1.2	1/1.6
South Meade 1	238	73	1/9.5	0
Peard 1	300	91	5.1	18
Simpson 1	269	82	1/2.4	0
East Simpson 1	431	131	1/8.3	10
East Simpson 2	382	116	0	1/1.1
South Simpson 1	524	160	<1/8	23
East Teshekpuk 1	181	55	<1/8	1.6
Topagoruk 1	370	113	<1/8	0
Tulageak 1	67	20	1/1.3	0
Tunalik 1	470	143	1.1	5.6
Walakpa 1	284	87	2.3	8.5
Walakpa 2	313	95	2.1	7.9
Sinclair Colville 1	324	99	n.d.	n.d.
Arco Itkillik River 1	322	99	n.d.	n.d.

*n.d., not determined.

The TR-3a unit coincides with the Shublik Formation. The variable thickness of the unit is associated with the principal tectonic features of the NPRA. In the eastern half of the Reserve, the maximum thickness of TR-3a occurs at

FIGURE 49

Ikpikpuk 1 (480 ft, or 146 m) and Inigok 1 (343 ft, or 15 m) in the Ikpikpuk Basin. East of the Dease Inlet, the basal "Pebble Shale" unconformity truncates TR-3a. The truncation zone runs roughly east-west and is just north of J. W. Dalton 1 and W. T. Foran 1. West of Dease Inlet, the unit onlaps the Barrow High.

Thicknesses of TR-3a at East Teshekpuk 1 and West Fish Creek 1 indicate thinning over the Fish Creek Platform. Thinning also is apparent on the flanks of the Meade Arch, as indicated at South Meade 1 and Kugrua 1. In the western half of the Reserve, the unit is thickest at Tunalik 1 and thins northeastward toward the Barrow High. Lithology and high gamma-ray curve deflections within TR-3a suggest that the thinning may be due to periodic nondeposition.

The TR-3a unit consists of calcareous carbonaceous shales and siltstones, silty limestones, and silty calcareous sandstones. Glauconite is a common accessory mineral in the sandstones, and thin shell beds occur throughout the interval. Sand-shale ratios and clastic ratios indicate that the best sand development is in the northwestern part of the Reserve.

High sand-shale ratios at Peard 1, Walakpa 1, Walakpa 2, and Iko Bay 1 indicate a source area northwest of the present shoreline. TR-3a is progressively more argillaceous toward the southeast and more calcareous toward the south. Over the Fish Creek Platform, the amount of limestone present increases significantly. At South Harrison Bay 1, the unit is mostly limestone. At Lisburne 1, with no nearby control, arenaceous limestone is indicated. Apparent lithologic anomalies occur at East Simpson 2 where the unit is interbedded siltstone and limestone and Drew Point 1 where the high sand count may be caused by statistical variations, or may indicate a small barlike body flanking the Barrow High.

NOTE: CONTOURING IN WEST BASED ON SEISMIC STRATIGRAPHIC INTERPRETATION.

ONLAP ONTO BARROW HIGH (LOGS)

TRUNCATED BY "PEBBLE SHALE" UNCONFORMITY

CHUKCHI SEA

WAINWRIGHT

BARROW

NPR-A

COLVILLE RIVER

KILLIK RIVER

ANAKTUVUK RIVER

CHANDLER RIVER

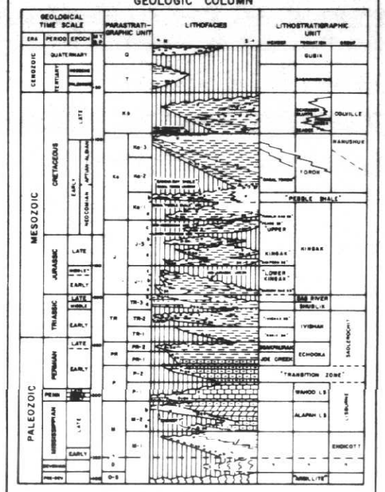
ITKILLIK RIVER

ETIVLUK RIVER

NOATAK RIVER

UTUKOK RIVER

GEOLOGIC COLUMN



0 10 20 30 40 50 KILOMETERS

0 10 20 30 MILES

EXPLANATION

SAND-SHALE RATIO — CLASTIC RATIO (IF CALCULATED)

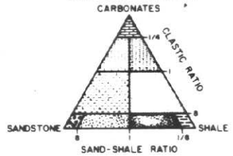
1/2, 1/4

ALASKA I 251' THICKNESS (ISOPACH)

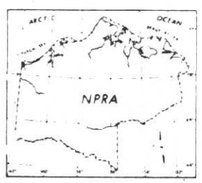
N.R. NOT REACHED

N.P. NOT PRESENT

CARBONATES



- LOCATION
- ABANDONED WELL
- ABANDONED WELL (GAS SHOW)
- ABANDONED WELL (OIL SHOW)
- GAS WELL
- OIL WELL
- ABANDONED OIL WELL



INDEX MAP

TETRA TECH, INC.

PRESTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

ISOPACH & LITHOFACIES MAP TR-3a

NPR — ALASKA

FOR

ONPRA

HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J. W. BRUYNZEEL		PROJECT NO. TC 7174	
INTERPRETATION BY: R. M. PRATT		REVISED	
		DATE	INITIAL
DATE: OCT. 1978	DATUM:	AUG 1978	R.C.B.
		AUG 1980	R.A.F.
CONTOUR INT: 50'	SCALE:	AUG 1981	A.G./D.A.H.

TGC 0170

FIGURE 49

FIGURE 50

ISOPACH AND LITHOFACIES MAP, TR-3b

Well	Thickness Feet	Thickness Meters	Sand-Shale Ratio
Atigaru Point 1	94	29	3.4
South Barrow 3	47	14	1.8
South Barrow 13	50	15	>1/8
South Barrow 17	80	24	1.4
Cape Halkett 1	131	40	1.6
West Dease 1	151	46	1.8
Drew Point 1	104	32	3.9
West Fish Creek 1	36	11	>8
South Harrison Bay 1	54	17	1/1.2
Iko Bay 1	106	32	3.1
Ikpikpuk 1	51	16	1.6
Inigok 1	44	13	<1/8
North Inigok 1	93	28	1/5.2
Kugrua 1	132	40	2
Kuyanak 1	132	40	4.8
Lisburne 1	(?)		-
South Meade 1	122	37	1.2
Peard 1	216	66	1.8
Simpson 1	116	35	2.1
East Simpson 1	157	48	2.3
East Simpson 2	154	47	3.0
South Simpson 1	143	44	2.6
East Teshekpuk 1	129	39	1/1.3
Topagoruk 1	150	46	1.1
Tulageak 1	117	36	2.0
Tunalik 1	88	27	<1/8
Walakpa 1	126	38	2.86
Walakpa 2	147	45	2.3
Sinclair Colville	46	14	n.d.*
Arco Itkillik River 1	74	23	<1/8

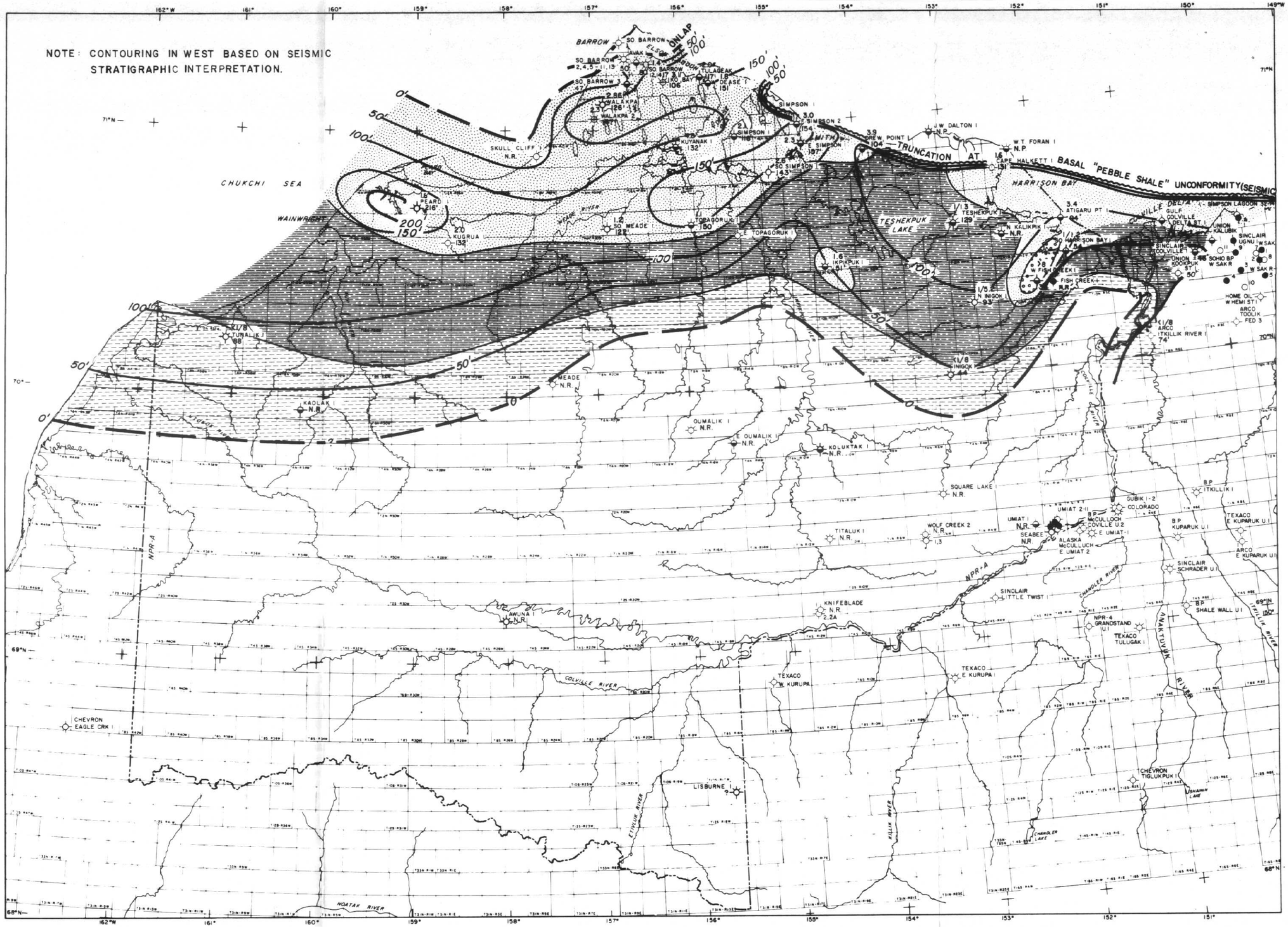
*n.d., not determined.

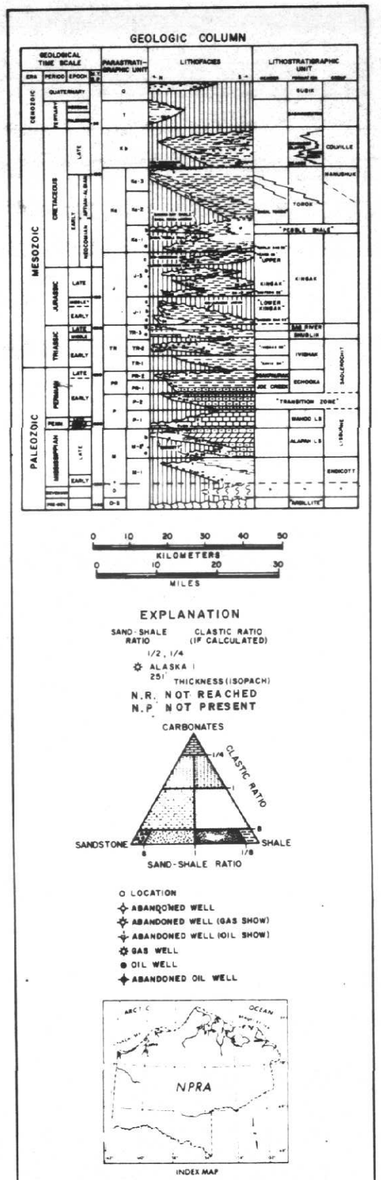
In the northern part of the NPRA, Unit TR-3b contains the Sag River Sandstone. The unit ranges in thickness from 216 ft (66 m) at Peard 1 to 36 ft (11 m) at West Fish Creek 1, with the thickest development just south of and parallel to the Barrow High. The unit thins toward the south across the Reserve and probably is present only in the northern half of the NPRA. In the Barrow area, TR-3b thins toward the north where it onlaps the Barrow High. East of Dease Inlet, the basal "Pebble Shale" unconformity truncates TR-3b. Near Dease Inlet, TR-3b appears to thicken toward the north-northeast, and it is uncertain whether truncation or onlap occurs.

Unit TR-3b is the "cleanest" stratigraphic unit drilled to date on the Reserve. The sandstone lithofacies of the Sag River is restricted to the northern part of the NPRA where it is a sheetlike sand probably consisting of a series of overlapping bars. The unit becomes increasingly silty toward the west and south. In the Barrow area, TR-3b consists of limestone and a shore facies of glauconitic, shelly sandstones, siltstones, and shales.

Sand-shale ratios indicate two areas of partly overlapping barlike complexes. The best developed area is in the northwestern NPRA, extending from South Barrow 17 in the north, to Peard 1 and Kugrua 1 to the southwest, to Drew Point 1 to the northeast. The second area of good sand development is associated with the Fish Creek Platform. A third, smaller area of sand located at Ikpikpuk 1 may be an extension of the Fish Creek Platform bar or may represent an isolated accumulation.

NOTE: CONTOURING IN WEST BASED ON SEISMIC STRATIGRAPHIC INTERPRETATION.





TETRA TECH, INC.
HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

ISOPACH & LITHOFACIES MAP
TR-3b

NPR — ALASKA

FOR

ONPRA

HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J.W. BRUYNEEL		PROJECT NO. T.C.7174	
INTERPRETATION BY: R.M. PRATT		REVISED	
		DATE	INITIAL
DATE: OCT. 1978	DATUM:	AUG 1979	RPC/JWJ
		AUG 1980	RMP
CONTOUR INT: 50'	SCALE:	AUG 1981	A.G.

TETRA TECH REPORT NO. 8200

TG2070

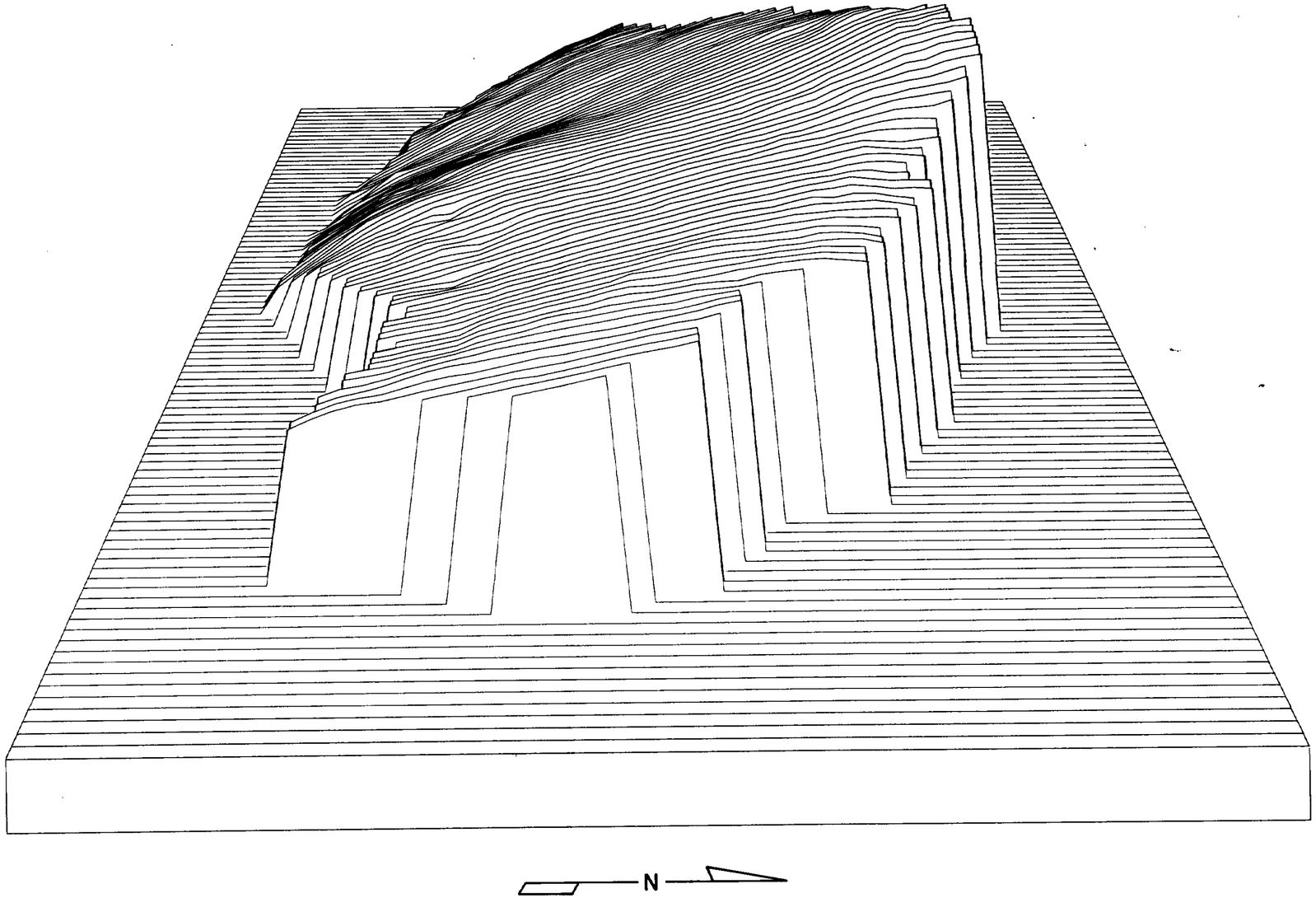
FIGURE 50

FIGURE 51

THREE-DIMENSIONAL PERSPECTIVE
OF HORIZON 1000

This computer-plotted image of horizon 1000 as viewed from the east was generated from about 6,000 records in an NPRA geophysical data base. The illustration is a generalized configuration of the top of parastratigraphic unit TR-3 as represented by horizon 1000.

FIGURE 51



THREE - DIMENSIONAL
PERSPECTIVE OF
HORIZON 1000

TGZ-0170

FIGURE 51

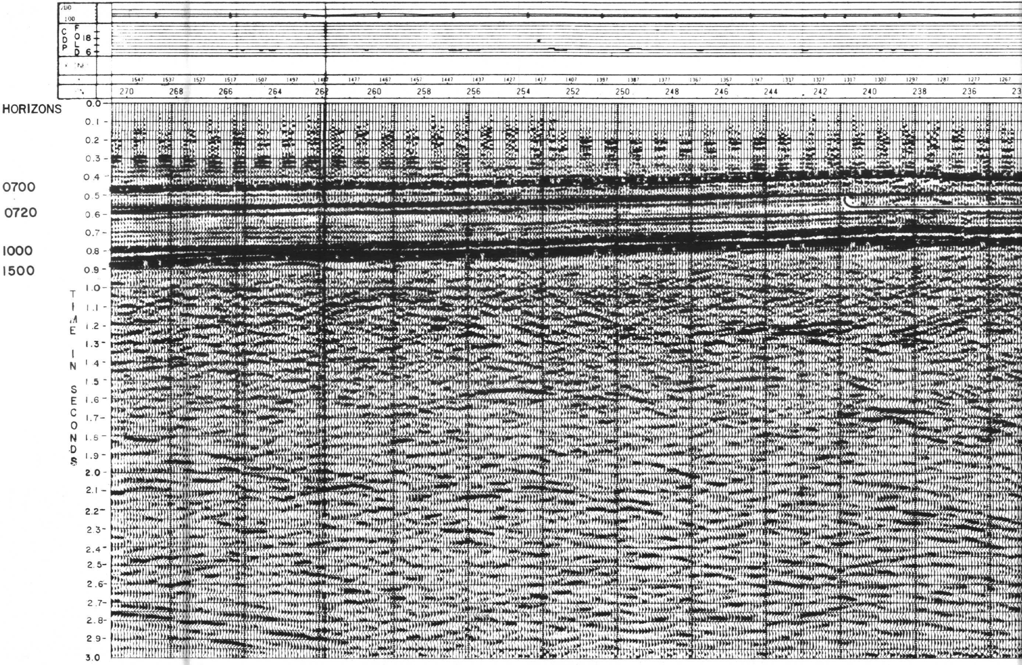
FIGURE 52

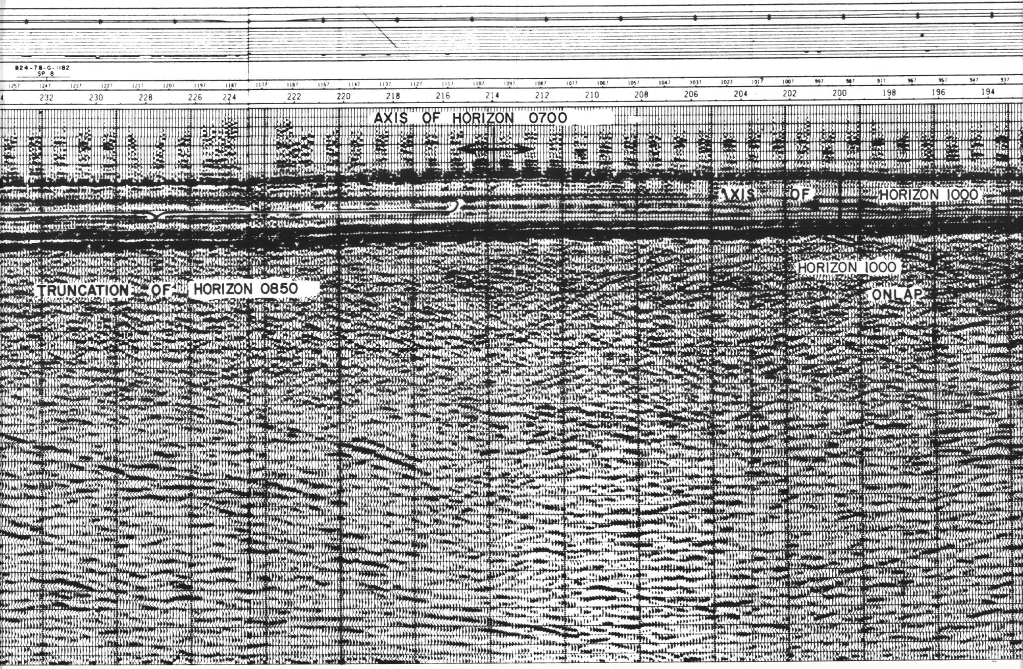
LINE B1-78-G-1182, SHOTPOINTS 8-270,
SCALED FINAL STACK

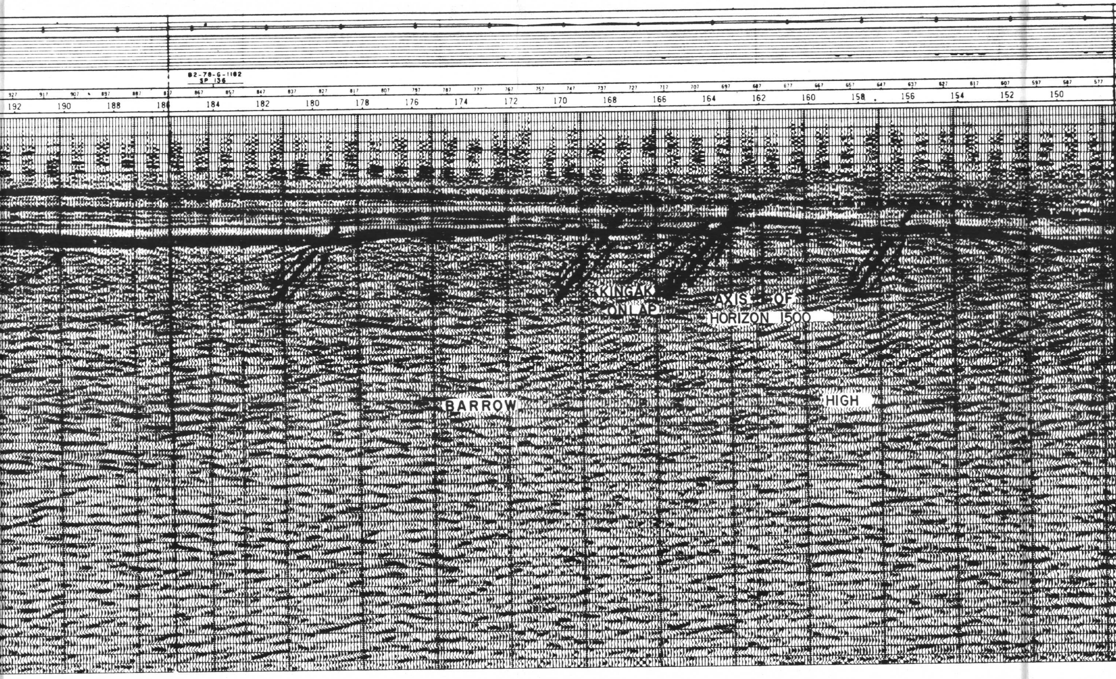
Line B1-78, a north-northeast seismic line subparallel to the northwest coastline of the Barrow area, shows the large structural feature known as the Barrow High. This broad anticline trends nearly east-west across the Barrow area, extending westward into the Chukchi Sea. Most of the pre-Cretaceous section terminates due to onlap onto the southern flank of the Barrow High or is truncated by the basal "Pebble Shale" unconformity. Line B1-78 shows the lapouts of horizon 1000 and the Kingak Formation. Horizons 1040 and 1100 lap out farther to the south, demonstrating the extension of younger horizons northward beyond the terminations of older horizons. These onlap terminations provide possible stratigraphic traps.

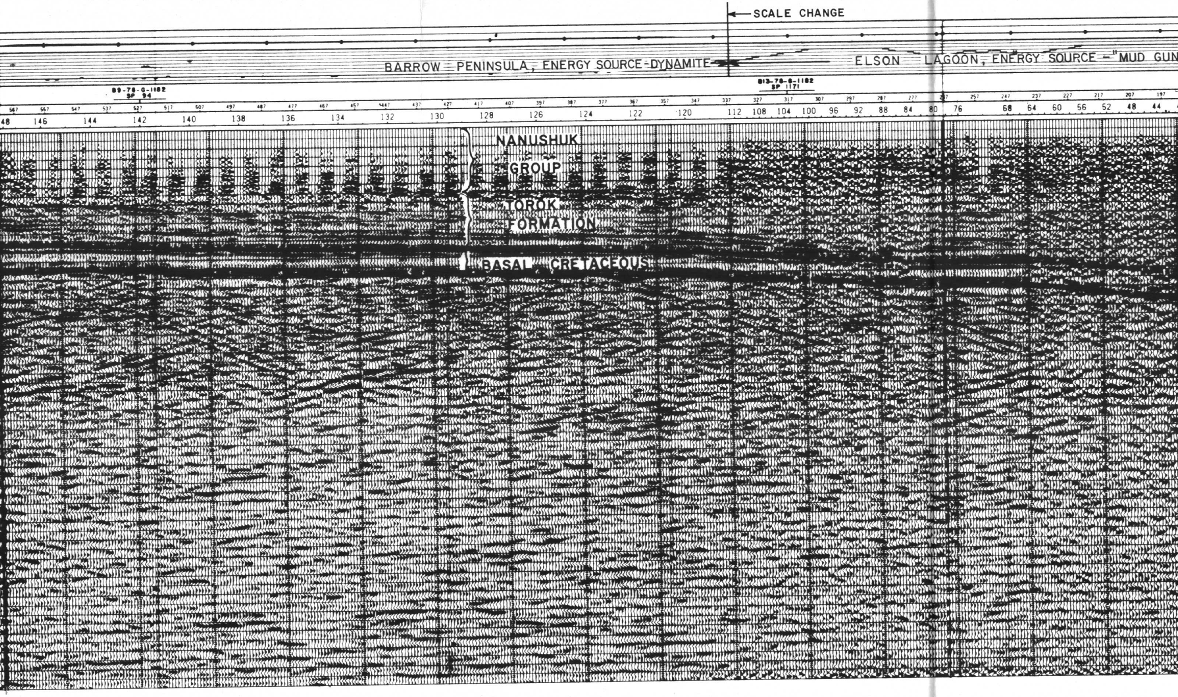
B1-78 also shows the displacement of the Barrow High axis with depth. The axis, which trends generally east-west, migrates northward with increasing depth. Thinning of the Cretaceous portion of the section over the Barrow High is also evident.

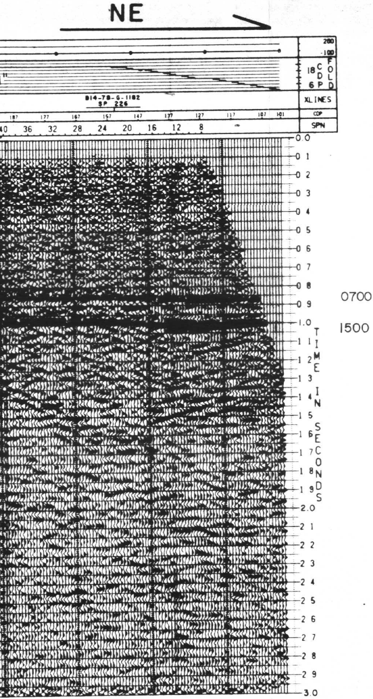
FIGURE 52











USGS
ONPRA

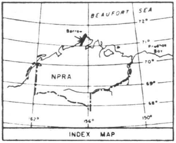
HUSKY OIL NPR OPRS INC
NATIONAL PETROLEUM RESERVE ALASKA
BARROW AREA

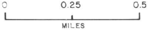
B1 -78-G-1182

SHOTPOINTS 8 - 270

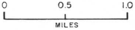
SCALED FINAL STACK

FIGURE 52


BEAUFORT SEA
72°
Barrow
71°
Prudhoe Bay
70°
NPRA
69°
68°
162°
156°
150°
INDEX MAP


0
0.25
0.5
MILES

ELSON LAGOON SCALE


0
0.5
1.0
MILES

BARROW PENINSULA SCALE

TETRA TECH REPORT NO. 8200

TG7-0170

FIGURE 53

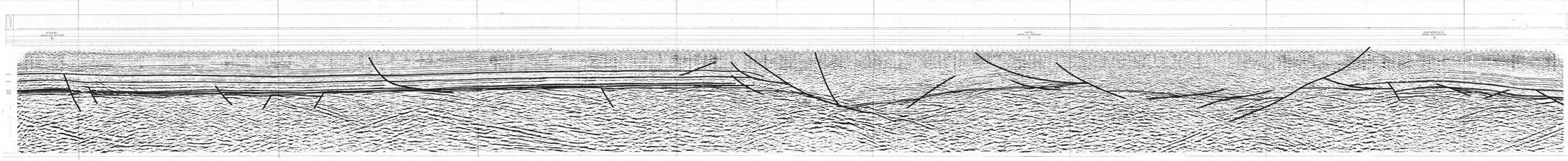
LINE B11-78-G-1182, SHOTPOINTS 1-305,
SCALED FINAL STACK

Near the center of the Barrow High is an area of complex faulting and folding called the "Disturbed Zone." The boundaries of this subround structure are defined by a series of high-angle faults, and its interior is structurally complex. The development of this zone may be due to an igneous piercement body which did not extend upward through the basement.

The South Barrow gas field lies on the western edge of this zone, and the East Barrow gas field is on the eastern edge. Both of these fields produce from the "Barrow gas sand" (horizon 0970), which may have been deposited as a channel sand. Line B11-78 is oriented northwesterly across part of the East Barrow gas field and the "Disturbed Zone," and lies just north of the South Barrow gas field.

High-angle faults along the margin of the "Disturbed Zone" are difficult to pinpoint on the seismic data because of strong diffractions.

FIGURE 53



USGS
ONPRA

B11-78-G-1182

SCALED FINAL STACK

FIGURE 53

FIGURE 54

ISOPACH AND LITHOFACIES MAP, J-1

Well	Thickness Feet	Thickness Meters	Sand-Shale Ratio
Atigaru Point 1	750	229	<1/16
South Barrow 3	748	228	n.d.*
South Barrow 13	187	57	1/8.4
South Barrow 17	503	153	1/3.2
Cape Halkett 1	178	54	<1/16
West Dease 1	431	131	1/8
Drew Point 1	71	22	1/16
West Fish Creek 1	252	77	<1/16
South Harrison Bay 1	667	203	<1/16
Iko Bay 1	643	196	1/3.9
Ikpikpuk 1	580	177	1/16
Inigok 1	150	46	<1/16
North Inigok 1	136	41	1/11.4
Kugrua 1	616	188	<1/16
Kuyanak 1	587	179	1/11.2
Lisburne 1	(?)		-
South Meade 1	714	218	1/7
Peard 1	205	63	<1/16
Simpson 1	520	159	<1/16
East Simpson 1	282	86	1/16
East Simpson 2	87	27	1/8
South Simpson 1	814	248	<1/16
East Teshekpuk 1	1,038	316	<1/16
Topagoruk 1	782	238	1/16
Tulageak 1	812	248	1/9.1
Tunalik 1	140	43	<1/16
Walakpa 1	640	195	1/7.7
Walakpa 2	613	187	1/7.7

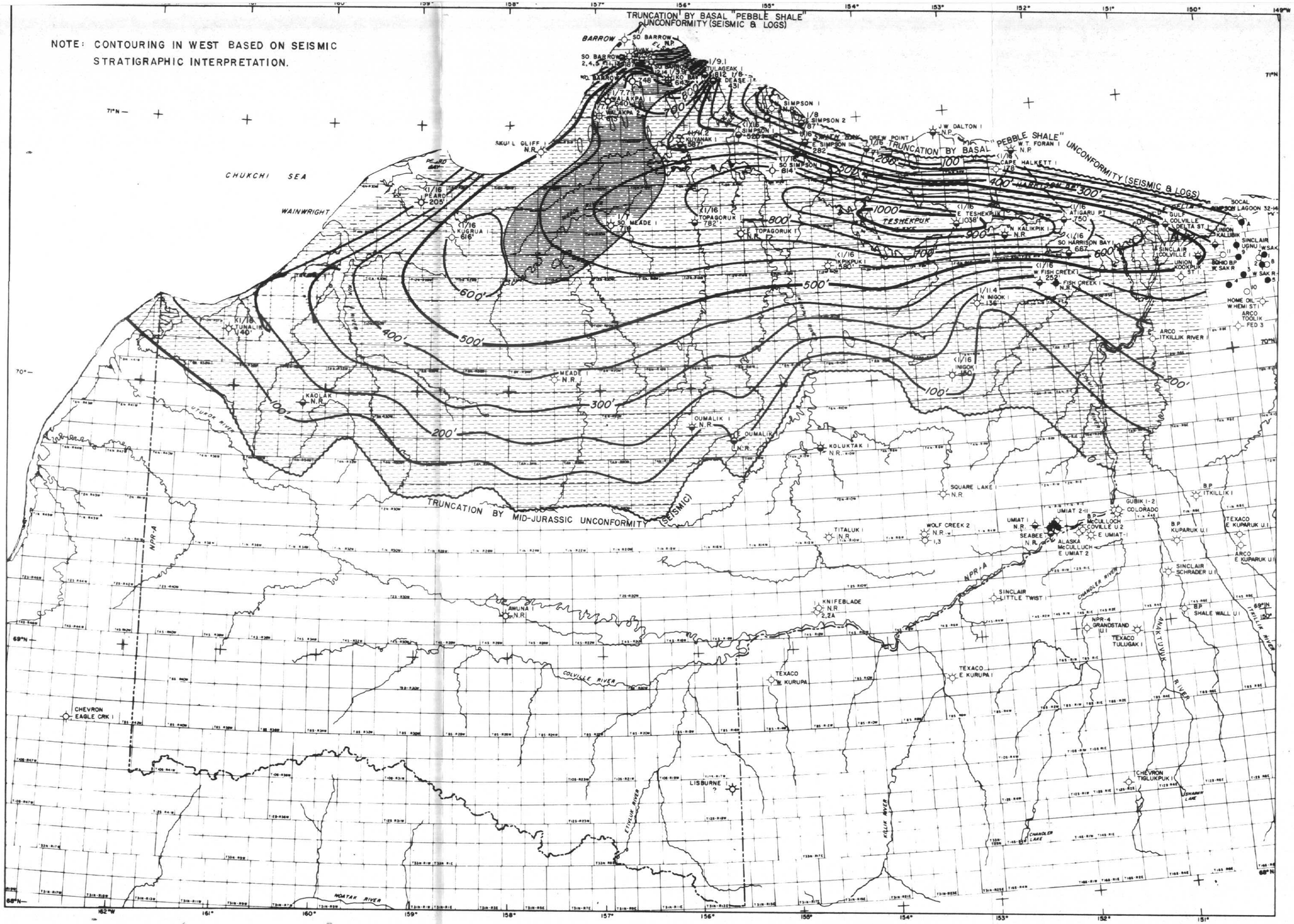
*n.d., not determined.

Unit J-1, which contains the reservoir "Barrow sandstone" in the Barrow area, lies unconformably on TR-3 and is restricted to the northern part of the NPRA. J-1 is Early-Middle(?) Jurassic and coincides with foraminiferal zones F-17 and F-18 (Anderson, Warren, and Associates, 1974-1979).

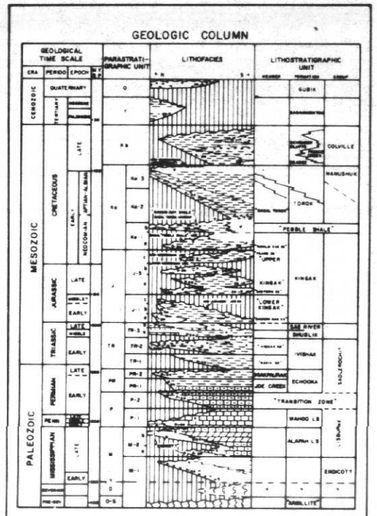
The thickness of J-1 is related to its truncation by the overlying mid-Jurassic and basal "Pebble Shale" unconformities. The thickest section penetrated is 1,038 ft (316 m) thick at East Teshekpuk 1; this section extends to the west and parallels the Barrow Arch. Northward, toward the Barrow High and the Barrow Arch, unit J-1 is progressively truncated by the basal "Pebble Shale" unconformity. In the eastern half of the NPRA, the mid-Jurassic unconformity deeply truncates J-1 toward the southeast; J-1 thickness ranges from 580 ft (177 m) at Ikpikpuk 1 to 136 ft (42 m) at North Inigok 1.

In the western half of the Reserve, truncation by the basal "Pebble Shale" unconformity is more gradual, and 140 ft (43 m) of J-1 is present at Tunalik 1. The mid-Jurassic unconformity probably truncates J-1 completely in an east-west direction across the middle of the NPRA.

Unit J-1 consists of cyclically deposited shale units that coarsen upward into siltstone or sandstone. The only economically important sandstone in J-1 is the "Barrow sandstone." The unit becomes increasingly argillaceous toward the south, away from the Barrow area. At South Meade 1, a sand-shale ratio of 1 to 7 probably denotes the southern limit of any potential reservoir rock in J-1.



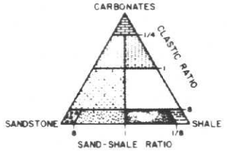
GEOLOGIC COLUMN



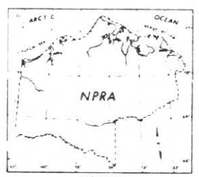
0 10 20 30 40 50 KILOMETERS
0 10 20 30 MILES

EXPLANATION

SAND-SHALE RATIO — CLASTIC RATIO (IF CALCULATED)
1/2, 1/4
ALASKA I
251 THICKNESS (ISOPACH)
N.R. NOT REACHED
N.P. NOT PRESENT



- LOCATION
- ABANDONED WELL
- ABANDONED WELL (GAS SHOW)
- ABANDONED WELL (OIL SHOW)
- GAS WELL
- OIL WELL
- ABANDONED OIL WELL



INDEX MAP

TETRA TECH, INC.
HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

ISOPACH & LITHOFACIES MAP
J-1

NPR — ALASKA

FOR
ON PRA
HUSKY OIL NPR OPERATIONS INC

PROJECT MANAGER: J.W. BRUYNZEEL	PROJECT NO. TC-7174
INTERPRETATION BY: D.A. HIGGS	REVISED: DATE / INITIAL
DATE: SEPT 1980 — DATUM:	AUG 1981 / A.G.
CONTOUR INT: 100' — SCALE:	DWG NO.

TETRA TECH REPORT NO. 8200

TGE-0170

FIGURE 54

FIGURE 55

ISOPACH MAP, Ka-1a AND J-3

Well	Thickness Feet	Thickness Meters
Atigaru Point 1	183	56
South Barrow 3	175	53
West Fish Creek 1	1,719	524
South Harrison Bay 1	946	288
Ikpikpuk 1	1,779	547
Inigok 1	2,703	824
North Inigok 1	2,141	663
Kugrua 1	1,590	485
Kuyanak 1	497	152
South Meade 1	1,276	389
Peard 1	1,442	440
Seabee 1	2,271+	692
South Simpson 1	186	57
East Teshekpuk 1	377	115
Topagoruk 1	903	275
Tunalik 1	3,222	982
Walakpa 1	497	151
Walakpa 2	594	181
Sinclair Colville 1	1,289	393
Arco Itkillik River 1	1,820	555

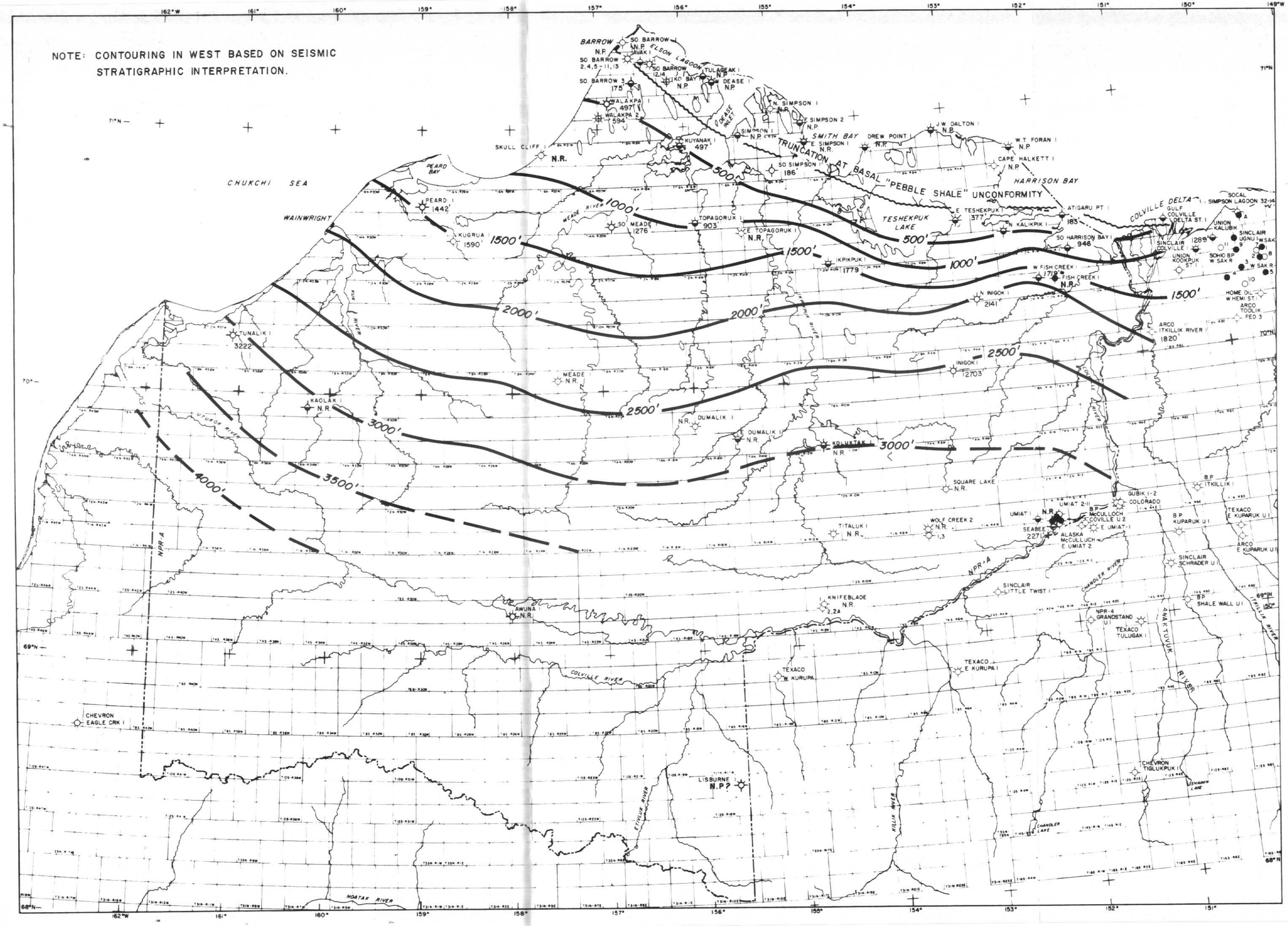
The base of the "Upper Kingak" (units Ka-1a and J-3) is the mid-Jurassic unconformity; the upper boundary is the basal "Pebble Shale" unconformity. The "Upper Kingak" is Late Jurassic to Early Neocomian and coincides approximately with foraminiferal zones F-13 to F-16 (Anderson, Warren, and Associates, 1974-1979).

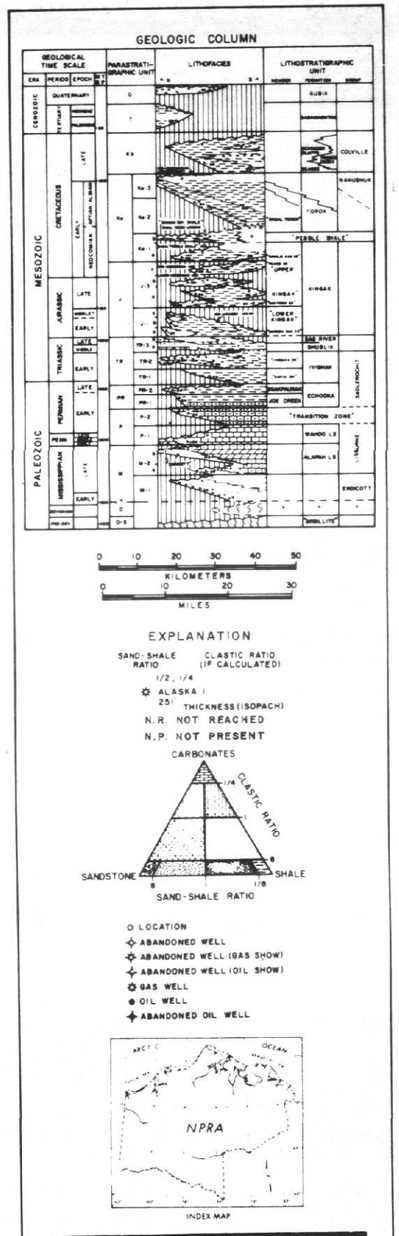
The "Upper Kingak" is a wedge-shaped body that thins northward toward the Barrow High and Barrow Arch because of progressive truncation by the basal "Pebble Shale" unconformity. In the eastern half of the Reserve, the unit thickens to the south, attaining a maximum thickness of 2,703 ft (824 m) at Inigok 1. South of Inigok 1, there is little data, and character of the "Upper Kingak" is uncertain.

The maximum thickness of the unit in the Reserve is 3,222 ft (982 m) at Tunalik 1. On seismic sections, the "Upper Kingak" thickens southwestward from Tunalik 1.

The "Upper Kingak" is mostly shale in the eastern half of the NPRA. In the western NPRA, it contains several sand bodies. The best developed of these sands is the "Simpson sandstone," which is shown on figure 57.

NOTE: CONTOURING IN WEST BASED ON SEISMIC STRATIGRAPHIC INTERPRETATION.





TETRA TECH, INC
HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

ISOPACH MAP
Ka-Ia and J-3

NPR — ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J.W. BRUYNZEEL	PROJECT NO. TC-7174
INTERPRETATION BY: D.A. HIGGS	REVISED: DATE AUG 1981 / INITIAL V.E.B.
DATE: APRIL 1980 DATUM:	
CONTOUR INT. 500' SCALE:	DWG NO.

TETRA TECH REPORT NO. 8200

TG2-0170

FIGURE 55

FIGURE 56

ISOPACH AND LITHOFACIES MAP, J-3a

Well	Thickness Feet	Thickness Meters	Sand-Shale Ratio
Atigaru Point 1	183	56	1/5.5
South Barrow 3	175	53	1/8
West Fish Creek 1	1,096	334	1/4
South Harrison Bay 1	805	245	1/10
Ikpikpuk 1	744	227	<1/8
Inigok 1	1,123	342	<1/8
North Inigok 1	1,088	332	<1/8
North Kalikpik 1	248+	76	n.d.*
Kugrua 1	458	140	1/2
Kuyanak 1	497	152	1/2.9
South Meade 1	496	151	1/2.6
Peard 1	400	122	1/3.5
South Simpson 1	186	57	n.d.
East Teshekpuk 1	377	115	1/2.8
Topagoruk 1	409	126	1/4
Tunalik 1	452	138	<1/8
Walakpa 1	497	152	<1/8
Walakpa 2	594	181	<1/8
Sinclair Colville 1	918	280	n.d.
Arco Itkillik River 1	1,020	311	n.d.

*n.d., not determined

Unit J-3a in the basal part of the "Upper Kingak" includes all the Oxfordian rocks. The unit coincides with foraminiferal zone F-16 (Anderson, Warren, and Associates, 1974-1979). Unit J-3aI, a subunit of J-3a shown in figure 57, contains the "Simpson sandstone."

The J-3a depositional pattern is similar to that of J-3aI. The major differences are the argillaceous Kimmeridgian strata (up to 860 ft, or 262 m) in J-3a, and truncation of J-3a by the basal "Pebble Shale" unconformity, which occurs to the north. In the east, the J-3a unit is truncated north of Atigaru Point 1 where 183 ft (56 m) of strata are present.

J-3a is silty in the north, near the truncation by the basal "Pebble Shale" unconformity; west of the Meade Arch, sand-shale ratios are highest to the north where J-3a is truncated by the unconformity. The sand-shale ratios shown above are statistical anomalies resulting from the absence of the siltstone interval overlying the "Simpson sandstone." The J-3a becomes increasingly argillaceous toward the south across the Reserve.

NOTE: CONTOURING IN WEST BASED ON SEISMIC STRATIGRAPHIC INTERPRETATION.

FOUNDATION AT BASAL "PEBBLE SHALE" UNCONFORMITY (SEISMIC & LOGS)

CHUKCHI SEA

BARROW

ELSON LAGOON

SMITH BAY

HARRISON BAY

WAINWRIGHT

TESHEKPUK

DELTA

NPR-A

COLVILLE RIVER

KILIK RIVER

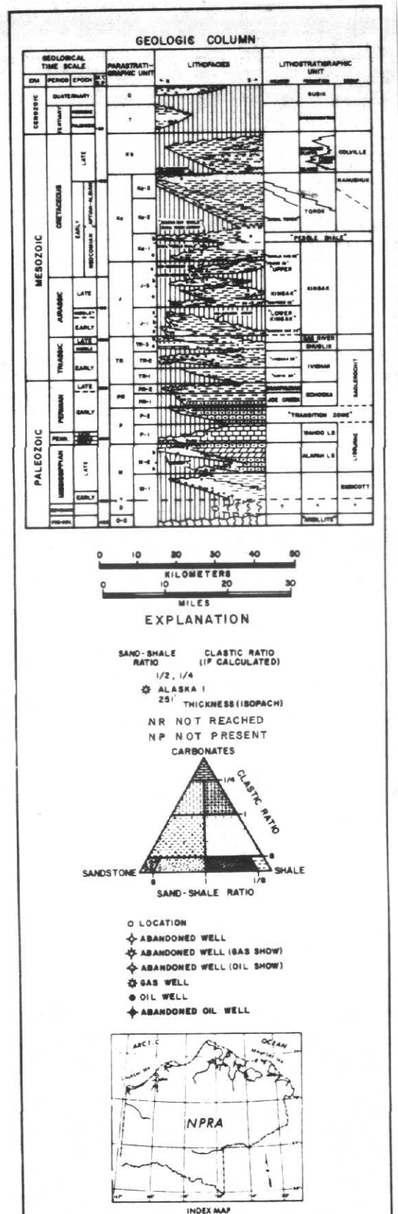
ETIVLUK RIVER

NOATAK RIVER

ANAKTUVUK RIVER

CHANDLER RIVER

SO BARROW 1
SO BARROW 2, 4, 5
SO BARROW 3
SO BARROW 12, 14
TAVAK 1
TULAGEAK 1
KO BAY
DEASE 1
ALASKA 1
ALASKA 2
N. SIMPSON 1
E SIMPSON 2
SIMPSON 1
E SIMPSON 1
SO SIMPSON 186
DREW POINT 1
J.W. DALTON 1
W.T. FORAN 1
CAPE HALKETT 1
SKULL CLIFF 1
KUYANAK 1
PEARD 1
KUGRUA 1
SO MEADE 1
TOPAGORUK 1
E TOPAGORUK 1
E TESHEKPUK 1
ATIGARU PT 1
N KALIKPIK 1
SO HARRISON BAY
SINCLAIR COLVILLE
UNION KOOKPUK ST
SOCAL SIMPSON LAGOON 32-14
GULF COLVILLE
UNION KALUBIK
SINCLAIR UGNU 1
W SAK
SOHIO BP W SAK R
W SAK R
HOME OIL W HEMI ST
ARCO TOOLIK FED 3
KPIKPUK 1
FISH CREEK 1
N. INGOK 1
INIGOK 1
ARCO ITKILLIK RIVER 1
TUNALIK 1
KAOLAK 1
MEADE
OUMALIK 1
KOLUKTAK 1
SQUARE LAKE
GUBIK 1-2
COLORADO
UMIAT 2
McCULLOCH COVILLE U 2
E UMIAT
SEABEE
ALASKA McCULLUCH E UMIAT 2
WOLF CREEK 2
TITALUK 1
BP ITKILLIK 1
BP KUPARUK U 1
TEXACO E KUPARUK U 1
ARCO E KUPARUK U 1
SINCLAIR SCHRADER U 1
BP SHALE WALL U 1
SINCLAIR LITTLE TWIST 1
KNIFEBLADE 2, 2A
NPR-4 GRANDSTAND U 1
TEXACO TULUGAK 1
AWUNA 1
TEXACO W KURUPA
TEXACO E KURUPA 1
CHEVRON EAGLE CRK 1
LISBURNE 1
CHEVRON TIGLUKPUK 1
CHANDLER LAKE



TETRA TECH, INC.
HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

ISOPACH & LITHOFACIES MAP
J-3a

NPR — ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J. W. BRUYNZEEL	PROJECT NO. TC-7174
INTERPRETATION BY: D. A. HIGGS	REVISED: DATE AUG. 1981, INITIAL V.P.R.
DATE: SEPT 1980 DATUM:	
CONTOUR INT: 100' SCALE:	DWG NO.

TETRA TECH REPORT NO. 8200

TGE-0170

FIGURE 56

FIGURE 57

FIGURE 57

ISOPACH AND LITHOFACIES MAP, J-3aI

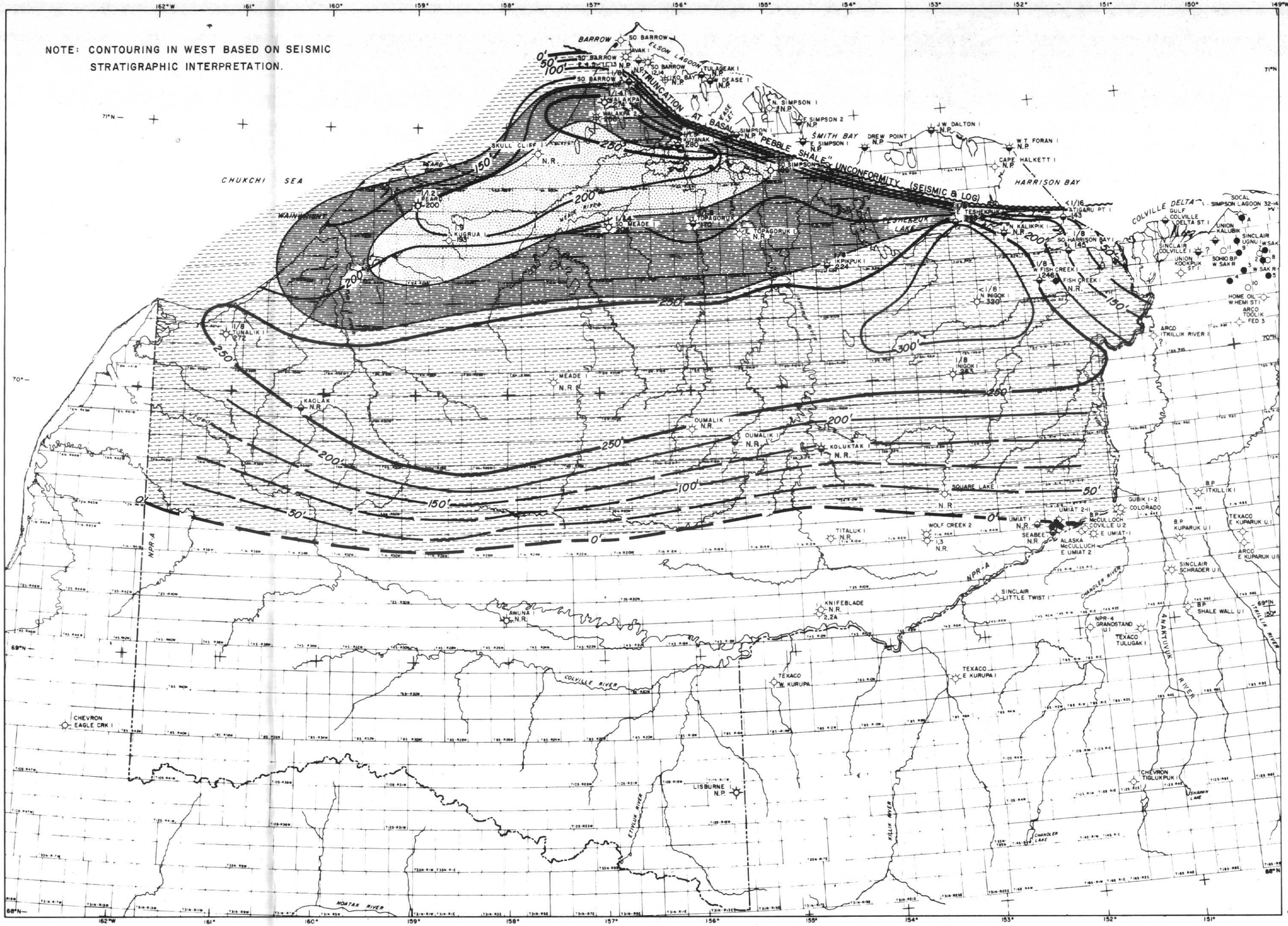
Well	Thickness Feet	Thickness Meters	Sand-Shale Ratio
Atigaru Point 1	143	44	<1/16
South Barrow 3	117	36	1/8
West Fish Creek 1	246	75	1/8
South Harrison Bay 1	145	44	1/8
Ikpikpuk 1	224	68	1/8
Inigok 1	263	80	1/8
North Inigok 1	320	98	<1/8
Kugrua 1	193	59	1.9
Kuyanak 1	280	85	1/1.9
South Meade 1	206	63	1/1.4
Peard 1	200	61	1/1.2
South Simpson 1	186	57	1/1.2
East Teshekpuk 1	293	89	1/8
Topagoruk 1	170	52	1/1.8
Tunalik 1	272	83	1/8
Walakpa 1	274	84	1/1.4
Walakpa 2	268	82	1/1.5
Sinclair Colville 1	(?)		n.d.*
Arco Itkillik River 1	(?)		n.d.

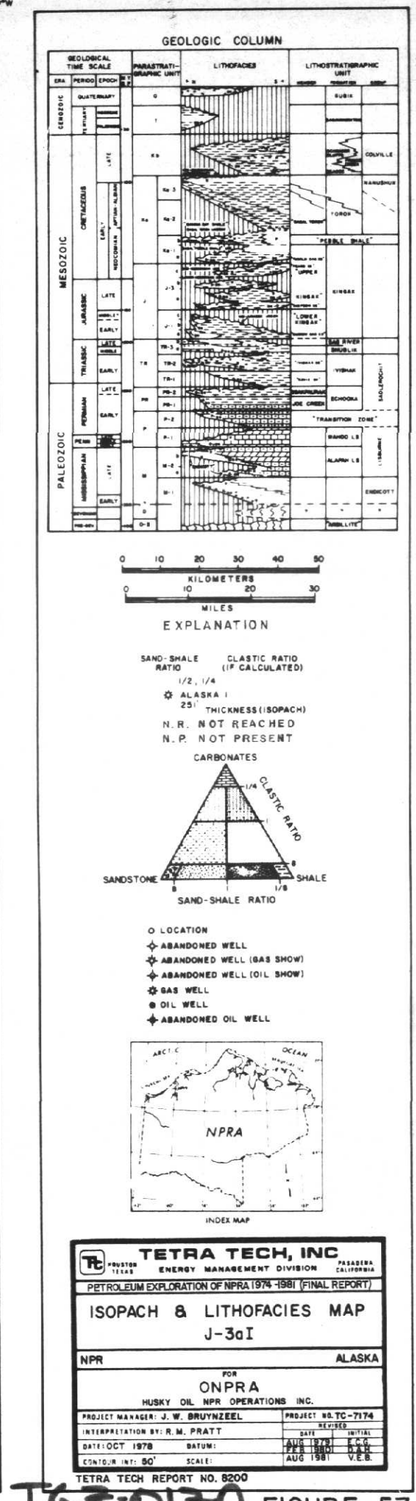
*n.d., not determined

Unit J-3aI, the base of the "Upper Kingak," directly overlies the mid-Jurassic unconformity. In the northwestern NPRA, the unit contains the "Simpson sandstone." In the north, J-3aI is truncated by the basal "Pebble Shale" unconformity, just south of South Barrow 13 and Simpson 1, and just north of Atigaru Point 1. J-3aI thickens to the south-southwest from South Simpson 1; the thickest section of J-3aI is at East Teshekpuk 1. The unit thins toward the south. In the eastern part of the Reserve, J-3aI consists of shales and siltstones.

The unit thickens to a maximum of 274 ft (84 m) at Walakpa 1 in the western half of the NPRA. South of Tunalik 1, lithology of the unit is uncertain because of a lack of data. The "Simpson sandstone" is a barlike sand body best developed at Kugrua 1. The source of the "Simpson sandstone" was most likely northwest of Kugrua 1; the sands probably were transported eastward and east-northeastward by longshore currents. The sand-shale ratio is 1 to 1.2 at Peard 1 and South Simpson 1, but the sandstone is increasingly silty toward the south and east.

NOTE: CONTOURING IN WEST BASED ON SEISMIC STRATIGRAPHIC INTERPRETATION.





TETRA TECH, INC

HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

ISOPACH & LITHOFACIES MAP J-3aI

NPR — ALASKA

FOR

ONPRA

HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J. W. BRUYNZEEL		PROJECT NO. TC-7174	
INTERPRETATION BY: R. M. PRATT		REVISED DATE	INITIAL
DATE: OCT 1978	DATUM:	AUG 1979	F.C.C.
		APR 1980	D.A.N.
CONTOUR INT: 50'	SCALE:	AUG 1981	V.E.B.

TETRA TECH REPORT NO. 8200

TGZ-0170 FIGURE 57

FIGURE 58

ISOPACH AND LITHOFACIES MAP, J-3b

Well	Thickness Feet	Thickness Meters	Sand-Shale Ratio
West Fish Creek 1	440	134	1/1.1
South Harrison Bay 1	141	43	1/9
Ikpikpuk 1	850	259	1/1.2
Inigok 1	580	177	<1/8
North Inigok 1	557	170	1/2.6
Kugrua 1	435	133	1/1.3
South Meade 1	459	140	<1/8
Peard 1	400	122	<1/8
Sinclair Colville 1	365	111	n.d.*
Arco Itkillik River 1	685	209	1/8

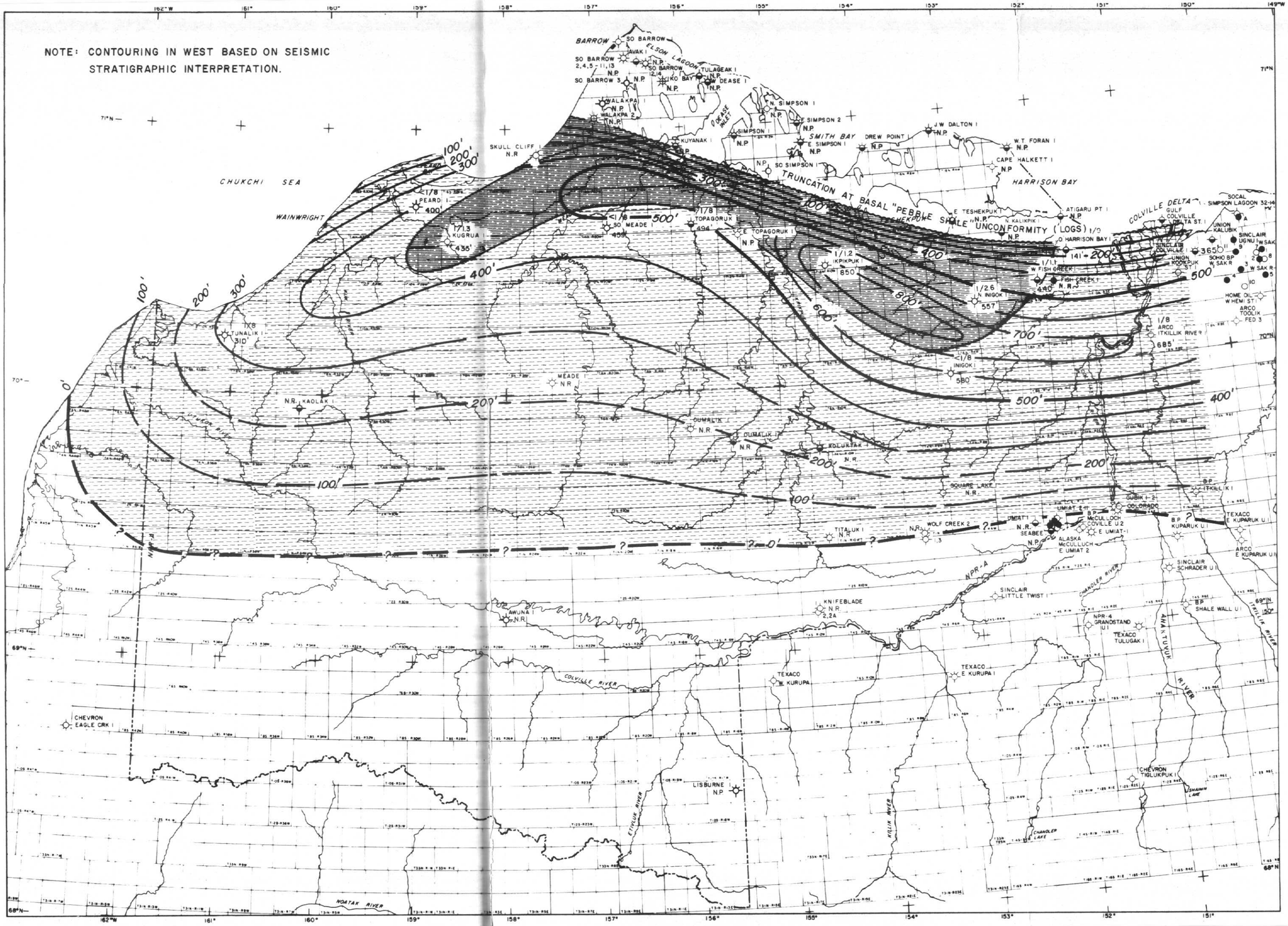
*n.d., not determined.

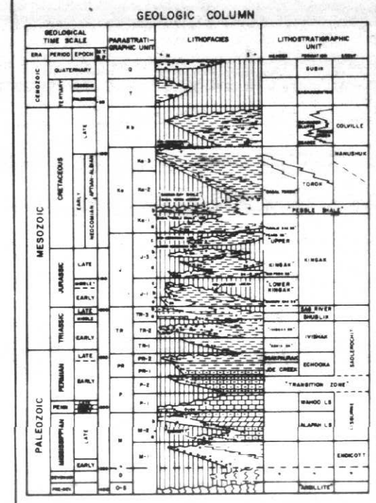
Unit J-3b, the latest Jurassic part of the "Upper Kingak," overlies horizon 0850 and underlies the earliest Neocomian part (unit J-3c) of the "Upper Kingak." J-3b coincides approximately with foraminiferal zones F-15 and F-16 (Anderson, Warren, and Associates, 1974-1979).

J-3b is relatively thin west of the Meade Arch, but thickens to over 800 ft (244 m) in the Ikpikpuk Basin east of the Meade Arch. North of Ikpikpuk 1, J-3b is truncated by the basal "Pebble Shale" unconformity. Seismic stratigraphy indicates that the unit thins toward the south. No wells penetrated J-3b south of Inigok 1. It is not known whether the thinning is real and, if so, whether it is caused by erosional truncation or nondeposition.

J-3b contains many thin sandstone layers, particularly near the base of the unit.

NOTE: CONTOURING IN WEST BASED ON SEISMIC STRATIGRAPHIC INTERPRETATION.

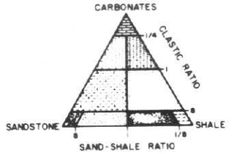




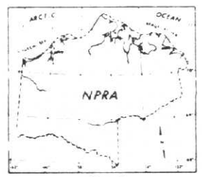
0 10 20 30 40 50
KILOMETERS
0 10 20 30
MILES

EXPLANATION

SAND-SHALE RATIO — CLASTIC RATIO (IF CALCULATED)
1/2, 1/4
ALASKA I
251' THICKNESS (ISOPACH)
N.R. NOT REACHED
N.P. NOT PRESENT



O LOCATION
ABANDONED WELL
ABANDONED WELL (GAS SHOW)
ABANDONED WELL (OIL SHOW)
GAS WELL
OIL WELL
ABANDONED OIL WELL



INDEX MAP

TETRA TECH, INC
HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

ISOPACH & LITHOFACIES MAP
J-3b

NPR — ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC

PROJECT MANAGER: J.W. BRUYNZEEL	PROJECT NO. T.C.7174	
INTERPRETATION BY: D.A. HIGGS	REVISED DATE	INITIAL
DATE: SEPT. 1980 DATUM:	AUG 1981	A.G.
CONTOUR INT: 100' SCALE:	DWG NO.	

TETRA TECH REPORT NO. 8200

FIGURE 58

TGC0170

FIGURE 59

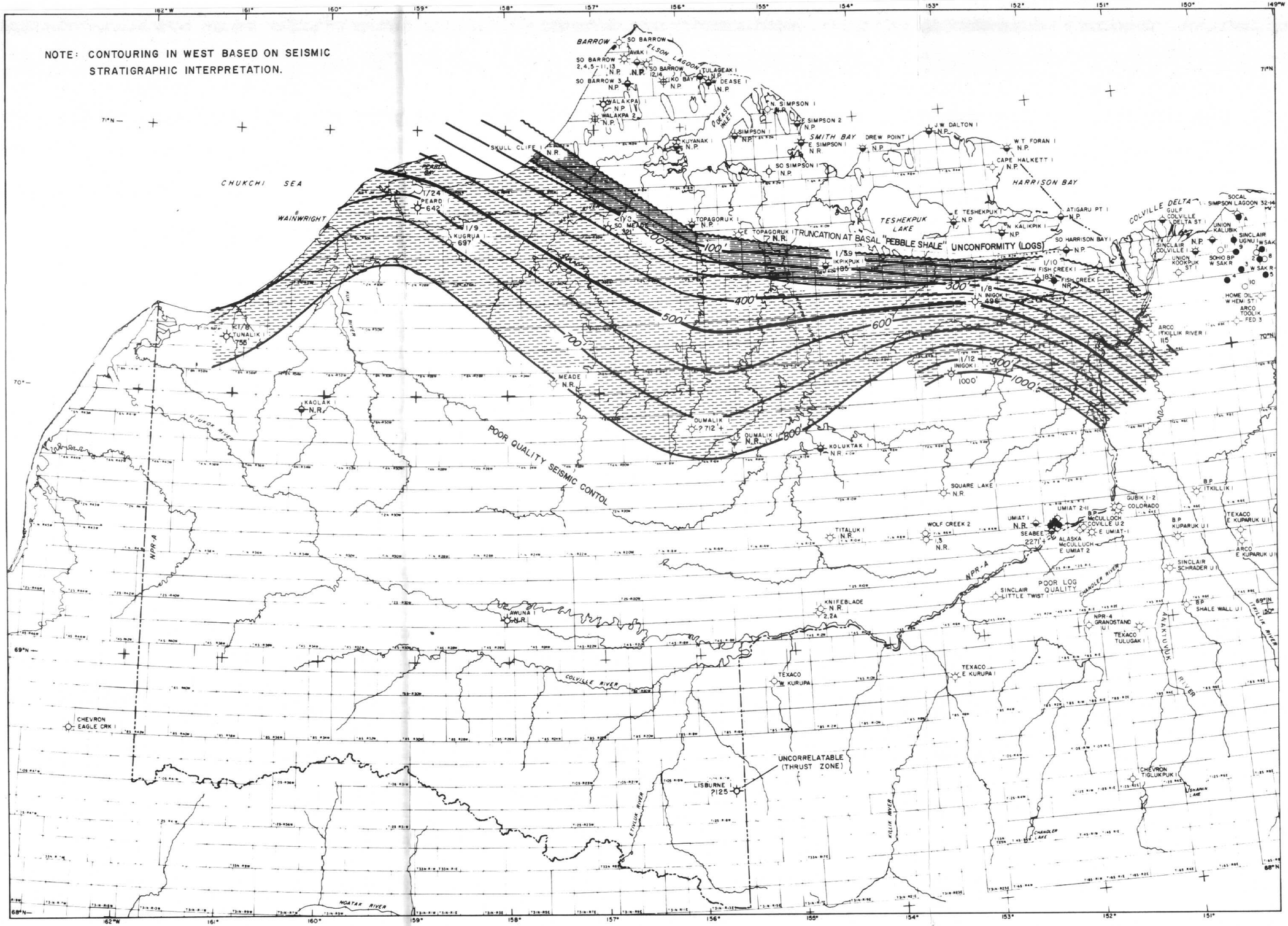
ISOPACH AND LITHOFACIES MAP, J-3c

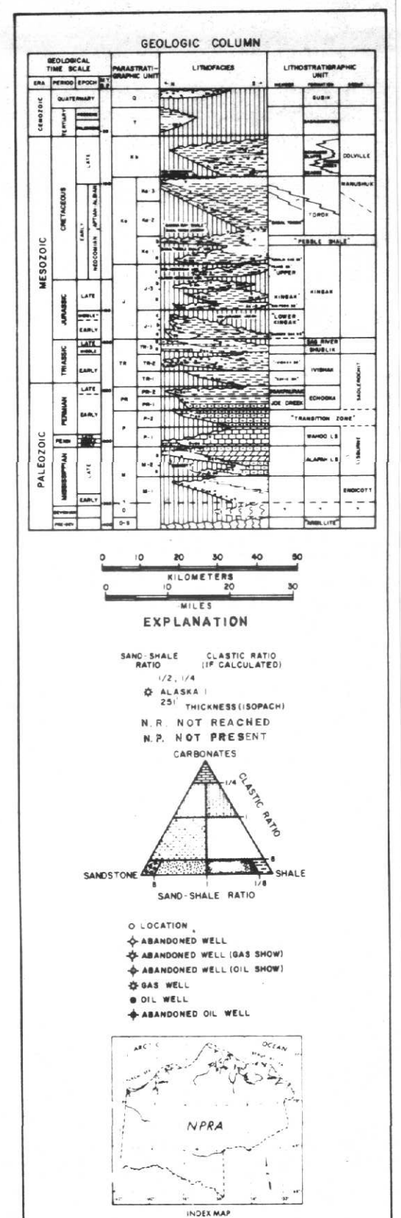
Well	Thickness		Sand-Shale Ratio
	Feet	Meters	
West Fish Creek 1	183	56	1/10
Ikpikpuk 1	185	56	1/3.9
Inigok 1	1,000	305	1/12
North Inigok 1	496	151	1/8
Kugrua 1	697	212	1/9
Lisburne 1	125(?)	38	n.d.*
South Meade 1	321	98	<1/8
Oumalik 1	712+	217+	n.d.
Peard 1	642	196	1/24
Seabee 1	2,271+	692+	n.d.
Tunalik 1	755	230	<1/8
Arco Itkillik River 1	115	35	n.d.

*n.d., not determined.

The J-3c unit includes the earliest Neocomian "Upper Kingak" strata below the mid-Neocomian unconformity or the basal "Pebble Shale" unconformity.

J-3c is shown to be more sandy toward the north, near the truncation by the basal "Pebble Shale" unconformity; however, this effect is mainly statistical. The lower part of the unit, which contains more sand, occurs below the unconformity to the north where the finer clastic fractions are missing. The unit is composed mainly of siltstone and shale.





TETRA TECH, INC.
HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

ISOPACH & LITHOFACIES MAP

J - 3C

NPR — ALASKA

FOR

ONPRA

HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J. W. BRUYNZEEL		PROJECT NO. TC-7174 REV-003	
INTERPRETATION BY: D.A. HIGGS		DATE	INITIAL
DATE: SEPT 1980	DATUM:	AUG 1981	A.G.
CONTOUR INT: 100'	SCALE:	DWG NO.	

TETRA TECH REPORT NO. 8200

TGC-0170

FIGURE 59

FIGURE 60

TYPE LOG OF J-3c AND Ka-1a PARASTRATIGRAPHIC UNITS, TUNALIK 1

Units J-3c and Ka-1a are best shown at Tunalik 1 between 10,900 ft (3,323 m) and 13,360 ft (4,072 m).

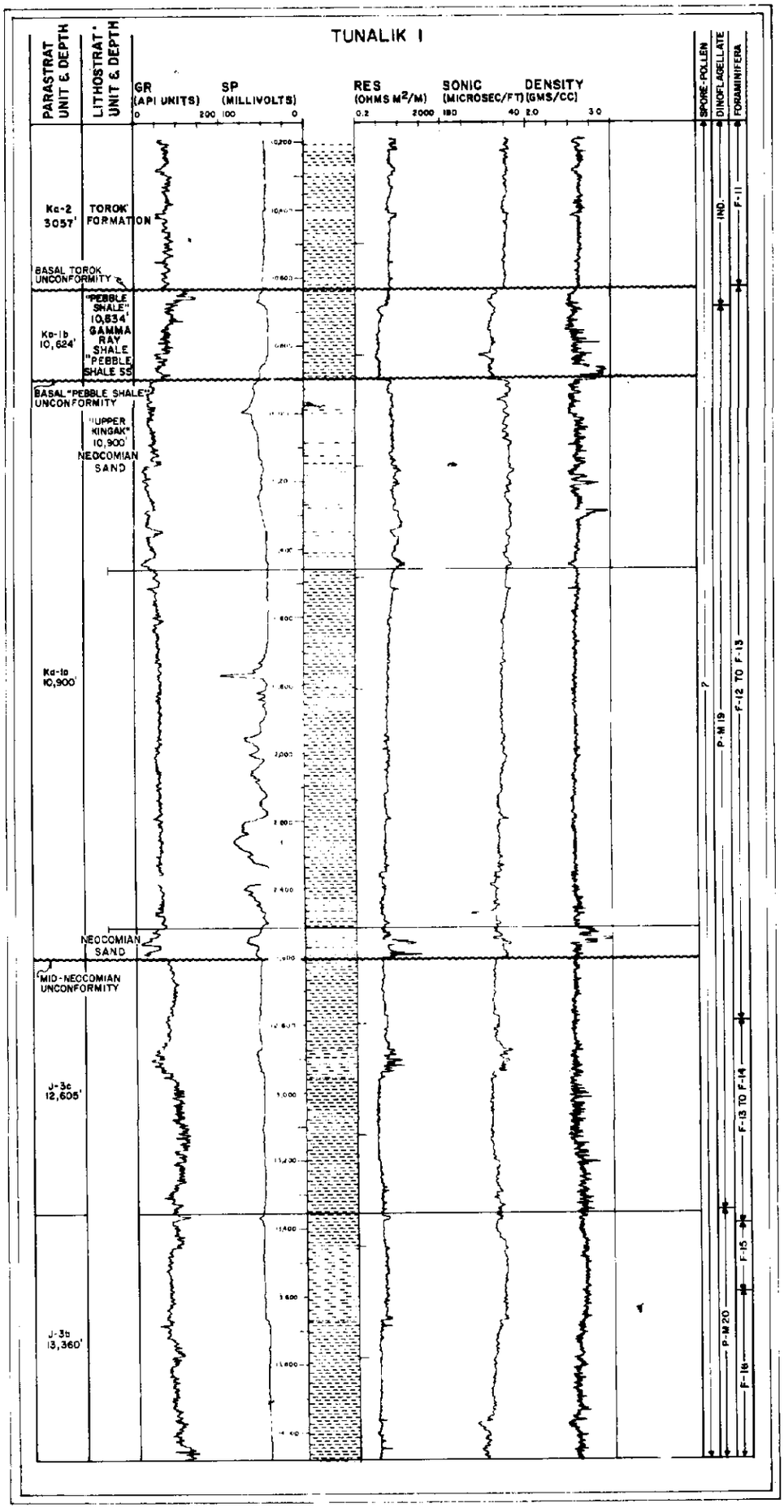
Unit J-3c is difficult to separate from the underlying J-3b. These units consist mainly of shale and lack many definitive log markers. In most places, the top of J-3b is located near a log "shoulder" caused by a rightward shift of the gamma-ray curve; a leftward shift of either the resistivity, sonic, or density curve; or both.

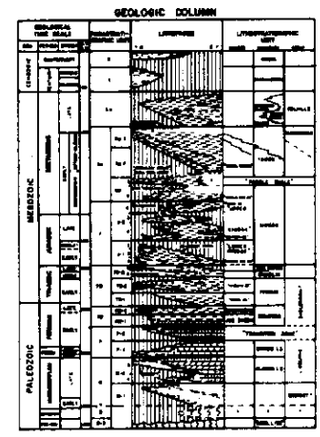
The top of J-3c is picked at the basal "Pebble Shale" unconformity in all wells except Tunalik 1. At Tunalik 1, the top of J-3c is under a Neocomian sand at 12,605 ft (3,842 m). The log shifts are leftward deflections in the gamma-ray and spontaneous potential curves and rightward deflections in the resistivity and sonic curves. The behavior of log curves at the basal "Pebble Shale" unconformity varies according to the presence or absence of the "Pebble Shale" sandstone above the unconformity.

The boundary between J-3b and J-3c is picked near the boundary between AWA foraminiferal zones F-15 to F-16 and F-13 to F-14 (Anderson, Warren, and Associates, 1974-1979), and between dinoflagellate zonules P-M20 and P-M19. The J-3b unit is entirely Late Jurassic, whereas J-3c is Late Jurassic to Early Neocomian.

The boundary between J-3c and overlying parastratigraphic units is picked near the top of AWA foraminiferal zone F-13 to F-14. The Ka-1a unit, which was recognized only at Tunalik 1, overlies the mid-Neocomian unconformity and is in AWA foraminiferal zone F-12 to F-13 and dinoflagellate zonule P-M19.

At Tunalik 1, the bottom of Ka-1a is picked at 12,605 ft (3,842 m), which is below the Neocomian sands, and the top is picked at the boundary between the Neocomian sands and the "Pebble Shale" at 10,900 ft (3,322 m). The sands are 570 ft (174 m) thick at the top of unit Ka-1b.





TETRA TECH, INC
HOUSTON, TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA, CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

TYPE LOG OF J-3c AND Ka-1a PARASTRATIGRAPHIC UNITS
TUNALIK I

NPR — ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J. W. BRUYNZEEL		PROJECT NO. TC-7174
INTERPRETATION BY: STAFF		REVISED: DATE / INITIAL
DATE: SEPT., 1981	DATUM:	
CONTOUR INT.:	SCALE:	DWG NO.

TETRA TECH REPORT NO. 6200

FIGURE 60

T62-0170

FIGURE 61

ISOPACH AND LITHOFACIES MAP, Ka-1b

Well	Thickness Feet	Thickness Meters	Sand-Shale Ratio
Atigaru Point 1	43	13	n.d.*
South Barrow 3	430	131	<1/8
South Barrow 13	396	121	1/4.8
South Barrow 17	362	110	<1/8
Cape Halkett 1	326	99	1/2.7
J. W. Dalton 1	271	83	<1/8
West Dease 1	464	141	<1/8
Drew Point 1	184	56	1/12
W. T. Foran 1	204	62	1/5.2
Iko Bay 1	381	116	<1/8
Ikpikpuk 1	248	76	1/3.3
Inigok 1	218	66	<1/8
North Inigok 1	264	66	<1/8
North Kalikpik 1	259	79	n.d.
Kugrua 1	416	127	1/5.2
Kuyanak 1	517	158	1/5.6
Lisburne 1	750(?)	229	1/5.1
South Meade 1	306	93	<1/8
Ounalik 1	280	85	n.d.
Peard 1	382	116	1/11
Seabee 1	272	83	1.1
Simpson 1	340	104	<1/8
East Simpson 1	211	64	<1/8
East Simpson 2	202	62	<1/8
South Simpson 1	255	78	1/2
East Teshekpuk 1	279	85	1/2.9
Topagoruk 1	330	101	n.d.
Tulageak 1	447	136	<1/8
Tunalik 1	266	81	1/2.4
Walakpa 1	382	116	<1/8
Walakpa 2	434	132	<1/8
Sinclair Colville 1	350	107	1.0
Arco Itkillik River 1	325	99	1/2.3

*n.d., not determined.

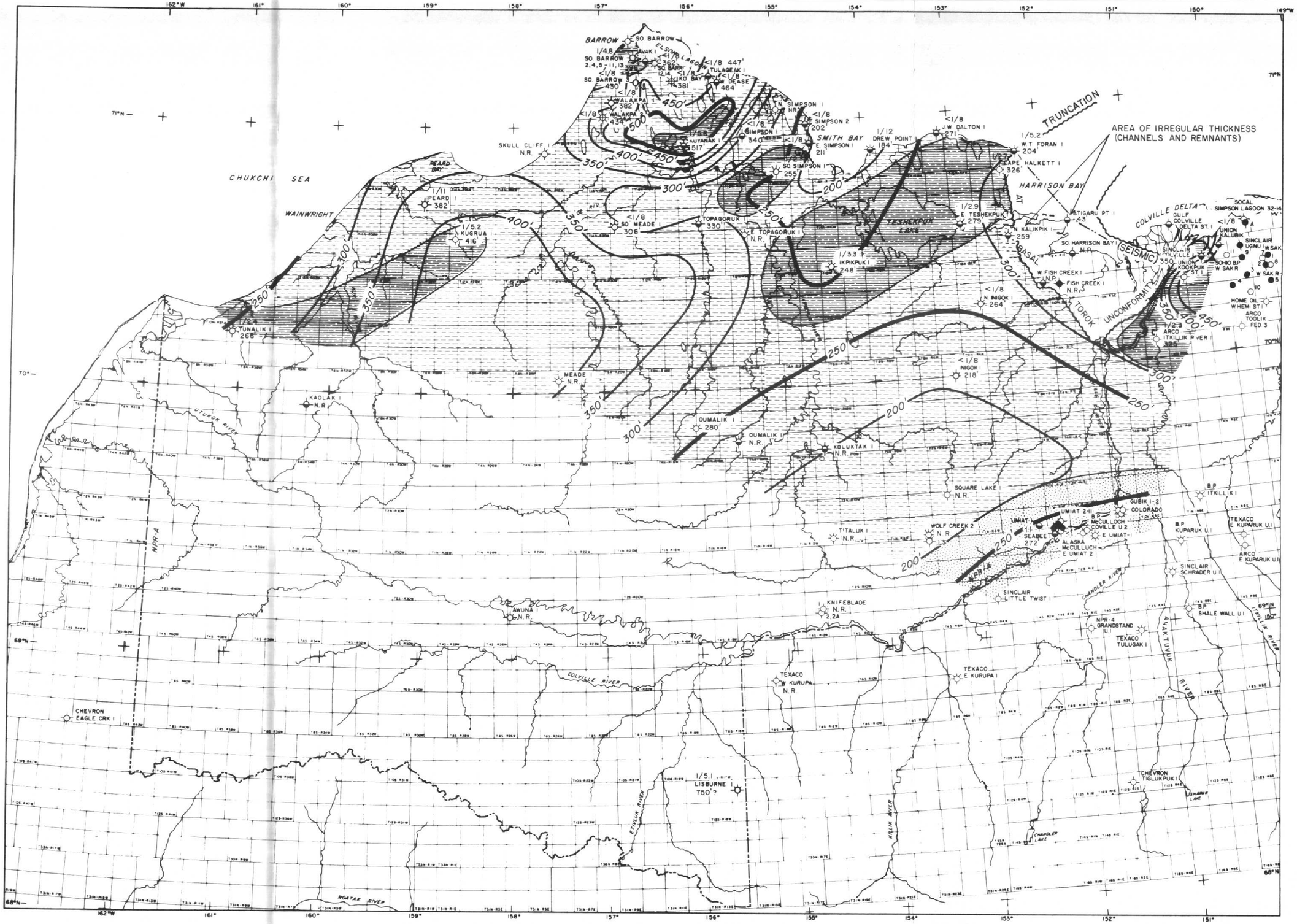
FIGURE 61

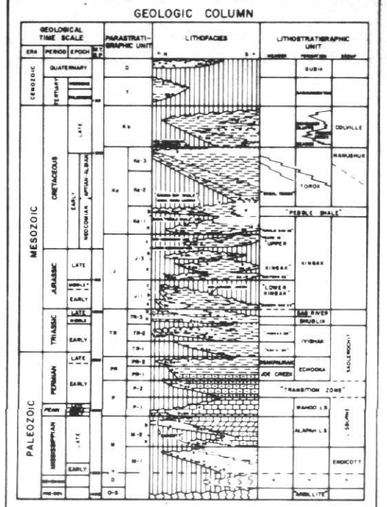
Unit Ka-1b coincides with the "Pebble Shale" unit and is one of the most widespread and easily distinguished units in the northern NPRA subsurface. It is lithologically distinct and homogeneous, well defined on logs, and easily traced on seismic sections.

The Ka-1b unit is thinnest near the Fish Creek Platform and on the south and southeast flank of the Barrow High. On the Fish Creek Platform, the unit thins and is absent in South Harrison Bay 1 and West Fish Creek 1. There, the "basal Torok" lies directly on the J-3 ("Upper Kingak") unit. The Ka-1b unit may be absent from the Fish Creek Platform area because of either nondeposition or subaqueous erosion.

The Ka-1b unit is more difficult to identify south of 70° N. The distinctive "Gamma Ray Shale" zone that is the log "signature" of this unit is not as well marked in Seabee 1 and Lisburne 1. The unit also loses its seismic character to the south, where it is likely that the "Pebble Shale" unit merges with the Okpikruak Formation.

In the north, the Ka-1b unit is composed mainly of dark, organic shales. A series of northeast-trending sand bodies, informally named the "Pebble Shale" sandstone, are present under the Arctic coast in the Prudhoe Bay area, Smith Bay-Harrison Bay area, and southwestern flank of the Meade Arch. The "Pebble Shale" also contains a significant amount of sandstone toward the south, particularly in the Umiat area.





EXPLANATION

SAND-SHALE RATIO — CLASTIC RATIO (IF CALCULATED)

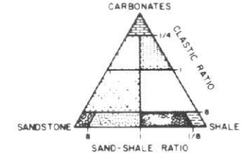
1/2, 1/4

ALASKA I

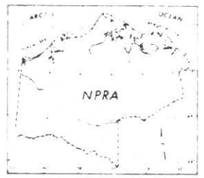
251' THICKNESS (ISOPACH)

N.R. NOT REACHED

N.P. NOT PRESENT



- LOCATION
- ABANDONED WELL
- ABANDONED WELL (GAS SHOW)
- ABANDONED WELL (OIL SHOW)
- GAS WELL
- OIL WELL
- ABANDONED OIL WELL



INDEX MAP

TETRA TECH, INC.
HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

ISOPACH & LITHOFACIES MAP
Ka-Ib

NPR — ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J.W. BRUYNZEEL		PROJECT NO. TC-7174	
INTERPRETATION BY: R.M. PRATT		REVISED DATE	INITIAL
DATE: OCT 1978	DATUM:	SEPT 1979	M.C.G./J.W.B.
		SEPT 1980	R.M./E.C.F.
CONTOUR INT. 50'	SCALE	SEPT 1981	V.E.B./A.G.

TETRA TECH REPORT NO. 8200

TGZ-0170

FIGURE 61

FIGURE 62

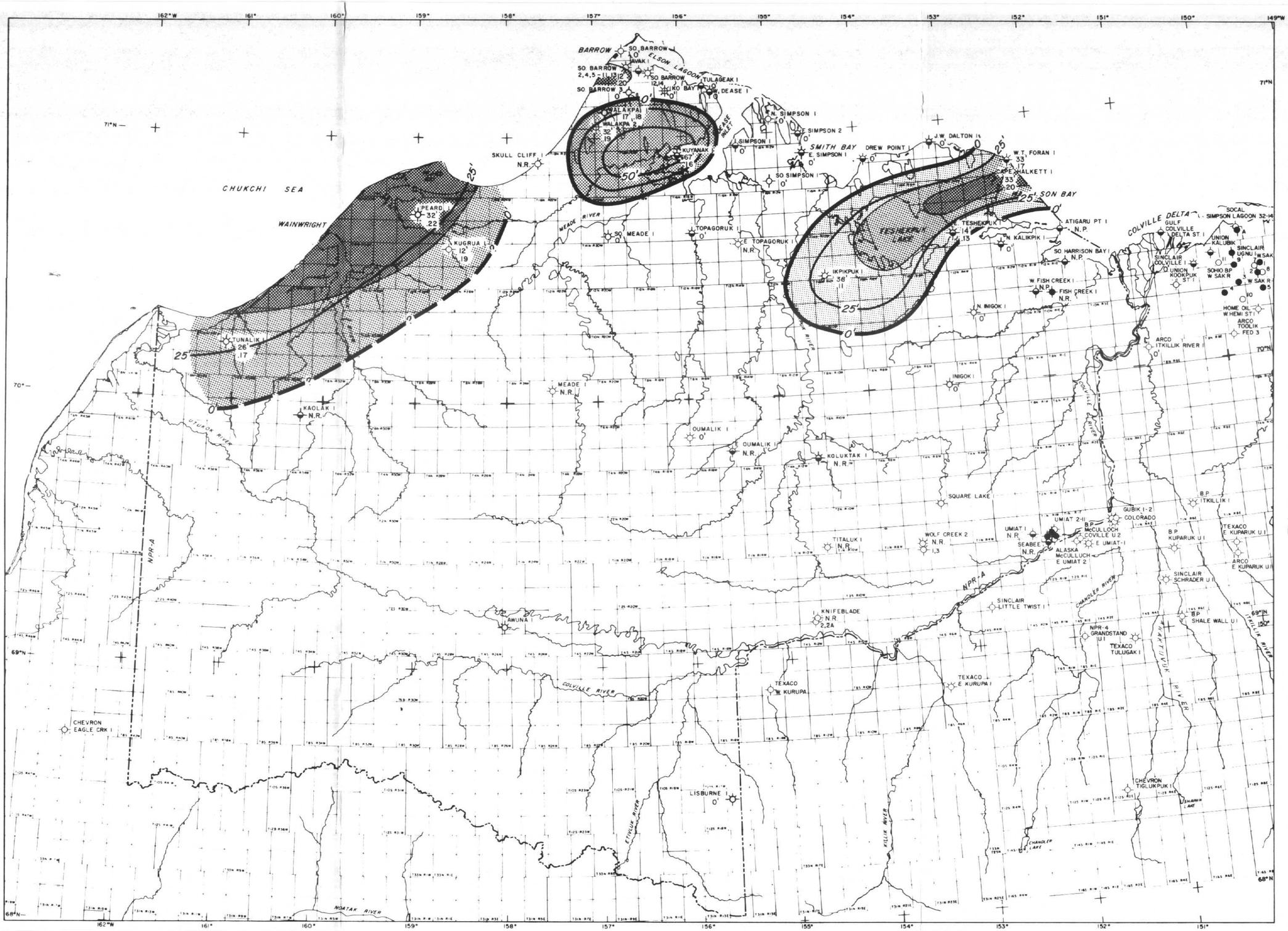
POTENTIAL RESERVOIR AND AVERAGE POROSITY MAP OF BASAL "PEBBLE SHALE" SANDSTONE

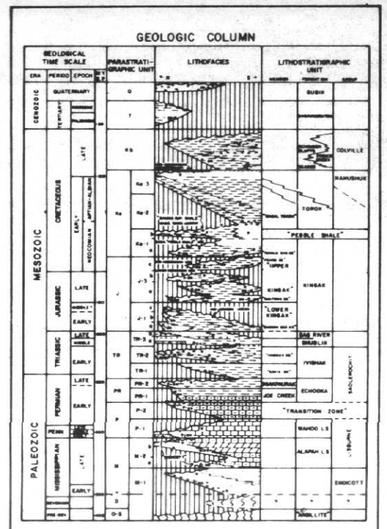
Well	Thickness Feet	Thickness Meters	Average Porosity (Percent)
South Barrow 13	12	4	20
Cape Halkett 1	33	10	20
W. T. Foran 1	33	10	17
Ikpikpuk 1	38	12	11
Kugrua 1	12	4	19
Kuyanak 1	67	21	16
Peard 1	32	10	22
East Teshekpuk 1	14	4	13
Tunalik 1	26	8	17
Walakpa 1	17	5	18
Walakpa 2	32	10	19

The "Pebble Shale" sandstone reservoir includes several discontinuous sand bodies present in the basal part of Ka-1b in the northern NPRA. Biostratigraphic studies suggest a Berriasian to Valanginian age for these sands (Anderson, Warren, and Associates, 1974-1979).

At Walakpa 2, commercial quantities of gas are present in the 32-ft (10-m) thick "Walakpa gas sandstone," with 19 percent average porosity. Previously, the "Walakpa gas sandstone" was considered to be part of unit J-3, but based on paleontological information from Walakpa 2, it is now considered to be part of Ka-1b. The sand body observed in the Barrow area wells is probably separate from the "Walakpa gas sandstone."

In the western NPRA, minor oil and gas shows were observed at Kugrua 1, Peard 1, and Tunalik 1. In the northeastern NPRA, both reservoir thickness and average porosity increase northeasterly from Ikpikpuk 1 (38 ft (11 m) thick, 11 percent average porosity) to Cape Halkett 1 (33 ft (10 m) thick, 20 percent average porosity). At W. T. Foran 1, minor amounts of gas were present within the "Pebble Shale" sandstone.





0 10 20 30 40 50 KILOMETERS

0 10 20 30 MILES

EXPLANATION

ALASKA I
251' THICKNESS (POTENTIAL RESERVOIR)
10 PERCENT POROSITY

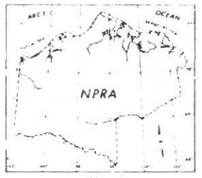
N.R. NOT REACHED

N.P. NOT PRESENT

0 7 10 15 20 25 30

AVERAGE POROSITY (PER CENT)

O LOCATION
ABANDONED WELL
ABANDONED WELL (GAS SHOW)
ABANDONED WELL (OIL SHOW)
GAS WELL
OIL WELL
ABANDONED OIL WELL



INDEX MAP

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HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

POTENTIAL RESERVOIR & AVERAGE POROSITY MAP OF BASAL "PEBBLE SHALE" SANDSTONE

NPR — ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC

PROJECT MANAGER: J.W. BRUYNZEEL	PROJECT NO. TC 7174
INTERPRETATION BY: GEOLOGICAL STAFF	REVISED: DATE / INITIAL
DATE: FEB 1982	DATUM:
CONTOUR INT: 25	SCALE:
TETRA TECH REPORT NO. 8200	DWG NO.

FIGURE 62

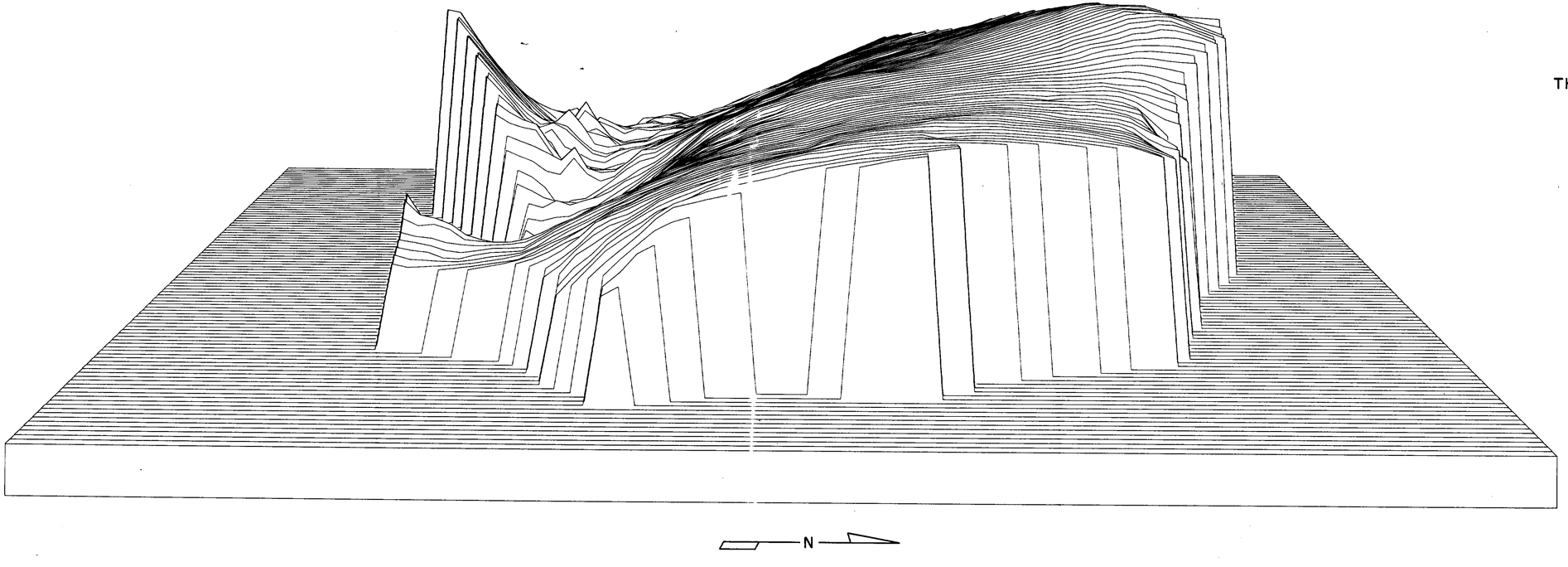
TGE-0170

FIGURE 63

THREE-DIMENSIONAL PERSPECTIVE
OF HORIZON 0700

This computer-plotted image of horizon 0700 as viewed from the east was generated from about 6,000 records in an NPRA geophysical data base. The illustration is a generalized configuration of the top of unit Ka-1b ("Pebble Shale") as represented by horizon 0700.

FIGURE 63



THREE - DIMENSIONAL
PERSPECTIVE OF
HORIZON 700

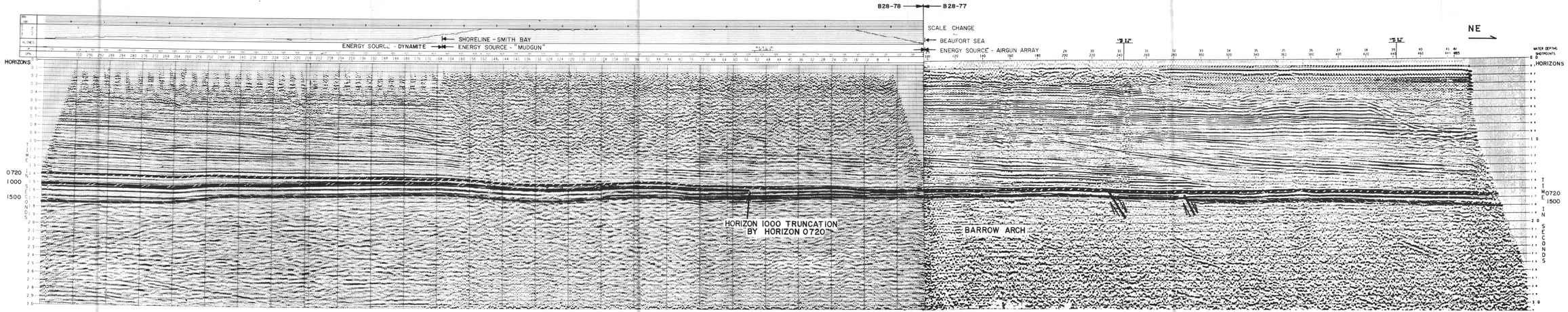
TGZ-D170
FIGURE 63

FIGURE 64

FIGURE 64

LINE B28-78-G-1182, SHOTPOINTS 4-300, AND
LINE B28-77-G-1182, SHOTPOINTS 100-485,
SCALED FINAL STACK

Lines B28-78 and B28-77 extend northeasterly offshore from the Teshekpuk Quadrangle into the Beaufort Sea. These lines cross the Barrow Arch, an east-southeast trending basement feature. The Barrow Arch is mostly just offshore of the NPRA in the Beaufort Sea, and is defined by the change of the regional dip of sediments in the northern NPRA from south to north-northeast. Potential traps in this area are stratigraphic, as much of the pre-Cretaceous section terminates because of truncation by the basal "Pebble Shale" unconformity (horizon 0720) or onlap onto the Arch.



USGS
ONPRA

HUSKY OIL NPR OPRS. INC
NATIONAL PETROLEUM RESERVE ALASKA
BARROW AREA

B28-78-G-1182

SHOTPOINTS 4 - 300
B28-77 SHOTPOINTS 100-485

SCALED FINAL STACK

FIGURE 56

0 5 10
MILES
SCALE FOR LINE B28-78

0 5 10
MILES
SCALE FOR LINE B28-77

TETRA TECH REPORT NO. 6200 TGZ-0170

FIGURE 65

FORAMINIFERA CORRELATION CHART
OF KEY NPRA WELLS

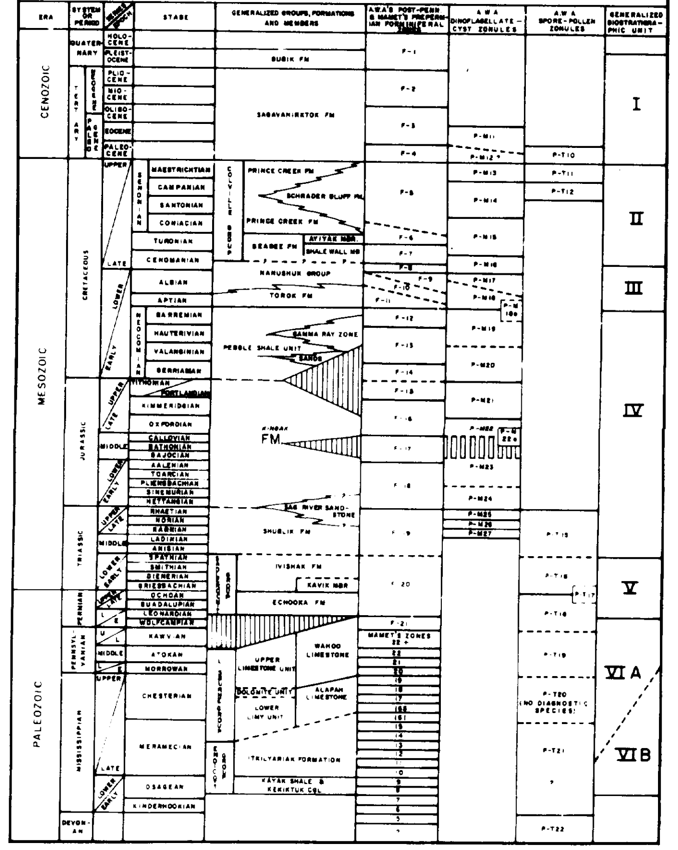
In figure 65, "F" designates foraminiferal zonules and "Z" denotes Mamet's carboniferous zones. The indeterminate intervals, which are barren of fossils, are bracketed by intervals where fossils were found.

Lisburne 1 was drilled in an area of complex thrust faults. The foraminiferal zones listed for Lisburne 1 are from plate 1 only. (See figure 69 for definition of plates 2-5.)

FORAMINIFERA ZONULES & MAMET'S CARBONIFEROUS ZONES.	ATIGARU PT. 1	AWUNA 1	* S. BARROW 3	S. BARROW 13	S. BARROW 17	CAPE HALKETT 1	J.W. DALTON 1	W. DEASE 1	DREW POINT 1	W. FISH CREEK 1	W.T. FORAN 1	S. HARRISON BAY 1	IKO BAY 1	IKPIKPUK 1	INIGOK 1	N. INIGOK 1	N. KALIKPIK 1	KOLUKTAK 1
F-1	N.P	N.P	N.P	N.P	N.P	N.P	90	N.P	80	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P
F-2	N.P	N.P	N.P	N.P	N.P	N.P	↓	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.F
F-3	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P
F-4	N.P	N.P	N.P	N.P	N.P	N.P	210	N.P	N.P	N.P	?500	N.P	N.P	N.P	N.P	?120	N.P	N.P
F-5 (Poor Marine)	530	N.P	N.P	N.P	N.P	510	N.P	N.P	N.P.	N.P	1010	500	N.P	N.P	N.P		N.P	N.P
F-5	980	N.P	N.P	N.P	N.P	1100	1050	N.P	140	500	1580	950	N.P	N.P	N.P	↓	80	N.P
F-5 to F-6	2300	N.P	N.P	N.P	N.P	2190	1950	N.P	350	1220	2450	2090	N.P	N.P	110	N.P	1100	N.P
F-6	2630	N.P	N.P	N.P	N.P	2440	2160	N.P	620	1550	2840	2330	N.P	N.P	560	N.P	1340	N.P
F-7	3080	N.P	N.P	N.P	N.P	2940	2550	N.P	1040	2090	3410	2880	N.P	N.P	1490	1590	2030	N.P
F-8	3410	N.P	N.P	N.P	N.P	3340	2730	N.P	1610?	2510	3650	3210	N.P	100 / 160	2090	?2040?	2450	N.P
F-9	3530	N.P	1216 / ?1397	200	N.P	3610	2820	100	1760	2630	3770	3330	180	740	2360	2220 / 3400	2570	110
F-10	↓	N.P			100	4430 / 5600	3600?	690	2860	↓	5000	↓		3485	3520	4170	4265	3420
F-11	5630	5310 / 8740	↓	↓	1000	6800	4740	1850	4740	4800	5950	5260	↓	5180	5130	5700	5180	N.R.
F-12; F-12 to F-13	7282	N.R.	?	?1740	1450	7320 / 7510	7380 / 7620	2930	6740	7250	7380 / 7510	N.P	1520	7240 / 7420	9060	7490	6970	N.R.
F-13; F-14; F-13 to F-14	N.P	N.R.	E. Cret.-Jur. ?1624	↓	1730	N.P	N.P	N.P	N.P	N.P	N.P	N.P	↓ 1850	7480	9480	7790	N.P	N.R.
F-15	N.P	N.R	↓ ?	L. Jur ?2080	N.P	N.P	N.P	N.P	N.P	7280	N.P	7270		8100	10260	N.P	N.P	N.R.
F-16	N.P	N.R.	Jur ?1638	↓	N.P	N.P	N.P	N.P	N.P	↓ 7870	N.P	↓ 7360	↓	↓ 8190	↓ 11006	8570	7137	N.R.
F-17	7340	N.R.	↓ ?	M-E Jur. ?2220	N.P	7630	N.P	N.P	N.P	8910	N.P	8230	2000	9180	11670	8930?	N.R	N.R
F-18	↓	N.R	E. Jur ?1999	↓	1820 / 2080	↓	N.P	N.P	6905	↓	N.P	↓	↓	↓	↓	↓	N.R	N.R
F-18 to F-19	? / 8250	N.R	? / Tri ?2631	? / Tri ?2411	?	7780 / 7850	N.P	3360	? / 6956	? / 9210	N.P	? / 8910	N.P	9600 / 9910	N.P	N.P	N.R	N.R
F-19	8310	N.R		↓	2170	7930	7730	3732	6977	9270	7590	8970	2448	10110	12210	10100	N.R	N.R
F-19 to F-20	N.P	N.R		N.P	N.P	N.P	N.P	4012	N.P	9510	N.P	9240	N.P	10390	N.P	N.R.	N.R	N.R
F-20	8580	N.R	↓ ? / 2643	N.P	N.P	8160	7880		7554	9660	7650	9360	N.P	10570	12480	N.R	N.R	N.R
F-21	9490	N.R.	N.P	N.P	N.P	N.P	N.P		N.P	N.P	N.P	10210	N.P	11380	13890	N.R	N.R	N.R
Z-21+	9550	N.R.	N.P	N.P	N.P	N.P	8317		N.P	10470	N.P	10275	N.P	11830	14150	N.R	N.R	N.R
Z-21	9910	N.R.	N.P	N.P	N.P	8820	8560		N.P	10620	8200	10720	N.P	12480	14740	N.R.	N.R	N.R
Z-20	10270	N.R.	N.P	N.P	N.P	9020	8980 / 9160		N.P	10950	8500	11170	N.P	12930	15215	N.R.	N.R	N.R
Z.18 to Z.19	10460	N.R.	N.P	N.P	N.P	9160			N.P	11100	N.P	N.R.	N.P	13480	15740	N.R	N.R	N.R
Z.17 to Z.18 Dolomite Unit	10640	N.R.	N.P	N.P	N.P	N.P			N.P	11160	N.P	N.R.	N.P	13760	16220	N.R	N.R	N.R
Z-16	?10760 / 10850	N.R.	N.P	N.P	N.P	L. Miss ?9320			N.P	11310	8590	N.R.	N.P	L. Miss ?14000	L. Miss ?16490	N.R	N.R	N.R
Z.14 to Z.15	?	N.R.	N.P	N.P	N.P				N.P			N.R.	N.P	Miss. ?14850	18110	N.R	N.R	N.R
Z.13 or Older	?	N.R.	N.P	N.P	N.P	↓	↓ ?		N.P	↓		N.R.	N.P	↓ ?		N.R	N.R	N.R
Devonian ?	N.P	N.R.	N.P	N.P	N.P	N.P	N.P		N.P	N.R.	↓	N.R.	N.P	N.P		N.R	N.R	N.R
Argillite	11330	N.R.	N.R.	2460	2344	9779	9250	↓	7830	N.R.	8770	N.R	N.R.	15400	↓	N.R	N.R	N.R
TOTAL DEPTH	11535	11200	2799	2890	2536	9900	9367	4170	7946	11427	8864	11290	2731	15481	20102	10170	7395	882

FORAMINIFERA ZONULES & MAMET'S CARBONIFEROUS ZONES.	KUGRUA 1	KUYANAK 1	LISBURNE 1	S. MEADE 1	* OUMALIK 1	PEARD 1	SEABEE 1	* SIMPSON 1	E. SIMPSON 1	E. SIMPSON 2	S. SIMPSON 1	E. TESHEKPUK 1	* TOPAGORUK 1	TULAGEAK 1	TUNALIK 1	WALAKPA 1	WALAKPA 2	ARCO ITKILLIK RIVER 1
F-1	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P
F-2	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P
F-3	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P
F-4	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P.	N.P	N.P.
F-5 (Poor Marine)	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	80
F-5	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	533	N.P	N.P	N.P.	N.P	N.P	790
F-5 to F-6	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	830?	N.P	N.P	N.P	N.P	N.P	2320
F-6	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P.	N.P	N.P	1050	N.P	N.P	N.P	N.P	N.P	3040
F-7	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P	100	N.P	N.P	1540	N.P	N.P	N.P	N.P	N.P	4480
F-8	N.P	N.P	N.P	N.P	N.P	N.P	N.P	N.P.	460	N.P.	N.P.	1940	N.P	N.P.	N.P	N.P	N.P	5820
F-9	100	100	N.P	95	E. Cret. ?10669	90	115	N.P	670	90 / 1050	510	2100	N.P	105	?90	90	130	6620
F-10	2760	990	N.P	1740		2610	↓ 2340	N.P	1960	2640	2640	3560	N.P	540	5950	↓	↓ ?	
F-11	4110	2980	130	3360		4110?	4110	N.P	3540	3510	3780	4800 / 5700	N.P	1980	7350	900	1060	↓
F-12; F-12 to F-13	6890 / 7190-7220	4680	2200	6500 / 6700	↓ ?	6240 / 6540	Neocom. ?13100	5074 / 5303	6420	6340	6340 / 6520	6930 / 7110	6460 / 6743	2490	10620	1690	2230	7650
F-13; F-14; F-13 to F-14	7450	5058 / 5093	Jur – E. Cret. ?6100	6760	10992	6720	?N.R.	5677?	N.P	N.P	N.P	N.P	7042	N.P	12800	2037	2560	8190
F-15	N.P	N.P		N.P	N.R.	N.P	N.R.	?N.P	N.P	N.P	N.P	N.P	7052 / 7063	N.P	13380	2064 / N.P	?N.P	8730
F-16	8020 / 8700	5165		6970 / 7860	N.R.	7243 / 7830	N.R.	N.P	N.P	N.P	N.P	7200	Prob. Jur ?8104	N.P	↓ 13590	2080 / 2370	2650 / 3010	↓ 8910
F-17	8890	5330		7990	N.R.	7920	N.R.	N.P	N.P	N.P	6700	7530		2949	14040	?	3220	9720
F-18	↓	↓	↓	↓	N.R	↓	N.R.	?5684?	6620	?6600	↓	↓		↓	↓	N.P	↓	↓
F-18 to F-19	9330 / 9520	6310	?	8520 / 8760	N.R.	8280 / 8400	N.R.	?	? / 6740	?	? / 7480	8370 / 8520	↓ ?	3560	N.P	3087	?	? / 10020
F-19	9700	6370	6940	8930	N.R	8532	N.R.	?6304 / 6346	6900	6705 / 7167	7660	8670	? / 9200	3710	14250	3363	3990	10080
F-19 to F-20	N.P	N.P	?	N.P	N.R.	N.P	N.R.	?	?	?	?	N.P	? / ?9416	N.P	N.P	N.P	N.P	10270
F-20	9970	N.P	7210	9170	N.R.	8730	N.R.	?	7460	N.P	8200	9000	Possible Miss.-Perm. ?9816	N.P	14810	N.P	N.P	10350
F-21	11130	N.P	↓	N.P	N.R.	N.P	N.R.	N.P	N.P	N.P	Carb-Perm. ?8590	9655		N.P	17135.5	N.P	N.P	?11520
Z-21+	11600	N.P	N.P	N.P	N.R.	N.P	N.R.	N.P	N.P	N.P	N.P	9680		N.P	19050	N.P	N.P	11580
Z-21	12380	N.P	N.P	N.P	N.R.	N.P	N.R.	N.P	N.P	N.P	N.P	9930		N.P	19550	N.P	N.P	12060
Z-20	?N.R.	N.P	N.P	N.P	N.R.	N.P	N.R.	N.P	N.P	N.P	N.P	10286		N.P	N.R.	N.P	N.P	12400
Z.18 to Z.19	N.R.	N.P	N.P	N.P	N.R.	N.P	N.R.	N.P	N.P	N.P	N.P	10440		N.P	N.R.	N.P	N.P	12840
Z.17 to Z.18 Dolomite Unit	N.R.	N.P	N.P	N.F	N.R	N.P	N.R.	N.P	N.P	N.P	N.P	N.P		N.P	N.R.	N.P	N.P	13230
Z-16	N.R.	N.P	?7390	N.P	N.R	N.P	N.R.	N.P	N.P	?7460	N.P	?10620		N.P	N.R.	N.P	N.P	13510
Z.14 to Z.15	N.R.	N.P	↓	N.P	N.R.	N.P	N.R.	N.P	N.P		N.P			N.P	N.R.	N.P	N.P	
Z.13 or Older	N.R	N.P	L. Miss ?8220	N.P	N.R.	N.P	N.R.	N.P	N.P	↓ ?	N.P	↓	↓ ?	N.P	N.R.	N.P	N.P	↓
Devonian ?	N.R	N.P	N.R.	9530	N.R.	N.P	N.R.	N.P	N.P	N.R.	N.P	N.R.	?N.P	N.P	N.R.	N.P	N.P	N.P.
Argillite	N.R.	?6580	N.R.	N.R.	N.R.	9630	N.R.	?N.P	7620	N.R.	8740	N.R.	N.R.	3950	N.R.	3620?	4290	14950
TOTAL DEPTH	12588	6690	17000	9945	11872	10225	15611	7002	7739	7505	8795	10664	10503	4015	20335	3666	4360	15310

ALASKAN NORTH SLOPE GENERALIZED SUBSURFACE BIOSTRATIGRAPHIC CORRELATION CHART (12/80)
MODIFIED FROM ANDERSON, WARREN, AND ASSOCIATES, INC.



EXPLANATION

- ? — NOT IDENTIFIED
- ?100 — ZONE QUESTIONABLE
- 100? — EXACT DEPTH QUESTIONABLE
- N.P — NOT PRESENT
- N.R — NOT REACHED
- 100 (hatched) — INDETERMINATE
- ↓ — RANGE OF ZONES
- ✳ — BASED ON SCATTERED SAMPLES

TETRA TECH, INC
HOUSTON, TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA, CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

FORAMINIFERA CORRELATION CHART OF KEY NPRA WELLS

PROJECT MANAGER: J. W. BRUYNZEEL	PROJECT NO. TC-7174
COMPILED BY: H. Y. BAIK	REVISED — DATE / INITIAL
DATE: JULY 1981 DATUM:	
CONTOUR INT: SCALE:	DWG NO.

TETRA TECH REPORT NO. 8200

FIGURE 65

TGZ-0170

FIGURE 66

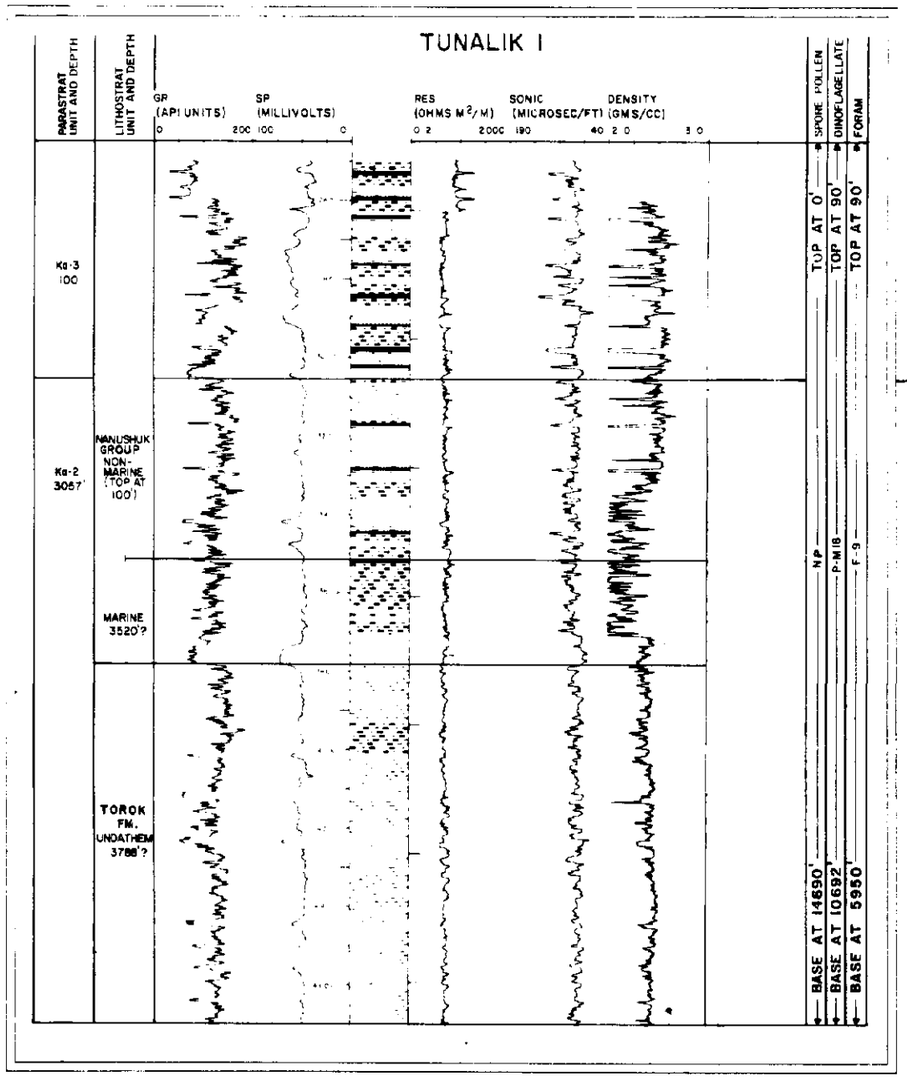
TYPE LOG OF Ka-2/Ka-3 PARASTRATIGRAPHIC UNITS, TUNALIK 1 AND IKPIKPUK 1

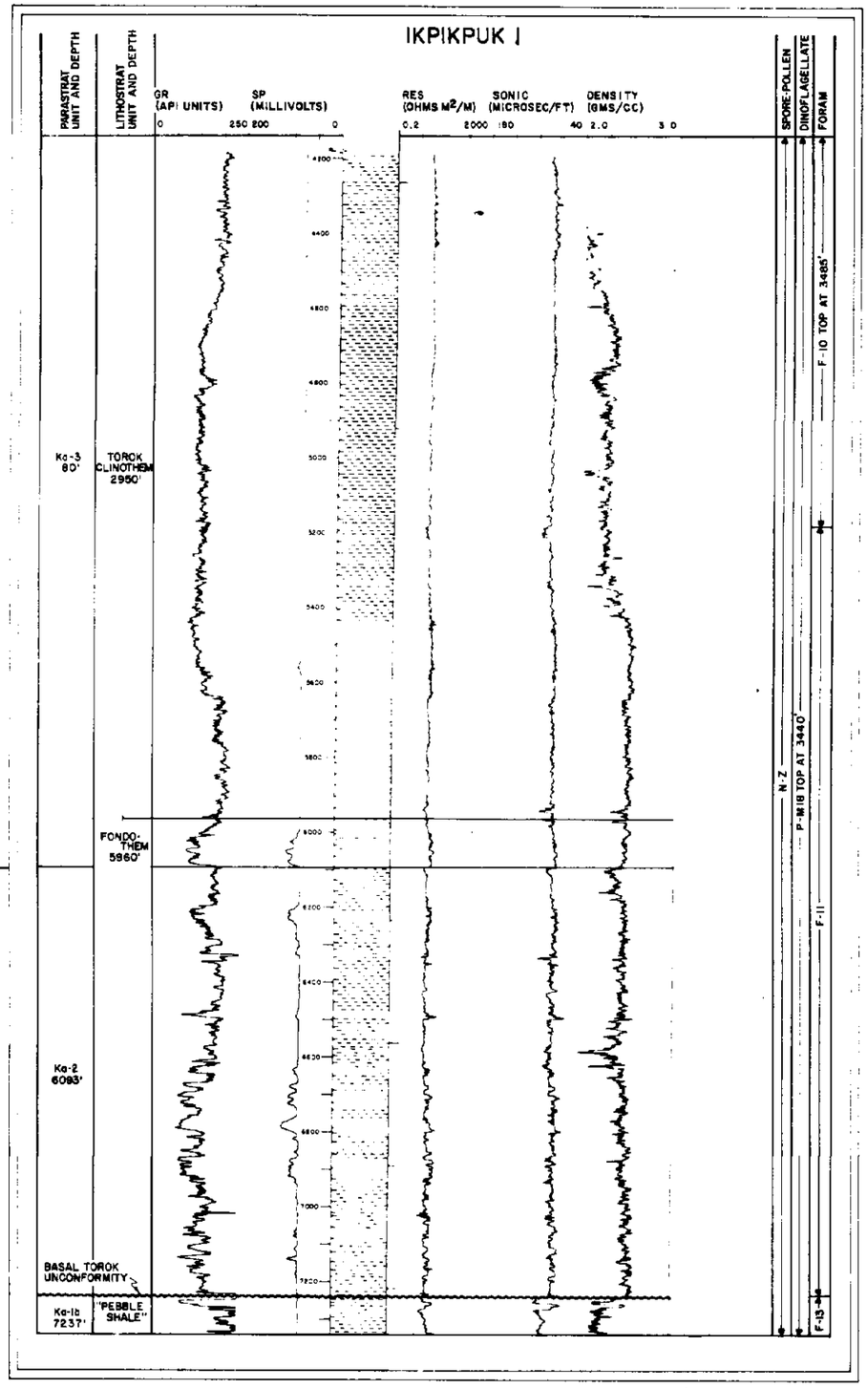
Ka-2 and Ka-3 are parastratigraphic units that are entirely in the Torok-Nanushuk lithostratigraphic sequence. The boundary between the older underlying Ka-2 and the younger overlying Ka-3 cuts through lithofacies. Tunalik 1 and Ikpikpuk 1 are typical wells showing the boundary in the Nanushuk nonmarine rocks and Torok fondothem, respectively.

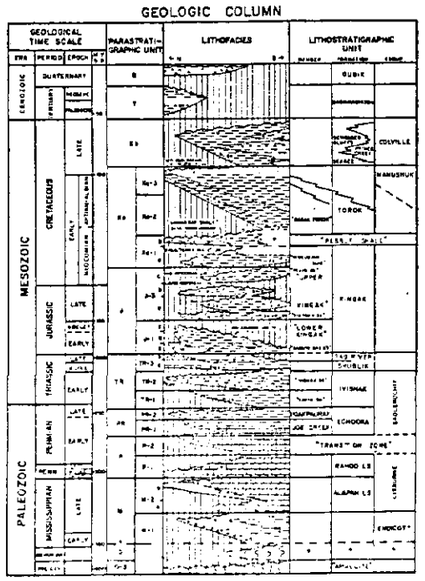
These units are defined almost entirely on seismic character. Ka-2 corresponds to an early stage of the Torok-Nanushuk sequence, including rocks deposited in basin, slope, marine shelf, and continental environments. In compressed seismic sections, Ka-2 contains more lower angle, less well defined clinoform beds than the overlying Ka-3 unit. This may indicate a more rapid and uniform deposition rate for the Ka-2 unit.

Ka-3 corresponds to the remainder of the time-transgressive Torok-Nanushuk sequence. The Torok clinoform beds, as seen on seismic sections, are relatively steeper and more variable than those in the underlying Ka-2 unit, which may indicate a more sporadic depositional history of the Ka-3 unit.

Few consistent and obvious log characters are used to define the boundary between Ka-2 and Ka-3. At Tunalik 1, the Ka-2/Ka-3 boundary is in the Nanushuk nonmarine; at South Meade 1, the boundary is in the Nanushuk marine; at Topagoruk 1, it is in the Torok undathem; and at Ikpikpuk 1, it is in the Torok fondothem. In all cases, the log boundary was picked where log curves indicate a change upward from shale to a more clastic rock. AWA foraminiferal zones F-9, F-10, and F-11 occur in both the Ka-2 and Ka-3 units. These facies-controlled zones are of little value for time-stratigraphic correlations.







TETRA TECH, INC
HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

TYPE LOG OF Ka-2/Ka3
PARASTRATIGRAPHIC UNITS
TUNALIK I, IKPIKPUK I

NPR — ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J. W. BRUYNZEEL	PROJECT NO. TC-7174
INTERPRETATION BY: STAFF	REVISED — DATE / INITIAL
DATE: SEPT., 1981 — DATUM:	
CONTOUR INT: — SCALE:	DWG NO.

TETRA TECH REPORT NO. 8200

FIGURE 66

T62-0170

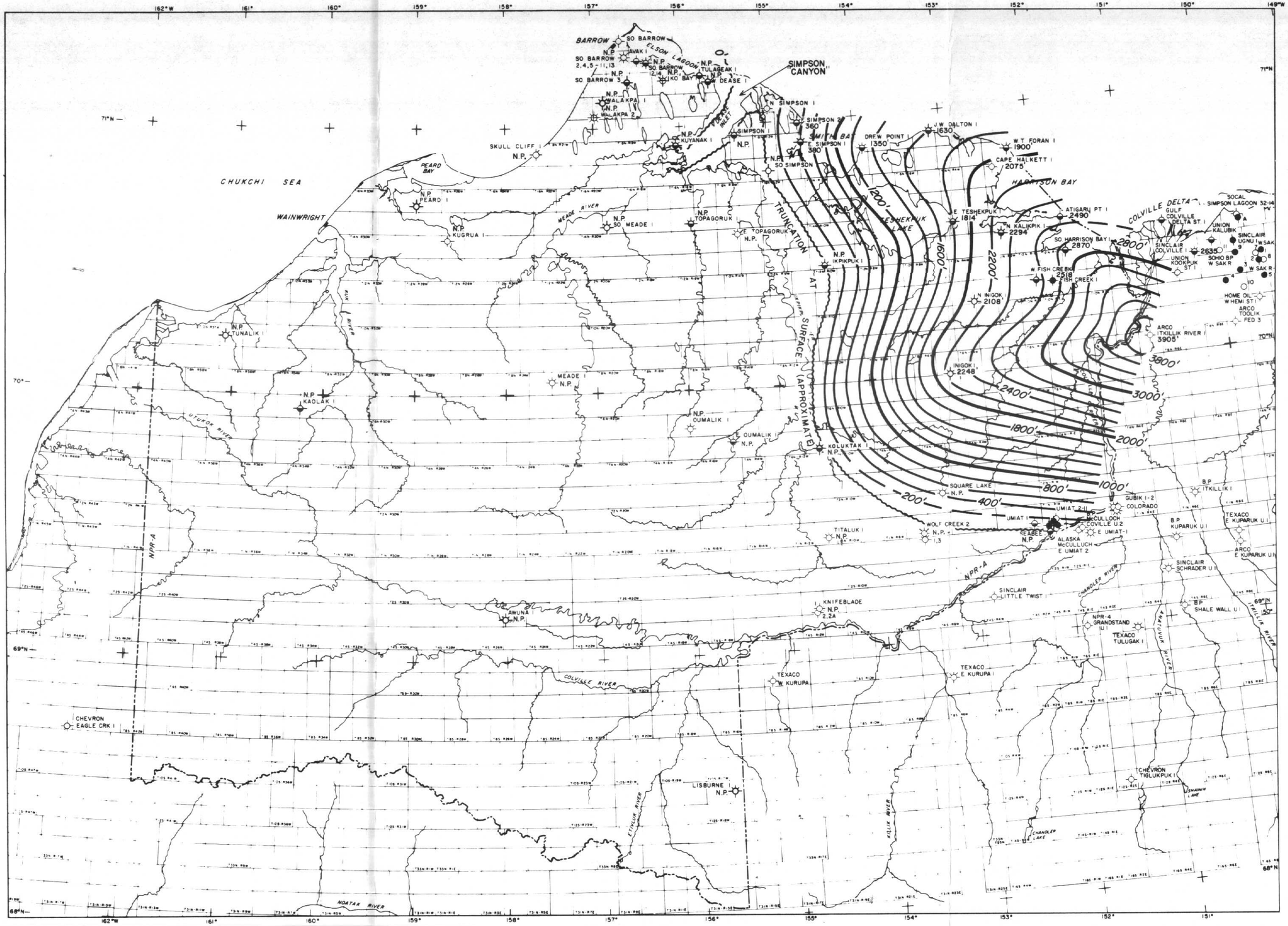
FIGURE 67

ISOPACH MAP, Kb

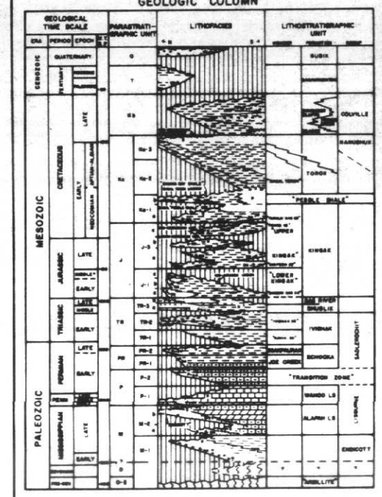
Well	Thickness Feet	Meters
Atigaru Point 1	2,490	759
Cape Halkett 1	2,075	632
J. W. Dalton 1	1,630	497
Drew Point 1	1,350	412
West Fish Creek 1	2,518	767
W. T. Foran 1	1,900	579
South Harrison Bay 1	2,870	875
Inigok 1	2,248	685
North Inigok 1	2,108	643
North Kalikpik 1	2,294	699
East Simpson 1	380	116
East Simpson 2	360	110
East Teshekpuk 1	1,814	553
Sinclair Colville 1	2,635	803
Arco Itkillik River 1	3,905	1,191

The Kb unit represents nearly all the late Cretaceous rocks in the NPRA. The base of Kb is marked by the mid-Cenomanian unconformity, which separates it from the underlying Ka-3 unit. The top of the Kb unit nearly coincides with the top of foraminiferal zone F-5 (Anderson, Warren, and Associates, 1974-1979).

Geographically, Kb is restricted to the northeastern part of the NPRA. The unit is thickest along the Barrow Arch from J. W. Dalton 1 in the northwest to Arco Itkillik River 1 in the southeast, outside of the Reserve. The unit thins by truncation southeast of the Barrow High. At West Fish Creek 1, North Kalikpik 1, East Simpson 1, East Simpson 2, and East Teshekpuk 1, Kb is directly below Quaternary surface deposits. Kb is completely truncated at the surface just east of South Simpson 1, Ikpikpuk 1, and Koluktak 1.



GEOLOGIC COLUMN



0 10 20 30 40 50 KILOMETERS

0 10 20 30 MILES

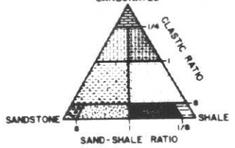
EXPLANATION

ALASKA I
251'
.10 THICKNESS (POTENTIAL RESERVOIR)
PER CENT POROSITY

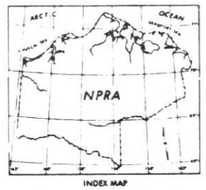
N.R. NOT REACHED

N.P. NOT PRESENT

CARBONATES



- LOCATION
- ABANDONED WELL
- ABANDONED WELL (GAS SHOW)
- ABANDONED WELL (OIL SHOW)
- GAS WELL
- OIL WELL
- ABANDONED OIL WELL



INDEX MAP

TETRA TECH, INC
HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

ISOPACH MAP
Kb

NPR — ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J.W. BRUYNZEEL		PROJECT NO. TC 7174
INTERPRETATION BY: D. HIGGS		REV. NO. / DATE / INITIAL
DATE: AUG 1980	DATUM:	SEPT. 1981 / V.E.B.
CONTOUR INT: 200'	SCALE:	DWG NO.

TETRA TECH REPORT NO. 8200

FIGURE 67

FIGURE 68

PALYNOLOGY CORRELATION CHART
OF KEY NPRA WELLS

In figure 68, "P-M" designates marine dinoflagellate-cyst zonules, "P-T" designates nonmarine spore-pollen zonules, and "N.Z." denotes that no zone or zonule is recognized for a given geologic time span. No dinoflagellate-cyst zonules are recognized for nonmarine rocks in the upper chart, because dinoflagellates and cysts are marine organisms. Conversely, no spore-pollen zonules are recognized for marine rocks in the lower chart because spores and pollen are used to subdivide nonmarine rocks. The indeterminate intervals are rocks barren of fossils and are bracketed by intervals where fossils were found.

Lisburne 1 was drilled in an area of complex thrust faults. The palynologic zonules listed in the chart are for plate 1 only. (See figure 69 for definition of plates 2-5).

For Drew Point 1, two depths are given for the P-M17 zonule on the dinoflagellate-cyst chart. The upper number indicates a questionable P-M17 zonule top, and the lower number is a definite P-M17 zonule top.

FIGURE 68

DINOFLAGELLATE CYST CORRELATION CHART

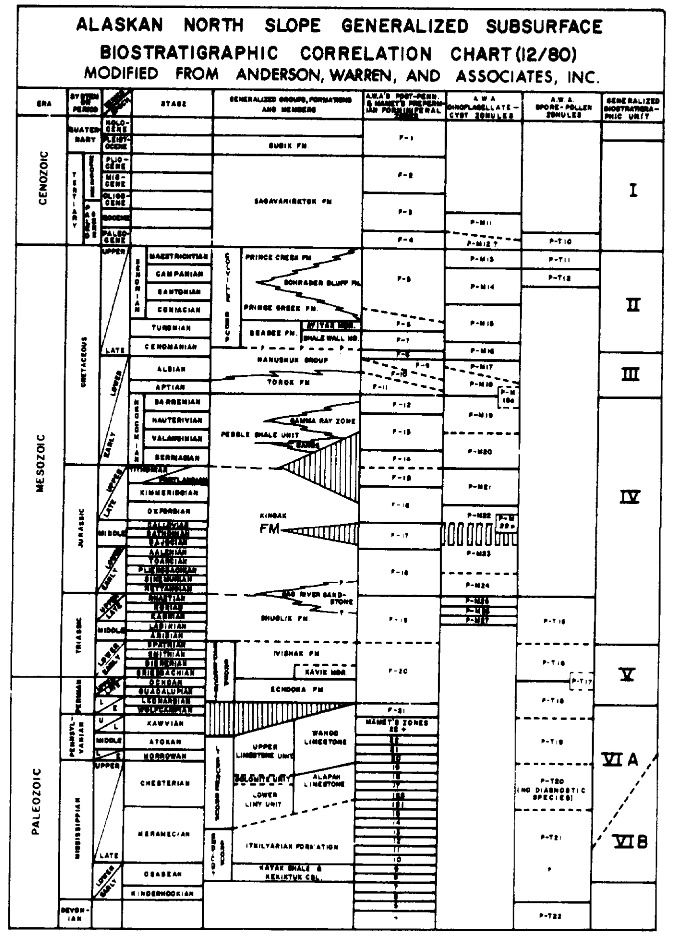
A.W.A. DINOFLAGELLATE CYST ZONULES	ATIGARU PT. 1	AWUNA 1	✱ S. BARROW 3	S. BARROW 13	S. BARROW 17	CAPE HALKETT 1	J.W. DALTON 1	W. DEASE 1	DREW POINT 1	W. FISH CREEK 1	W.T. FORAN 1	S. HARRISON BAY 1	IKO BAY 1	IKPIKPUK 1	INIGOK 1	N. INIGOK 1	N. KALIKPIK 1
P-M 11 to P-M 12	?530	N.P.	N.P.	N.P.	N.P.	510 N.P.	270	N.P.	N.P.	?	500 590	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.
P-M 13	?	N.P.	N.P.	N.P.	N.P.	?	?	N.P.	?	?	?	?	N.P.	N.P.	?	?	?
P-M 14	1520	N.P.	N.P.	N.P.	N.P.	1320	900	N.P.	80	500	1850	950	N.P.	N.P.	110	660	80
P-M 15	2330	N.P.	N.P.	N.P.	N.P.	2040	2160	N.P.	620	770	2570	1850	N.P.	N.P.	560	1100	1010?
P-M 16	2780	N.P.	N.P.	N.P.	N.P.	2500	2520	N.P.	?980	1670	3020	2210	N.P.	100	1460	1650	?1490
P-M 17 (P-M 18 to P-M 17)	3950	N.P.	200	200	N.P.	3357	2970	N.P.	?1610 1790	2840	4010	3376	180	550	2360	2190	2570
P-M 18	7083	5310 10730	↓ 1222	↓	100	6820?	5490	110	2420	4620	5800	6090	↓	3440	7064	?3200 7200	5876
P-M 18a	N.P.	?	?	?	1450	N.P.	7380	2495	?	7260	7330	N.P.	↓ ?	N.P.	N.P.	N.P.	6990
P-M 19	7163	?	Prob. Neocom. ?1388	Prob. Neocom. ?1710	1640	7506	N.P.	?3355?	?6750	N.P.	7510	N.P.	Poss. Neocom. ?1640	7360	9210	7470	7047
P-M 20	↓	?	↓ ?	↓ ?	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	7539	N.P.	↓ ?	7480	9448	7650	N.P.
P-M 21	N.P.	N.R.	?	?N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	7290		N.P.	Poss. Jur. ?2000	7840?	Jur.– Tri. ?9814	Prob. L. Jur. ?8550	N.P.
P-M 22	N.P.	N.R.	?	?N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	7630		7188	↓ ?	8290		↓ ?	7137
P-M 23 (P-M 24 to P-M 23)	7350	N.R.	?1744 2420	?N.P.	1800	N.P. 7660	N.P.	N.P.	N.P.	8940		8230	? Tri.– E. Jur. ?2337	9100		N.R.	N.R.
P-M 24	?8012	N.R.	E. Jur. ?2430	?N.P.	?	N.P.	7714	?3356	?	?9210		?9300	2571	9730		N.R.	N.R.
P-M 25 (P-M 26 to P-M 25)		N.R.	2595	Prob. Tri. ?2411	2295	?		3800	?6905 6977				Poss. L. Tri. 2683	Perm.– Tri. ?10700		N.R.	N.R.
P-M 26	↓ ?	N.R.	↓	↓	2322	7810	↓	3850 4000.3	7093	↓	↓	↓	↓	↓	↓	N.R.	N.R.
N.Z.	?	N.R.	?	?2430	2350	?8040	?	?	?7830	?10470	?8510	?10020	?	?	?14020	N.R.	N.R.
TOTAL DEPTH	11535	11200	2799	2890	2536	9900	9367	4170	7946	11427	8864	11290	2731	15481	20102	10170	7395

A.W.A. DINOFLAGELLATE CYST ZONULES	KOLUKTAK 1	KUGRUA 1	KUYANAK 1	LISBURNE 1	S. MEADE 1	✱ OUMALIK 1	PEARD 1	SEABEE 1	✱ SIMPSON 1	E. SIMPSON 1	E. SIMPSON 2	S. SIMPSON 1	E. TESHEKPUK 1	✱ TOPAGORUK 1	TULAGEAK 1	TUNALIK 1	WALAKPA 2	ARCO ITKILLIK RIVER 1
P-M 11 to P-M 12	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.
P-M 13	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	?	N.P.	?	N.P.	N.P.	N.P.	N.P.	?
P-M 14	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	90	N.P.	533	N.P.	N.P.	N.P.	N.P.	2140
P-M 15	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	?930	N.P.	680	N.P.	N.P.	N.P.	N.P.	3130?
P-M 16	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	100	N.P.	N.P.	1540	N.P.	N.P.	N.P.	N.P.	4390
P-M 17 (P-M 18 to P-M 17)	110	N.P.	N.P.	N.P.	N.P.	517 733	N.P.	43	?133	460	1088	510	2260	N.P.	N.P.	N.P.	N.P.	6320
P-M 18	↓	?100	100	130	?95	911	?90	2370	633 5087	1360	2410	870	4650	?6749	105	90 8230	?130 1840	?
P-M 18a	N.R.	6912	4690	N.P.	6560	Jur.– Cret. ?8488	6210	13230	?	?6330	6340	6340	6930	↓	2520	↓	2200	N.P.
P-M 19	N.R.	7197	50382	2087 6070	Jur.– Crete ?6910		?6660	L. Jur.– Neocom. ?13500	?5297	6510	N.P.	N.P.	7110	? 6860	2880	10692	2470	7740
P-M 20	N.R.	?	50725	?	↓ ?		6668		↓ 5484	N.P.	N.P.	N.P.	N.P.	7042 7063	N.P.	13340	N.P.	8190
P-M 21	N.R.	Tri.– Jur. ?7202	N.P.	?	L. Jur. ?7600		Jur. ?7243		?5677	?6602	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	8730
P-M 22	N.R.		5093	?	↓ ?			↓ ?	↓ ?		N.P.	N.P.	7290	N.P.	N.P.	13520	2650	8910
P-M 23 (P-M 24 to P-M 23)	N.R.		5320	?	Tri.– Jur. ?7840			N.R.	?	↓ ?	N.P.	6700	7470	7804 8814	2949	13880	? 3280	N.P.
P-M 24	N.R.		↓	?		↓ ?	↓ ?	N.R.	?	?	?6660	?	8080 8700	?	↓ ?	↓ ?	↓	?9720
P-M 25 (P-M 26 to P-M 25)	N.R.		6490	?	↓	N.R.	Tri. ?8214	N.R.	Tri. ?6173	?6897	N.P.	?7690	?	?	3783	?	?	
P-M 26	N.R.	↓ ?	?N.P.	?	8819	N.R.	↓	N.R.	↓	↓ ?	6705	Perm.– Tri. ?8230	N.P.	?	3870	14330 14690	3820	↓
N.Z.	N.R.	?10480	?6560	?7870	?	N.R.	?	N.R.	?	?	?6736	?8680	?	?	?3960	?	?4170	?11625
TOTAL DEPTH	5882	12588	6690	17000	9945	11872	10225	15611	7002	7739	7505	8795	10664	10503	4015	20335	4360	15310

SPORE-POLLEN CORRELATION CHART

A.W.A. SPORE-POLLEN ZONULES	ATIGARU PT. 1	AWUNA 1	✱ S. BARROW 3	S. BARROW 13	S. BARROW 17	CAPE HALKETT 1	J.W. DALTON 1	W. DEASE 1	DREW POINT 1	W. FISH CREEK 1	W.T. FORAN 1	S. HARRISON BAY 1	IKO BAY 1	IKPIKPUK 1	INIGOK 1	N. INIGOK 1	N. KALIKPIK 1
P-T 10	?	N.P.	N.P.	N.P.	N.P.	510	Quat. ?90 270	N.P.	80 N.P.	N.P.	500 590	?	N.P.	N.P.	N.P.	N.P.	N.P.
P-T 11	Cret.– Tert. ?530 890	N.P.	N.P.	N.P.	N.P.	1100	?	N.P.	N.P.	N.P.	1490	500	N.P.	N.P.	N.P.	N.P.	N.P.
P-T 12	1160	N.P.	N.P.	N.P.	N.P.	↓	?	N.P.	?	N.P.	1670	770	N.P.	N.P.	N.P.	120	N.P.
N.Z.	?	5310	200	200	100	?	900	110	?	?	?	?	180	100	110	660	?
P-T 15	?8012	N.R.	?	?	?	?7715	?7714	?	?	?9210	?	?9300	?	9730	8914	N.R.	N.R.
P-T 16 (P-T 17 to P-T 16)	8540	N.R.	N.P.	N.P.	N.P.	8040	7967	?N.P.	7554	9660	7610	9570	?N.P.	10740	12625	N.R.	N.R.
P-T 17	9260	N.R.	N.P.	N.P.	N.P.	8620 8826	↓ ?	?N.P.	7794	10200	↓	10200	?N.P.	↓	↓	N.R.	N.R.
P-T 18	9440? 9530	N.R.	N.P.	N.P.	N.P.		?	N.P.		?	8240	?	N.P.	11740 11830	14020	N.R.	N.R.
P-T 19	10250	N.R.	N.P.	N.P.	N.P.		?	N.P.		10470		10210	N.P.	?13020	14164	N.R.	N.R.
P-T 20	?	N.R.	N.P.	N.P.	N.P.	↓	N.P. 8370	N.P.					N.P.	13470	15203	N.R.	N.R.
P-T 21	11070	N.R.	N.P.	N.P.	N.P.	?9230	?	N.P.	↓	↓	?8510	↓	N.P.	↓	18300	N.R.	N.R.
Argillite	11330	N.R.	?	?	2350	9779	9250	?	7830	?	8780	?	N.R.	?	?	N.R.	N.R.
TOTAL DEPTH	11535	11200	2799	2890	2536	9900	9367	4170	7946	11427	8864	11290	2731	15481	20102	10170	7395

A.W.A. SPORE-POLLEN ZONULES	KOLUKTAK 1	KUGRUA 1	KUYANAK 1	LISBURNE 1	S. MEADE 1	✱ OUMALIK 1	PEARD 1	SEABEE 1	✱ SIMPSON 1	E. SIMPSON 1	E. SIMPSON 2	S. SIMPSON 1	E. TESHEKPUK 1	✱ TOPAGORUK 1	TULAGEAK 1	TUNALIK 1	WALAKPA 2	ARCO ITKILLIK RIVER 1
P-T 10	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	?
P-T 11	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	340
P-T 12	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	790
N.Z.	[illegible]	100	100	130	?	517	90	43	133	100	90	?	533	6501	105	?	130	?
P-T 15	N.R.	7202	?	?	?	N.R.	8214	N.R.	?	?6897	?	?	?8080	?	?	14690	?	?9720
P-T 16 (P-T 17 to P-T 16)	N.R.	10480	?N.P.	?	?9090	N.R.	↓	N.R.	N.P.	?7070	N.P.	8230	9092	?	N.P.		N.P.	10350
P-T 17	N.R.	↓ ?	?N.P.	?	?9370	N.R.	?	N.R.	N.P.	↓	N.P.	8500	9510 9690	?	N.P.	↓ ?	N.P.	11070
P-T 18	N.R.	11032 11130	?N.P.	?	9510	N.R.	?	N.R.	N.P.	?N.P.	N.P.	?	?	?	N.P.	16926 17858	N.P.	11340
P-T 19	N.R.	Prob. Penn. ?12330	?N.P.	?		N.R.	N.P.	N.R.	N.P.	N.P.	N.P.	8680	?	N.R.	N.P.	19620	N.P.	11520
P-T 20	N.R.	N.R.	?N.P.	?		N.R.	N.P.	N.R.	N.P.	N.P.	N.P.		?	N.R.	N.P.	19890	N.P.	↓
P-T 21	N.R.	N.R.	?N.P.	?		N.R.	N.P.	N.R.	N.P.	N.P.	7167	↓	?	N.R.	N.P.	↓	N.P.	14610
Argillite	N.R.	N.R.	?6560	N.R.	↓	N.R.	9630	N.R.	?	7680	N.R.	8718	?	N.R.	3960	N.R.	4260?	?
TOTAL DEPTH	5882	12588	6690	17000	9945	11872	10225	15611	7002	7739	7505	8795	10664	10503	4015	20335	4360	15310



EXPLANATION

Symbol	Meaning
?	NOT IDENTIFIED
?100	ZONE QUESTIONABLE
100?	EXACT DEPTH QUESTIONABLE
N.P.	NOT PRESENT
N.R.	NOT REACHED
100 (hatched)	INDETERMINATE
↓	RANGE OF ZONES
N.Z.	NO ZONES RECOGNIZED
✱	BASED ON SCATTERED SAMPLES

TETRA TECH, INC — HOUSTON, TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA, CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

PALYNOLOGY CORRELATION CHART OF KEY NPRA WELLS

NPR — ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J.W. BRUYNZEEL		PROJECT NO. TC-7174	
COMPILED BY: H.Y. BAIK		REVISED DATE	INITIAL
DATE: JULY 1981	DATUM:		
CONTOUR INT:	SCALE:	DWG NO.	

TETRA TECH REPORT NO. 8200

FIGURE 68 T62-0170

FIGURE 69

LITHOSTRATIGRAPHIC CORRELATION CHART OF KEY NPRA WELLS

The "Simpson sandstone" in NPRA wells was informally designated the "Simpson" by Bird (1979). The "Barrow sandstone" is one of several informal names used for many years to describe the production gas horizons in the South Barrow fields; the term collectively refers to the "Upper Barrow gas sand" and "Lower Barrow gas sand." The depths given in this chart for the "Barrow sandstone" refer to regional marker-defined units, not to production tops.

At Tunalik 1, the "Transition Zone" includes a 745-ft (229-m) basalt that should be subtracted from the Wahoo-to-Joe Creek thickness. The top of the Wahoo Limestone at Tunalik 1 is the top of the massive limestone. The overlying interbedded carbonates and shales are referred to here as the "Transition Zone."

The tops shown for the Lisburne clastics correlate lithologically with the Endicott Group, but are the lateral time-equivalents of the Alapah Limestone or the Wahoo Limestone.

The tops given in the chart for Lisburne 1 are for plate 1 only. The tops for the remaining plates at Lisburne 1 are as follows:

Stratigraphic unit or marker	Plate 2	Plate 3	Plate 4	Plate 5
Top of plate	8,599 ft (2,620 m)	10,898 ft (3,322 m)	13,370 ft (4,075 m)	15,318 ft (4,669 m)
"Pebble Shale" unit(?)	8,599 ft (2,620 m)	10,898 ft (3,322 m)	-- --	-- --
Shublik(?)	9,017 ft (2,748 m)	11,016 ft (3,358 m)	13,370 ft (4,075 m)	-- --
Ikiakpaurak(?)	9,440 ft (2,878 m)	11,340 ft (3,456 m)	13,540 ft (4,127 m)	15,318 ft (4,669 m)
Alapah Limestone (?)	9,670 ft (2,947 m)	11,549 ft (3,520 m)	13,735 ft (4,186 m)	15,405 ft (4,695 m)

Sinclair Colville 1 and Arco Itkillik River 1 are located east of the NPRA, but are included on the chart to tie the NPRA correlation units into Prudhoe Bay.

Oil and gas shows are indicated by the appropriate symbol shown above the unit top. Good shows, characterized by a good gas kick of heavy gases accompanied by a drilling break, a cut in mud weight, and significant fluorescence, are indicated by a "G" beside the show symbol.

FIGURE 69

GEOLOGIC AGE			GROUP	FORMATION – MEMBER	ATIGARU POINT 1 KB 27' 1/12/77–3/10/77	AWUNA 1 KB 32' 3/1/80–4/20/81	S. BARROW 3 KB 44' 8/26/49–6/23/49	S. BARROW 13 KB 40' 12/17/76–1/2/77	S. BARROW 17 KB 32' 3/2/78–4/2/78	CAPE HALKETT 1 KB 35' 3/24/75–5/23/75	J.W. DALTON 1 KB 37' 5/7/79–8/1/79	W. DEASE 1 KB 24' 2/18/80–3/23/80	DREW POINT 1 KB 35' 11/13/78–3/13/78	W. FISH CREEK 1 KB 113' 2/14/77–4/27/77	W.T. FORAN 1 KB 39' 3/7/77–4/24/77	S. HARRISON BAY 1 KB 45' 11/21/76–2/8/77	IKO BAY 1 KB 40' 8/7/75–3/11/75	INPIKPUK 1 KB 52' 11/28/78–2/26/80	INIGOK 1 KB 163' 6/7/78–5/23/79	N. INIGOK 1 KB 166' 2/12/81–4/3/81	N. KALIKPIK 1 KB 40' 2/5/78–5/5/78	KAOLAK 1 KB 178' 7/20/51–11/12/51	KOLUKTAK 1 KB 205' 3/20/81–4/19/81	KUGRUA 1 KB 85' 2/12/78–5/29/78	KUYANAK 1 KB 28' 2/13/81–3/31/81	LISBURNE 1 KB 186.2' 6/1/79–5/21/80	S. MEADE 1 KB 60' 2/7/78–1/22/79	OUMALIK 1 KB 94' 6/11/49–4/23/50	PEARD 1 KB 103' 2/12/79–4/9/79	SEABEE 1 KB 322' 7/1/79–4/14/80	SIMPSON 1 KB 29' 6/14/47–6/9/48	E. SIMPSON 1 KB 30' 2/19/79–4/10/79	E. SIMPSON 2 KB 40' 1/31/80–3/15/80	S. SIMPSON 1 KB 25' 2/20/77–3/5/77	E. TESHEKPUK 1 KB 37.5' 3/12/76–5/11/76	TOMAGORUK 1 KB 42' 6/15/50–9/28/51	TULAGEAK 1 KB 27' 2/25/81–3/24/81	TUNALIK 1 KB 110' 11/10/78–11/3/79	WALAKPA 1 KB 30' 12/25/79–2/7/80	WALAKPA 2 KB 61' 1/3/81–2/12/81	COLVILLE 1 KB 50' 11/12/65–3/8/66	ITKILLIK RIVER 1 KB 60' 2/16/72–7/23/72
CENOZOIC	QUATERNARY			GUBIK	SFC?		SFC?	SFC?	SFC?	SFC?	SFC?	SFC?	SFC?	SFC?	SFC?	?SFC	SFC?	SFC?	?SFC			SFC?	SFC?	N.P.	SFC?	SFC?		SFC?	SFC?	SFC?		SFC?	SFC?	SFC?	SFC?	SFC?	SFC?	SFC?	SFC?	SFC?	SFC?	SFC?	SFC?	SFC?	?	?
CENOZOIC	TERTIARY			SAGAVANIRKTOK	200?		N.P.	N.P.	N.P.	200?	210?	N.P.	?140	N.P.	310?	100?	N.P.	N.P.				N.P.	N.P.	N.P.	N.P.	N.P.		N.P.	N.P.	N.P.		N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	?	SFC?
MESOZOIC	CRETACEOUS	LATE	COLVILLE	PRINCE CREEK	N.P.		N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	?N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	☼ SFC?	SFC?	?N.P.	N.P.	N.P.	N.P.	N.P.	N.P.		N.P.	N.P.	N.P.		N.P.	N.P.	N.P.	N.P.	?N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.?
MESOZOIC	CRETACEOUS	LATE	COLVILLE	SCHRADER BLUFF	980?		N.P.	N.P.	N.P.	1020?	1050	N.P.	?380	✱ 100?	1580?	350?	N.P.	N.P.	N.P.	N.P.	100?	N.P.	N.P.	N.P.	N.P.	N.P.		N.P.	N.P.	N.P.		N.P.	N.P.	N.P.	N.P.	100?	N.P.	N.P.	N.P.	N.P.	N.P.	SFC?	335?
MESOZOIC	CRETACEOUS	LATE	COLVILLE	SEABEE	2629		N.P.	N.P.	N.P.	2242	1998?	N.P.	1230?	1559	2615	2280	N.P.	N.P.	775?	576?	1417	N.P.	N.P.	N.P.	N.P.			N.P.	N.P.	N.P.		N.P.	80?	100?	N.P.	914	N.P.	N.P.	N.P.	N.P.	N.P.	3260	3230
MESOZOIC	CRETACEOUS	LATE	COLVILLE	SHALE WALL	2679		N.P.	N.P.	N.P.	2242	1998?	N.P.	1230?	1559	2615	2280	N.P.	N.P.	1305?	1148?	1417	N.P.	N.P.	N.P.	N.P.			N.P.	N.P.	N.P.		N.P.	80?	100?	N.P.	914	N.P.	N.P.	N.P.	N.P.	N.P.	?	?
MESOZOIC	CRETACEOUS	LATE	NANUSHUK	NONMARINE *	N.P.		N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	✱ N.P.	N.P.	N.P.	N.P.	80?	N.P.	N.P.	N.P.	✱ 113	SFC.?	80?	80?		80?	?N.P.	80?	☼ SFC.?	N.P.	460?	460?	75?	N.P.	80?	N.P.	☼ 100?	N.P.	N.P.	?	?
MESOZOIC	CRETACEOUS	EARLY	NANUSHUK	MARINE *	◒ 3470		N.P.	N.P.	N.P.	3095	2680?	100?	1730?	☼ G 2618	◒ 3480	◒ 3220	N.P.	◒ 600?	☼ 2248	2108	☼ 2394	4280	☼ 100?	1600?	1105?		☼ G 1320?	☼ 80?	1220?	1350?	☼ 80?	1080?	1130?	1000?	1914	1120	100?	☼ 3520?	N.P.	N.P.	?	?
MESOZOIC	CRETACEOUS	EARLY	NANUSHUK	TOROK * UNDATHEM *	4420?		N.P.	N.P.	N.P.	4230?	N.P.	690?	3200?	◒ 3920?	4420?	4235?	75?	N.P.	N.P.	3264	3470?	☼ 5240	☼ 3072?	2330?	2040?		2130?	☼ 2825	◒ 2470	✱ 1675?	985?	2670?	2730?	1910?	3125?	2150?	552?	☼ 3788?	N.P.	N.P.	4093	4570
MESOZOIC	CRETACEOUS	EARLY	NANUSHUK	CLINOTHEM *	4695	?SFC	◒ 75?	75	☼ 75?	4676	4140	945?	3561	◒ 4150	4420	✱ G 4348	200?	2950?	☼ 3955?	3968	3810	?N.R.	4137?	☼ G 3376	☼ 2912?		☼ G 3058	☼ 3450?	☼ G 3110	✱ 2815?	1645?	3021	3075?	☼ 2873	3298	3330?	728?	☼ 5515	100?	100?	?	?
MESOZOIC	CRETACEOUS	EARLY	NANUSHUK	BASAL TOROK (FONDOTHEM) *	◒ 5993	?3181	860?	◒ 430?	☼ 642	☼ G 6205	6443	2390?	☼ 5265	☼ G 5520?	6330?	✱ G 6000?	✱ G 715	✱ 5960?	☼ G 7130?	☼ G 5832	✱ 5850?	?N.R.	N.R.?	☼ G 4790	◒ 4400?	?SFC	✱ G 5083	☼ 8640?	☼ G 4432	✱ 7477?	3955?	☼ 4954	✱ 5060?	✱ G 5159	5385	✱ 5170?	1950?	☼ 8769	370?	428?	?	?
MESOZOIC	CRETACEOUS			"PEBBLE SHALE"	7276	N.R.	◒ 1230	✱ 1840	☼ 1405	7278	7483	2905	6701	N.P.	7338	N.P.	1512	7237	9042	7384	✱ 6888	N.R.	N.R.	6892	4642	?6070	6474	☼ 10880	◒ 6196	☼ 13068?	?5290	☼ 6375	6327	6275	✱ G 6851	6685	2502	10634	1705	2202	5565	7575
MESOZOIC	CRETACEOUS			GAMMA RAY SHALE	N.P.		1230	1840	1405	7278	7483	2905	6701	N.P.	7338	N.P.	1512	7237	9042	7384	6888			6892	4642	?6070	6474	?10880	6196	13068?	?5290	6375	6327	6275	6851	6685	2502	10634	1705	2202	5565	7575
MESOZOIC	CRETACEOUS			"PEBBLE SHALE" SANDSTONE	N.P.		N.P.	N.P.	N.P.	7510	N.P.	N.P.	N.P.	N.P.	☼ 7508	N.P.	N.P.	7432	N.P.	N.P.	N.P.			☼ G 7202	5092	N.P.	N.P.	N.P.	◒ 6520	N.R.	?	N.P.	N.P.	N.P.	7086	?N.P.	N.P.	10823	☼ G 2070	☼ G 2604	N.P.?	N.P.?
MESOZOIC	JURASSIC	LATE		KINGAK "UPPER KINGAK" *	?7319		1660	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	✱ G 7277	N.P.	◒ 7289	N.P.	☼ 7485	☼ G 9260	☼ G 7648	7147			7308	5159	N.P.	6780	N.R.	6578		N.P.	N.P.	N.P.	✱ G 6530	7130	7015	N.P.	☼ 10900	☼ G 2087	☼ G 2636	5915	7900
MESOZOIC	JURASSIC	LATE		"SIMPSON SS"	N.P.		◒ ?1718	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.R.			8705	5376	N.P.	☼ 7850		7820		N.P.	N.P.	N.P.	✱ G 6530	N.P.	7748	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.
MESOZOIC	JURASSIC	E-M		"LOWER KINGAK"	?7502		1835	2236	1767	7604	N.P.	◒ 3369	6885	8996	N.P.	8235	✱ G 1893	◒ 9264	11963	9789				8898	5656	N.P.	8056		8020		5630	6586	6529	☼ 6716	✱ 7507	7918	◒ G 2949	14122	2584	◒ 3230	7198	9720
MESOZOIC	JURASSIC	E-M		"BARROW SS"	8200		✱ 2320	✱ 2290	✱ 2023	7729	N.P.	3685	N.P.	9218	N.P.	8877	✱ G 2295	9625	N.P.	N.P.				9394	6114	N.P.	8491		N.P.		☼ 6110	6766	6529	7470	✱ 8505	N.P.	3528	N.P.	2992	3646	N.P.	N.P.
MESOZOIC	TRIASSIC	M-LATE		SAG RIVER SS	◒ 8252		N.P.	N.P.	N.P.	7782	N.P.	3800	◒ 6956	◒ 9248	N.P.	◒ 8902	2536	9844	N.P.	N.P.				9514	☼ 6243	N.P.	8770		8225		◒ 6150	☼ 6868	6616	7530	☼ 8545	8700	◒ G 3761	N.P.	3224	3843	7710	N.P.
MESOZOIC	TRIASSIC	EARLY		SHUBLIK	8346		✱ 2630	N.P.	N.P.	7913	☼ 7754	3951	7060	9284	✱ 7542?	✱ 8956	2642	9895	12157	10018				9646	6375	✱ 6945?	8892		8441		6266	✱ 7025	6770	✱ 7673	✱ 8674	8850	3878	☼ 14350	3350	3990	7756	10048
MESOZOIC	TRIASSIC	EARLY	SADLEROCHIT	IVISHAK	✱ 8601		N.P.	N.P.	N.P.	8128	☼ 7893	N.P.	✱ 7570	9515	◒ 7635	◒ 9240	N.P.	10375	12500	N.R.				10018	N.P.	?	9130		8741		N.P.	◒ 7456	N.P.	8197	8855	9220	N.P.	N.P.	N.P.	N.P.	8080	10370
MESOZOIC	TRIASSIC	EARLY	SADLEROCHIT	KAVIK SHALE	9245		N.P.	N.P.	N.P.	8702	8230	N.P.	N.P.	10172	8133	9932	N.P.	11074	13330					10820	N.P.	?7195	N.P.		9358		N.P.	N.P.	N.P.	8550	9443	9669	N.P.	15561	N.P.	N.P.	8653	11070
PALEOZOIC	PERMIAN	LATE		ECHOOKA IKIAKPAURAK	☼ 9407		N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	10441	N.P.	10133	N.P.	11288	13656					10990	N.P.	?7320	N.P.		☼ G 9471		N.P.	N.P.	N.P.	8588	9611	9762	N.P.	16884	N.P.	N.P.	8835	11360
PALEOZOIC	PERMIAN	LATE		JOE CREEK	N.P.		N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	11529	13849					N.P.	N.P.	?	N.P.		N.P.		N.P.	N.P.	N.P.	N.P.	N.P.	?9830	N.P.	17002	N.P.	N.P.	?8913	N.P.
PALEOZOIC	PERMIAN	P	SADLEROCHIT	"TRANSITION ZONE"	N.P.		N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	11606	14026					11178	N.P.	N.P.	N.P.		N.P.		N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	17098	N.P.	N.P.	N.P.	?
PALEOZOIC	PENNSYLVANIAN		LISBURNE	WAHOO LIMESTONE	☼ 9518		N.P.	N.P.	N.P.	◒ 8775	✱ 8317	N.P.	N.P.	10496	◒ 8195	10232	N.P.	☼ 11818	14211					11535	N.P.	N.P.	N.P.		N.P.		N.P.	N.P.	N.P.	N.P.	✱ G 9649	N.P.	N.P.	19095	N.P.	N.P.	8960	11465
PALEOZOIC	MISSISSIPPIAN		LISBURNE	ALAPAH LIMESTONE	☼ 10490		N.P.	N.P.	N.P.	9160	N.P.	N.P.	N.P.	?11118	N.P.	N.R.	N.P.	☼ 13485	15718					N.R.	N.P.	☼ ?7408	N.P.		N.P.		N.P.	N.P.	N.P.	N.P.	10440?	N.P.	N.P.	N.R.	N.P.	N.P.	8992	?12760
PALEOZOIC	MISSISSIPPIAN		LISBURNE	LISBURNE CLASTICS	N.P.		N.P.	N.P.	N.P.	◒ 9325	✱ 8686	N.P.	N.P.	?11312	N.P.		N.P.	14838	N.P.						N.P.	N.R.	N.P.		N.P.		N.P.	N.P.	N.P.	N.P.	?10624	N.P.	N.P.		N.P.	N.P.	?9390	?14010
PALEOZOIC	MISSISSIPPIAN		ENDICOTT		☼ ?11021		N.P.	N.P.	N.P.	9555	?9196	N.P.	N.P.	?N.P.	?8572	.	N.P.	15117	17870						N.P.		N.P.		N.P.		N.P.	N.P.	✱ 7152	N.P.	?N.R.	N.P.	N.P.		N.P.	N.P.	?	?
PALEOZOIC	DEVONIAN				N.P.		N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.R.	N.P.		N.P.	N.P.	N.R.						N.P.		9537		N.P.		N.P.	N.P.	N.P.	N.P.	?N.R.	10031	N.P.		N.P.	N.P.	N.P.	N.P.
PALEOZOIC	EARLY DEVONIAN TO PRE-DEVONIAN			"ARGILLITE"	11208		2795	2473	2350	9708	9268	4018	7848		8760		2700	?15317							6559		9892		9635		6540	7624	7428	8750	?N.R.	N.R.	3945		3634	4303	9700	14940
TOTAL DEPTH					11535	11200	2890	2534	2382	9900	9367	4170	7946	11427	8864	11290	2731	15481	20102	10170	7395	6952	5882	12588	6690	17000	9945	11872	10225	15611	7002	7739	7505	8795	10654	10503	4015	20335	3666	4360	9930	15310

EXPLANATION

SFC.	SURFACE
?	NOT IDENTIFIED
?9160	UNIT QUESTIONABLE
9160?°	EXACT DEPTH QUESTIONABLE
N.P.	NOT PRESENT
N.R.	NOT REACHED

◒ OIL SHOW

☼ GAS SHOW

✱ OIL SHOW – ABANDONED

☼ GAS SHOW – ABANDONED

✱ SUSPENDED GAS WELL

✱ OIL AND GAS SHOW – ABANDONED

☼ DRY AND ABANDONED

TIME TRANSGRESSIVE, LITHOSTRATIGRAPHIC BOUNDARY

SEE EXPLANATION

G INDICATES GOOD OIL OR GAS SHOW

* INDICATES DEPOSITIONAL SEQUENCE WITHIN THE NANUSHUK GROUP

TETRA TECH, INC

HOUSTON, TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA, CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

LITHOSTRATIGRAPHIC CORRELATION CHART OF KEY NPRA WELLS

NPR — ALASKA

FOR ONPRA
HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J. W. BRUYNZEEL	PROJECT NO. TC-7174
INTERPRETATION BY: D. HIGGS	REVISED: DATE / INITIAL
DATE: JULY, 1981 DATUM:	
CONTOUR INT: SCALE:	DWG NO.

TETRA TECH REPORT NO. 8200

TG2-0170

FIGURE 69

FIGURE 70

POTENTIAL RESERVOIR AND AVERAGE POROSITY MAP OF IVISHAK FORMATION

Well	Thickness Feet	Thickness Meters	Average Porosity (Percent)
Atigaru Point 1	400	122	10
Cape Halkett 1	268	82	12
J. W. Dalton 1	180	55	13
Drew Point 1	175	53	12
West Fish Creek 1	128	39	9
W. T. Foran 1	326	99	15
South Harrison Bay 1	392	120	7
Ikpikpuk 1	198	60	9
Inigok 1	317	97	12
South Meade 1	81	25	13
Peard 1	117	36	7
East Simpson 1	114	46	10
South Simpson 1	134	41	10
East Teshekpuk 1	114	35	8

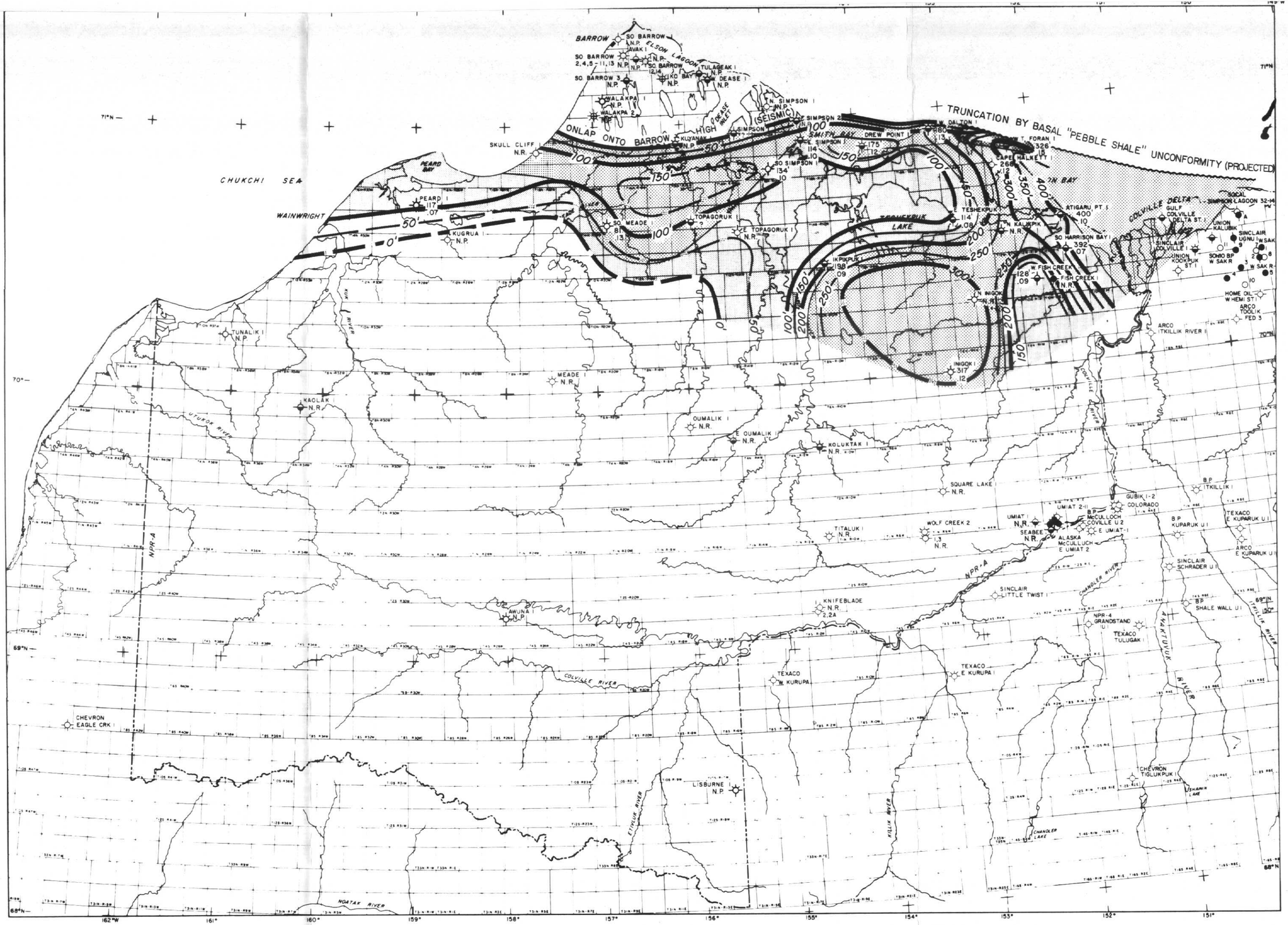
The sandstone lithofacies within the TR-2 parastratigraphic unit, commonly referred to as the "Ivishak sandstone," is the highly productive interval in the Prudhoe Bay field.

A thick sand trend just south of the Barrow High and the Barrow Arch runs approximately east-west. To the south, the sand lithofacies or "Ivishak sandstone" gradually thins out.

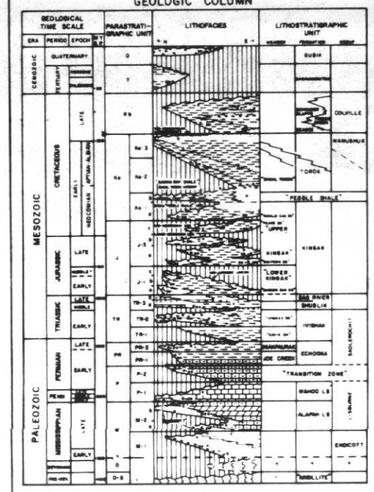
The "Ivishak sandstone" is composed of interbedded conglomerate, sandstone, and siltstone. Light-gray to white, very fine- to fine-grained sands with conglomeratic beds constitute the reservoir.

Only sands with porosities greater than 7 percent have been mapped as potential reservoirs within the Ivishak Formation. The porosity of the sands decreases southward due to secondary cementation. Along the northern limits, better quality reservoir sands are developed.

FIGURE 70



GEOLOGIC COLUMN



0 10 20 30 40 50 KILOMETERS

0 10 20 30 MILES

EXPLANATION

ALASKA 1
251'
.10 THICKNESS (POTENTIAL RESERVOIR)
PER CENT POROSITY

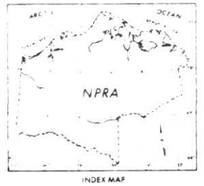
N.R. NOT REACHED

N.P. NOT PRESENT

0 7 10 15 20 25 30

AVERAGE POROSITY (PER CENT)

- LOCATION
- ABANDONED WELL
- ABANDONED WELL (GAS SHOW)
- ABANDONED WELL (OIL SHOW)
- GAS WELL
- OIL WELL
- ABANDONED OIL WELL



INDEX MAP

TETRA TECH, INC.
HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

POTENTIAL RESERVOIR & AVERAGE POROSITY MAP OF IVISHAK FORMATION

NPR — ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC

PROJECT MANAGER: J.W. BRUYNZEEL		PROJECT NO. TC-7174	
INTERPRETATION BY:		REVISED: DATE	INITIAL
DATE: OCT 1978	DATUM:	SEPT 1979	K.C.F.
		NOV 1980	K.C.F.
CONTOUR INT: 50'	SCALE:	SEPT 1981	A.G.

TETRA TECH REPORT NO. 8200

TGE0170

FIGURE 70

FIGURE 71

FIGURE 71

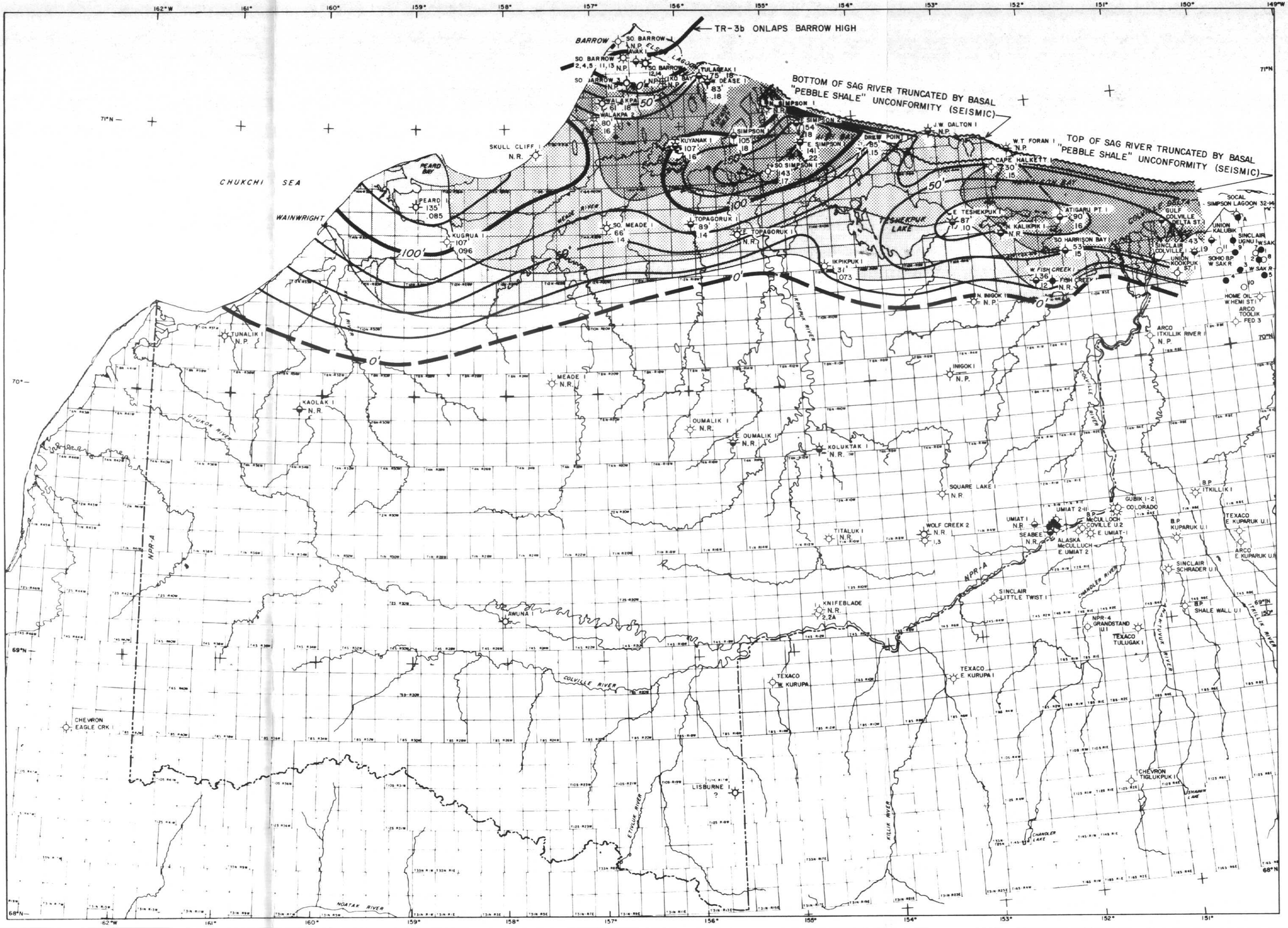
POTENTIAL RESERVOIR AND AVERAGE POROSITY MAP OF SAG RIVER SANDSTONE

Well	Thickness Feet	Thickness Meters	Average Porosity (Percent)
Atigaru Point 1	90	27	16
Cape Halkett 1	30	9	15
West Dease 1	83	25	18
Drew Point 1	85	26	15
West Fish Creek 1	36	11	12
South Harrison Bay 1	53	16	15
Ikpikpuk 1	31	9	7.3
Kugrua 1	107	33	9.6
Kuyanak 1	107	33	16
South Meade 1	66	20	14
Peard 1	135	41	8.5
Simpson 1	105	32	18
East Simpson 1	141	43	22
East Simpson 2	154	47	18
South Simpson 1	143	44	17
East Teshekpuk 1	87	27	10
Topagoruk 1	89	27	14
Tulageak 1	75	23	18
Walakpa 1	61	19	18
Walakpa 2	80	24	16
Sinclair Colville 1	43	13	19

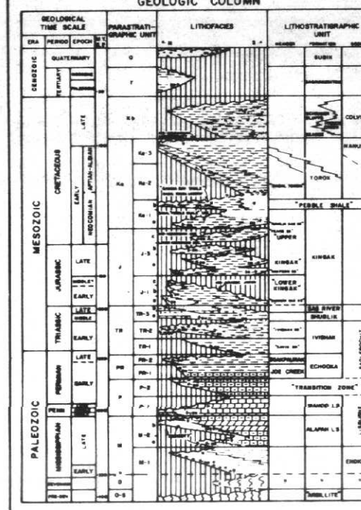
The Sag River Sandstone is the sandstone lithofacies of the TR-3b parastratigraphic unit. The rocks are Late Triassic to Early Jurassic and are restricted to the northern half of the Reserve.

The Sag River Sandstone is a sheetlike sand body that probably consists of a series of overlapping bars. The lithology is typically light-greenish-gray glauconitic calcareous sandstone. The Sag River Sandstone becomes increasingly silty toward the south and west. At Inigok 1 and Tunalik 1, laterally equivalent siltstone and shales are present. The Sag River Sandstone also grades into equivalent calcareous and glauconitic siltstones, shales, and silty sandstones on the Barrow High.

Porosity within the unit is very good in wells drilled on the Reserve. The lowest porosity, 7.3 percent, was at Ikpikpuk 1; the highest porosity, 22 percent, was in East Simpson 1. Porosities above 16 percent were recorded in all wells in the northwestern NPRA. A second area of good porosity development is over the Fish Creek Platform northward to where the unit is truncated by the basal "Pebble Shale" unconformity. There were several minor oil shows in the Sag River Sandstone at East Simpson 1 and East Simpson 2.



GEOLOGIC COLUMN



0 10 20 30 40 50
KILOMETERS
0 10 20 30
MILES

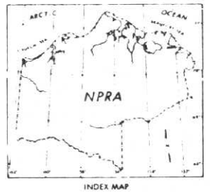
EXPLANATION

ALASKA 1
251' THICKNESS (POTENTIAL RESERVOIR)
10 PER CENT POROSITY

N.R. NOT REACHED
N.P. NOT PRESENT

0 7 10 15 20 25 30
AVERAGE POROSITY (PER CENT)

- LOCATION
- ABANDONED WELL
- ABANDONED WELL (GAS SHOW)
- ABANDONED WELL (OIL SHOW)
- GAS WELL
- OIL WELL
- ABANDONED OIL WELL



INDEX MAP

TETRA TECH, INC.
HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

POTENTIAL RESERVOIR & AVERAGE POROSITY MAP OF SAG RIVER SANDSTONE

NPR — ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC

PROJECT MANAGER: J.W. BRUYNZEEL	PROJECT NO. TC-7174
INTERPRETATION BY: GEOLOGICAL STAFF	REVISED DATE / INITIAL
DATE: FEB. 1982 — DATUM:	
CONTOUR INT: 25 — SCALE:	DWG NO.

TETRA TECH REPORT NO. 8200

FIGURE 71

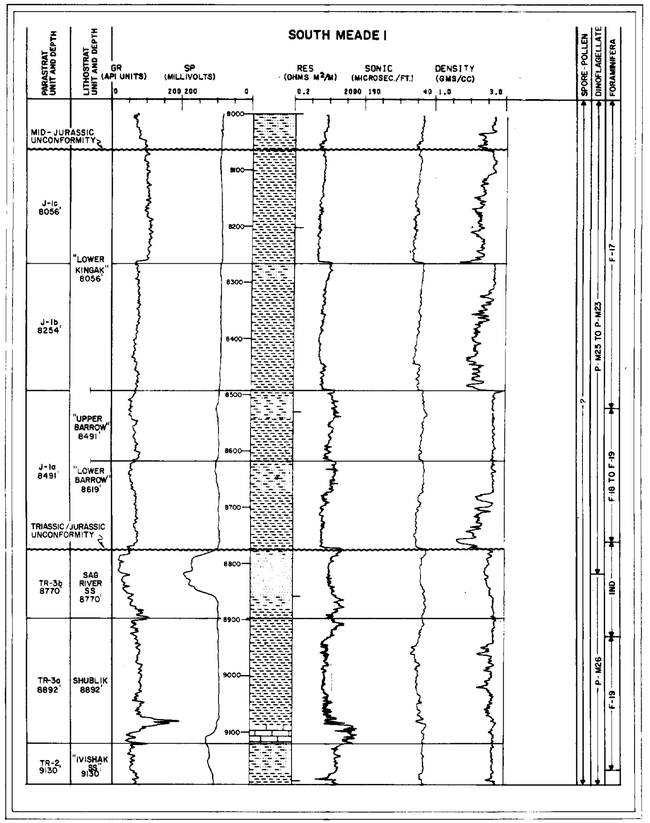
TG20170

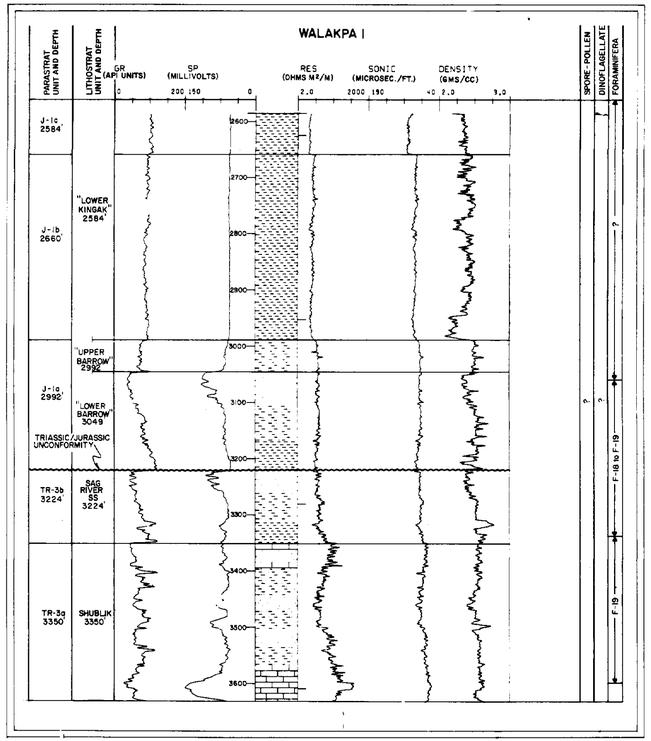
FIGURE 72

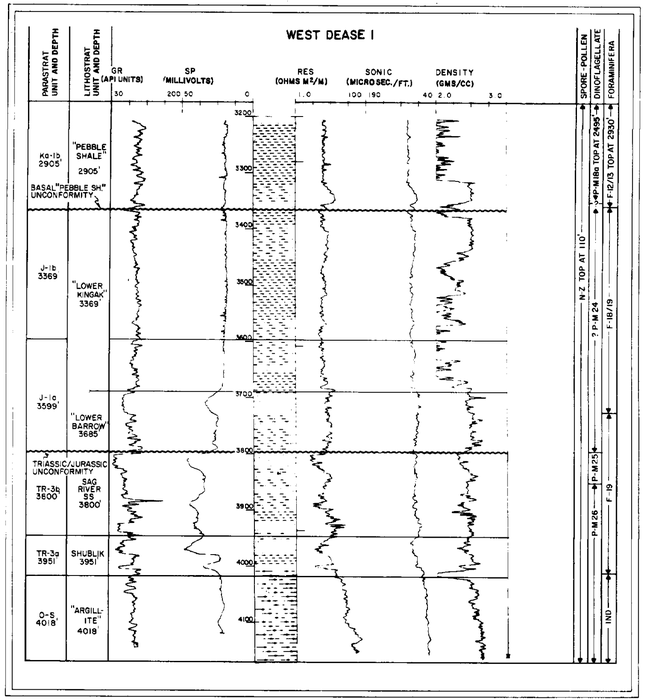
TYPE LOG OF UNCONFORMITY BETWEEN SAG RIVER SANDSTONE AND KINGAK FORMATION; SOUTH MEADE 1, WALAKPA 1, AND WEST DEASE 1

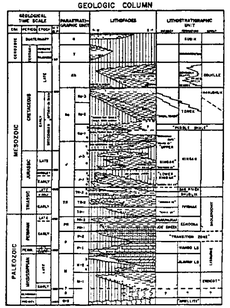
This figure shows representative sections of the Sag River Sandstone at South Meade 1, Walakpa 1, and West Dease 1. In this report, the top of the Sag River Sandstone is chosen at a prominent gamma-ray and resistivity deflection that can be recognized regionally. These sections show that the log character of the Sag River Sandstone is fairly consistent in the vicinity of the Meade Arch, while the overlying rocks are variable. The "Barrow sandstone" and Sag River Sandstone are separated by a shale and siltstone unit.

FIGURE 72









TETRA TECH, INC
HOUSTON, TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA, CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

TYPE LOG OF UNCONFORMITY BETWEEN SAG RIVER SANDSTONE AND KINGAK FM. S. MEADE I, WALAKPA I, W. DEASE I

NPR — ALASKA

FOR ONPRA
HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J. W. BRUYNZEEL		PROJECT NO. TC-774
INTERPRETATION BY: STAFF, (V. E. BERGER)		REVIEWED
DATE: SEPT., 1981	DATUM: TOP SAG RIVER	DATE / INITIAL
CONTOUR INT.:	SCALE:	DWG NO.

TETRA TECH REPORT NO. 8200

TGZ-0170

FIGURE 72

FIGURE 73

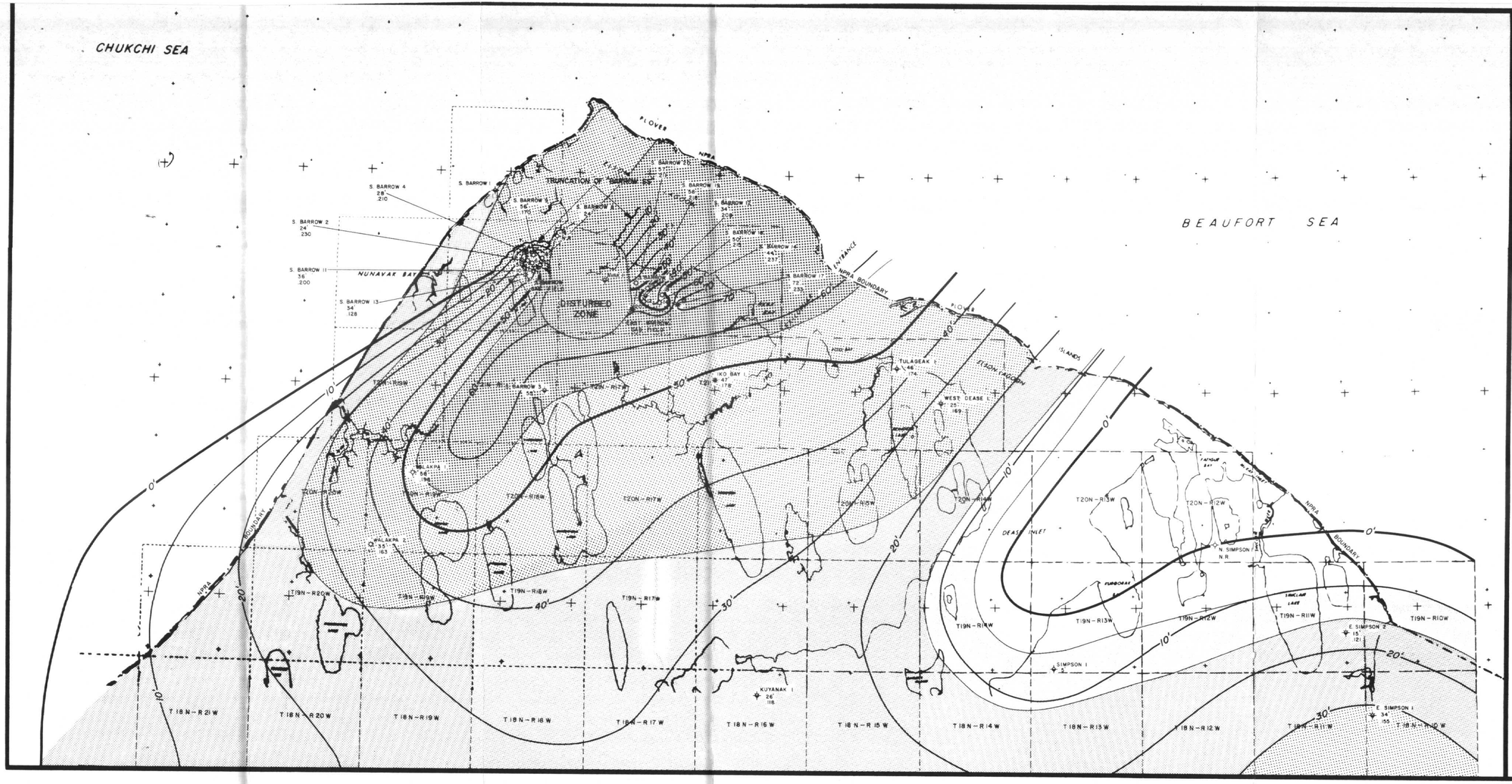
POTENTIAL RESERVOIR AND AVERAGE POROSITY MAP OF "BARROW SANDSTONE," BARROW AREA

Well	Thickness Feet	Thickness Meters	Average Porosity* (Percent)
South Barrow 2	24	7	23
South Barrow 3	n.d.	-	n.d.
South Barrow 4	28	9	21
South Barrow 5	n.d.	-	n.d.
South Barrow 6	25	8	n.d.
South Barrow 7	n.d.	-	n.d.
South Barrow 8	24	7	n.d.
South Barrow 9	26	8	17.0
South Barrow 10	n.d.	-	n.d.
South Barrow 11	36	11	20.0
South Barrow 12	34	10	20.8
South Barrow 13	54	17	17.8
South Barrow 14	44	13	23.72
South Barrow 17	72	13	23.25
South Barrow 18	50	15	21.5
South Barrow 19	58	18	21.83
South Barrow 20	57	17	21.11
West Dease 1	29	9	16.95
Iko Bay 1	59	18	17.82
Kuyanak 1	34	10	11.8
Simpson 1	5	2	n.d.
East Simpson 1	34	10	15.5
East Simpson 2	15	5	12.06
Tulageak 1	57	17	17.4
Walakpa 1	77	23	19.65
Walakpa 2	62	19	16.30

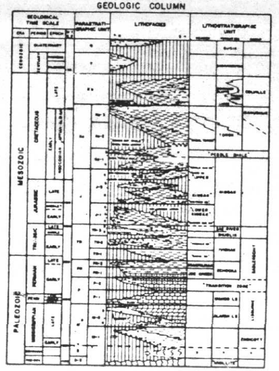
*Values combine the upper and lower "Barrow sandstone" units.

The "Barrow sandstone" is an argillaceous sandstone in the lower part of the Kingak Formation in the northern half of the NPRA. This rock unit, consisting of "Lower Barrow gas sand" and "Upper Barrow gas sand," is the gas-producing zone in the South Barrow and East Barrow gas fields. The "Barrow sandstone" is a series of isolated sandstone bodies that are barlike in map view (see "Jurassic Study"). The "Barrow sandstone" is a southeast-southwest transgressive marine facies deposited in early Jurassic time disconformably over the Sag River to the east of Simpson 1; are relatively lower than west and northwest of Simpson 1. Lower porosity and lesser thickness are attributed to lower wave energy, slower sedimentation rate, and lower rate of subsidence. The highest porosity and thickness occur within the South Barrow gas field where average porosities range as high as 23 percent and sands are as thick as 75 ft (23 m) at South Barrow 17. The thicker sands and higher porosities in this area indicate greater wave energy, rate of sedimentation, and rate of subsidence. Potential reservoir and average porosity are unknown in the "Disturbed Zone," an area between the South Barrow and East Barrow gas fields.

FIGURE 73



GEOLOGIC COLUMN



0 10 20 30 40 50 KILOMETERS

0 10 20 30 MILES

EXPLANATION

ALASKA 1
25
.10 THICKNESS (POTENTIAL RESERVOIR)
PERCENT POROSITY

N.R. NOT REACHED

N.P. NOT PRESENT

0 7 10 15 20 25 30

AVERAGE POROSITY (PER CENT)

O LOCATION
ABANDONED WELL
ABANDONED WELL (GAS SHOW)
ABANDONED WELL (OIL SHOW)
GAS WELL
OIL WELL
ABANDONED OIL WELL

TETRA TECH, INC

PROJECTS TEXAS ENERGY MANAGEMENT DIVISION PASADENA (A-1974)

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

POTENTIAL RESERVOIR & AVERAGE POROSITY MAP OF "BARROW SS" (BARROW AREA)

NPR — ALASKA

FOR ONPRA

HUSKY OIL NPR OPERATIONS INC

PROJECT MANAGER J.W. BRUINZEEL — PROJECT NO. TC-7174

INTERPRETATION BY: — REVIEWED — APPD.

DATE: OCTOBER, 1978 DATUM

SCALE 1 in. = 25 miles

TETRA TECH REPORT NO. 8200

TG2-0170

FIGURE 73

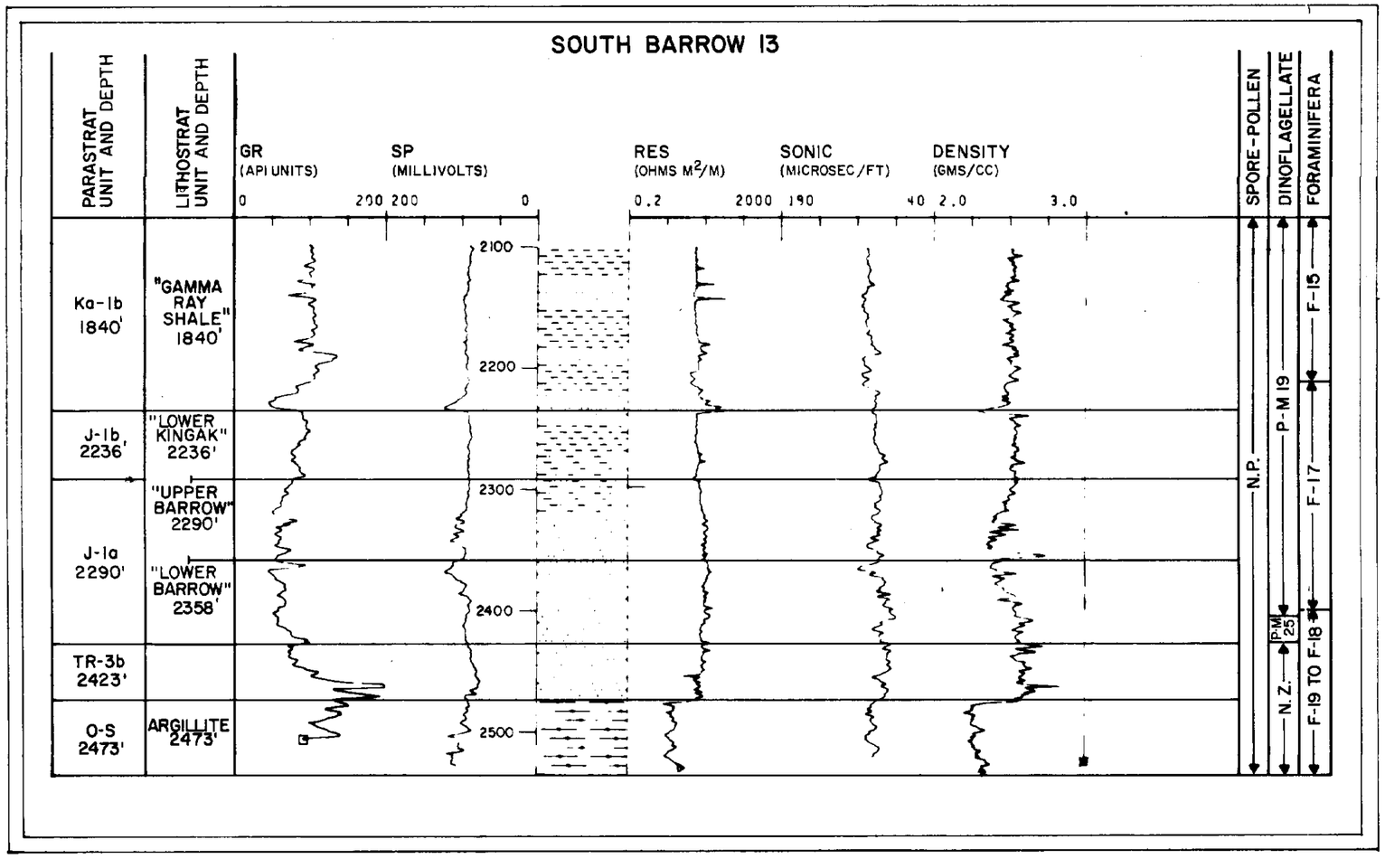
FIGURE 74

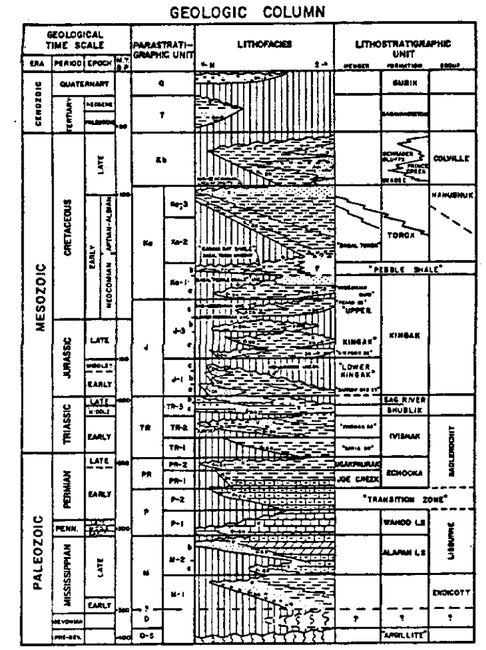
TYPE LOG OF "BARROW SANDSTONE,"
SOUTH BARROW 13

This figure is a representative section showing the "Barrow sandstone" at South Barrow 13. Regional variation in the "Barrow sandstone" can be seen ir figure 73.

The "Barrow sandstone" is the best known sandstone in the "Lower Kingak." This rock unit, consisting of "Lower Barrow gas sand" and "Upper Barrow gas sand," is the gas-producing zone in the South Barrow gas field. The "Barrow sandstone" is argillaceous in the Barrow area; a thin silty sandstone occurs at the same horizon at South Meade 1.

FIGURE 74





TETRA TECH, INC

HOUSTON, TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA, CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

TYPE LOG OF "BARROW SANDSTONE" SOUTH BARROW 13

NPR — ALASKA

FOR

ONPRA

HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J. W. BRUYNZEEL		PROJECT NO. TC-7174	
INTERPRETATION BY: STAFF		REVISED	
		DATE	INITIAL
DATE: SEPT. 1981	DATUM:		
CONTOUR INT:	SCALE:	DWG NO.	

TETRA TECH REPORT NO. 8200

TGZ-0170

FIGURE 74

FIGURE 75

POTENTIAL RESERVOIR AND AVERAGE POROSITY MAP OF "SIMPSON SANDSTONE"

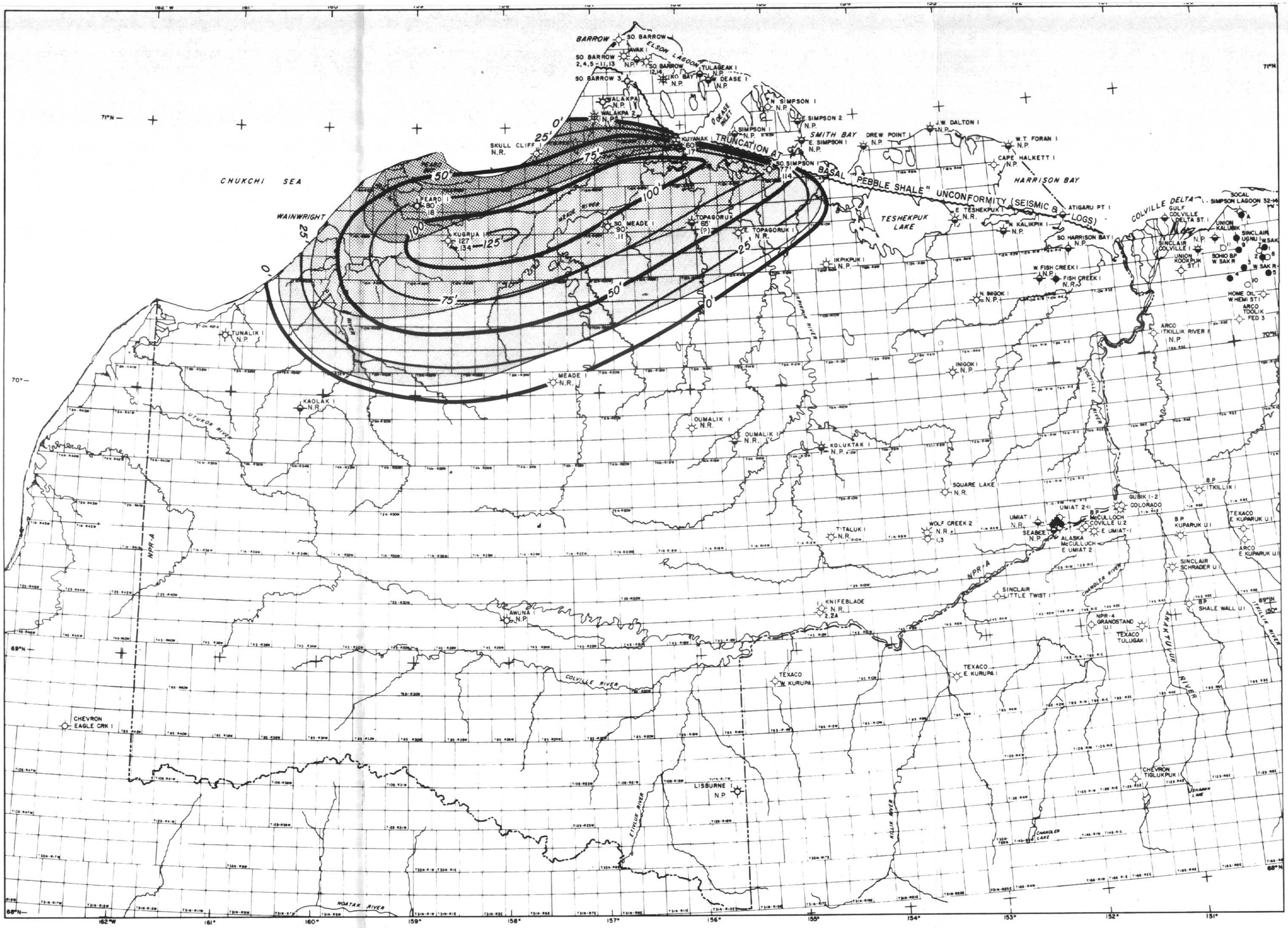
Well	Top of "Simpson sandstone" (Feet)	Thickness Feet	Thickness Meters	Average Porosity (Percent)
Kugrua 1	8,705	127	39	13.4
Kuyanak 1	5,376	60	18	17
South Meade 1	7,850	90	27	11
Peard 1	7,820	80	24	18
South Simpson 1	6,530	77	23	11.4
Topagoruk 1	7,748	65	20	(?)

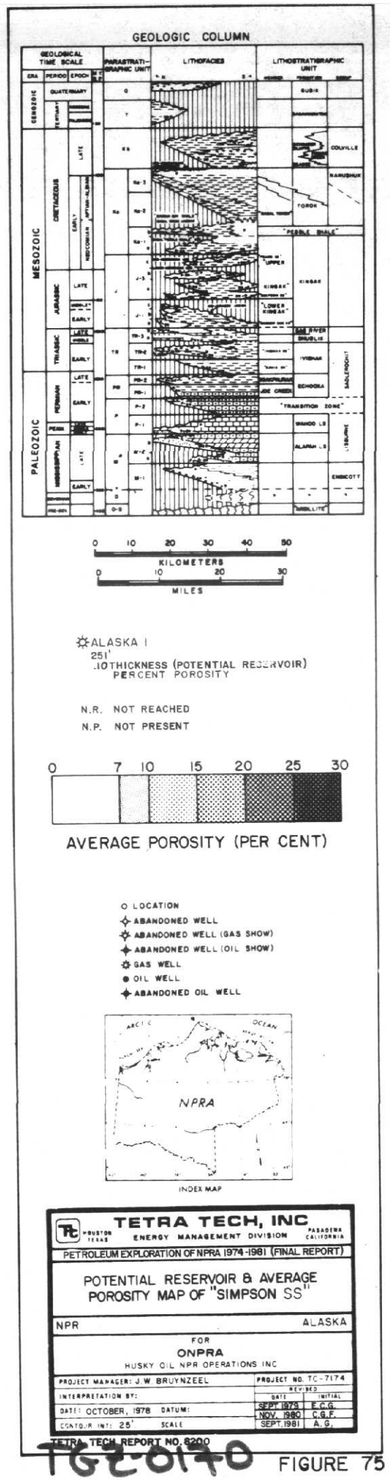
The "Simpson sandstone," a sandstone unit within the J-3aI parastratigraphic unit, trends northeast; the thickest section penetrated was at Kugrua 1.

Thickness of the sandstone ranges from 60 to 127 ft (18 to 39 m) and average porosities range from 11 to 18 percent. Porosities increase to the northwest, which is the probable source direction. The configuration of the sand body suggests deposition as a marine bar. Well data indicate the sand body shales out to the south and southeast and is truncated to the northeast by the basal "Pebble Shale" unconformity. Walakpa 1 and Walakpa 2 well data indicate the unit shales out to the north. Thinning to the northwest is indicated at Peard 1.

The "Simpson sandstone" grades vertically from a silty, shaly sand to moderately sorted, clean sandstone. The lower part of the sand is light-gray to gray, very fine- to fine-grained, glauconitic, with calcareous cement. The upper part of the sand contains clear, frosted quartz with some rock fragments. The quartz grains vary from subround to subangular, and are very fine- to fine-grained. The upper part is generally noncalcareous and contains much less glauconite than the lower part. The abundance of glauconite increases rapidly to the southeast.

Kugrua 1 had dead oil shows in the "Simpson sandstone." Very good gas shows were recorded at South Simpson 1, and a drillstem test of the interval recorded flow rates of 75 MCFD. Lost circulation zones were encountered in Kugrua 1 and South Meade 1.





TETRA TECH, INC.
HOUSTON TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

POTENTIAL RESERVOIR & AVERAGE POROSITY MAP OF "SIMPSON SS"

NPR — ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC

PROJECT MANAGER: J.W. BRUYNZEEL		PROJECT NO. TC-7174	
INTERPRETATION BY:		REVISED DATE	INITIAL
DATE: OCTOBER, 1978	DATUM:	SEPT. 1979	E.C.G.
		NOV. 1980	C.G.F.
CONTOUR INT: 25'	SCALE	SEPT. 1981	A.G.

TETRA TECH REPORT NO. 8200

TGC0140

FIGURE 75

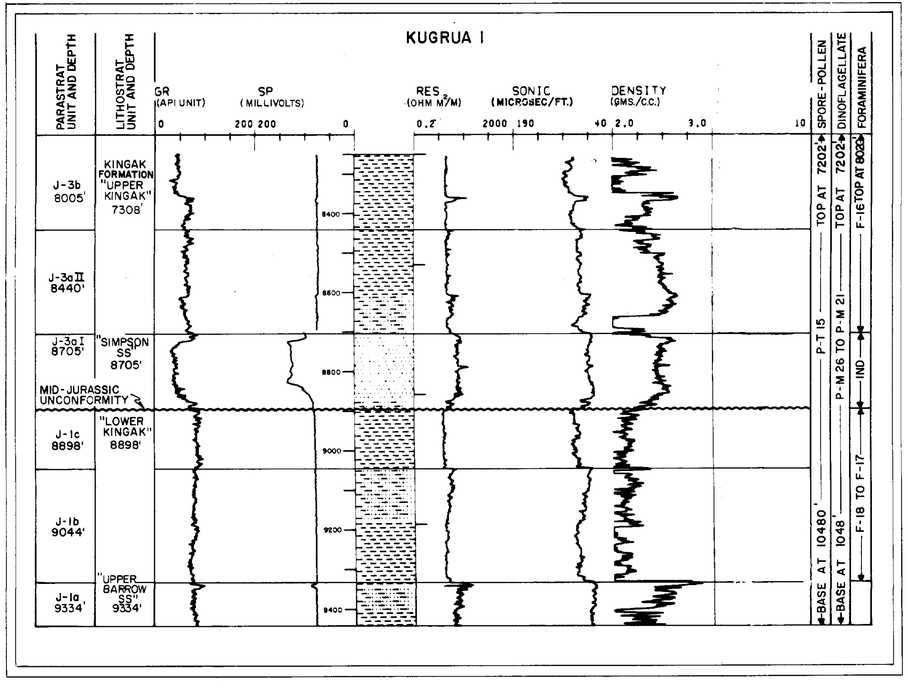
FIGURE 76

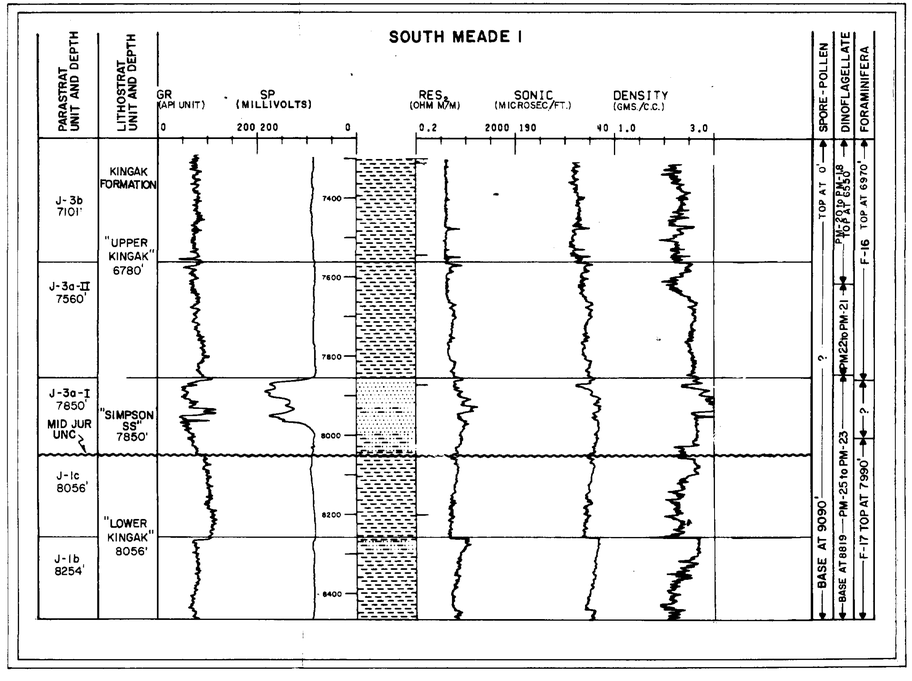
TYPE LOG OF "SIMPSON SANDSTONE,"
KUGRUA 1 AND SOUTH MEADE 1

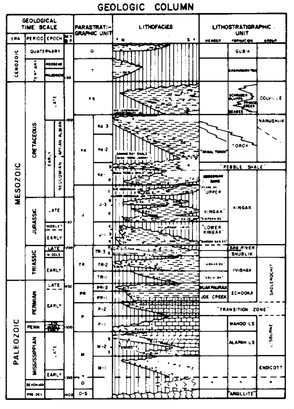
The "Simpson sandstone" was one of the targets at Kugrua 1, South Meade 1, Peard 1, Walakpa 1, and Kuyanak 1. It is a bar-like sandstone body restricted to the Meade Arch-Wainwright Arch area in the northwestern NPRA. The "Simpson" trends east-northeast, and is about 100 mi (161 km) long, 30 mi (48 km) wide, and 200 ft (61 m) thick.

Two representative sections of the "Simpson sandstone" are shown in this figure. The sandstone at Kugrua 1 is nearly a uniform sandstone with few shale breaks. At South Meade 1, the unit breaks into a relatively thin lower sandstone unit and a thicker upper sandstone unit. Regionally, the upper unit is more extensive than the lower unit.

FIGURE 76







TETRA TECH, INC

HOUSTON, TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA, CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

TYPE LOG OF "SIMPSON SANDSTONE"

KUGRUA I AND S. MEADE I

NPR — ALASKA

FOR

ONPRA

HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J.W. BRUYNZEEL	PROJECT NO. TC-7174	
INTERPRETATION BY: STAFF	REVISED	
DATE: SEPT., 1981 DATUM:	DATE	INITIAL
CONTOUR INT: SCALE:	DWG NO.	

TETRA TECH REPORT NO. 8200

TGZ-0170

FIGURE 76

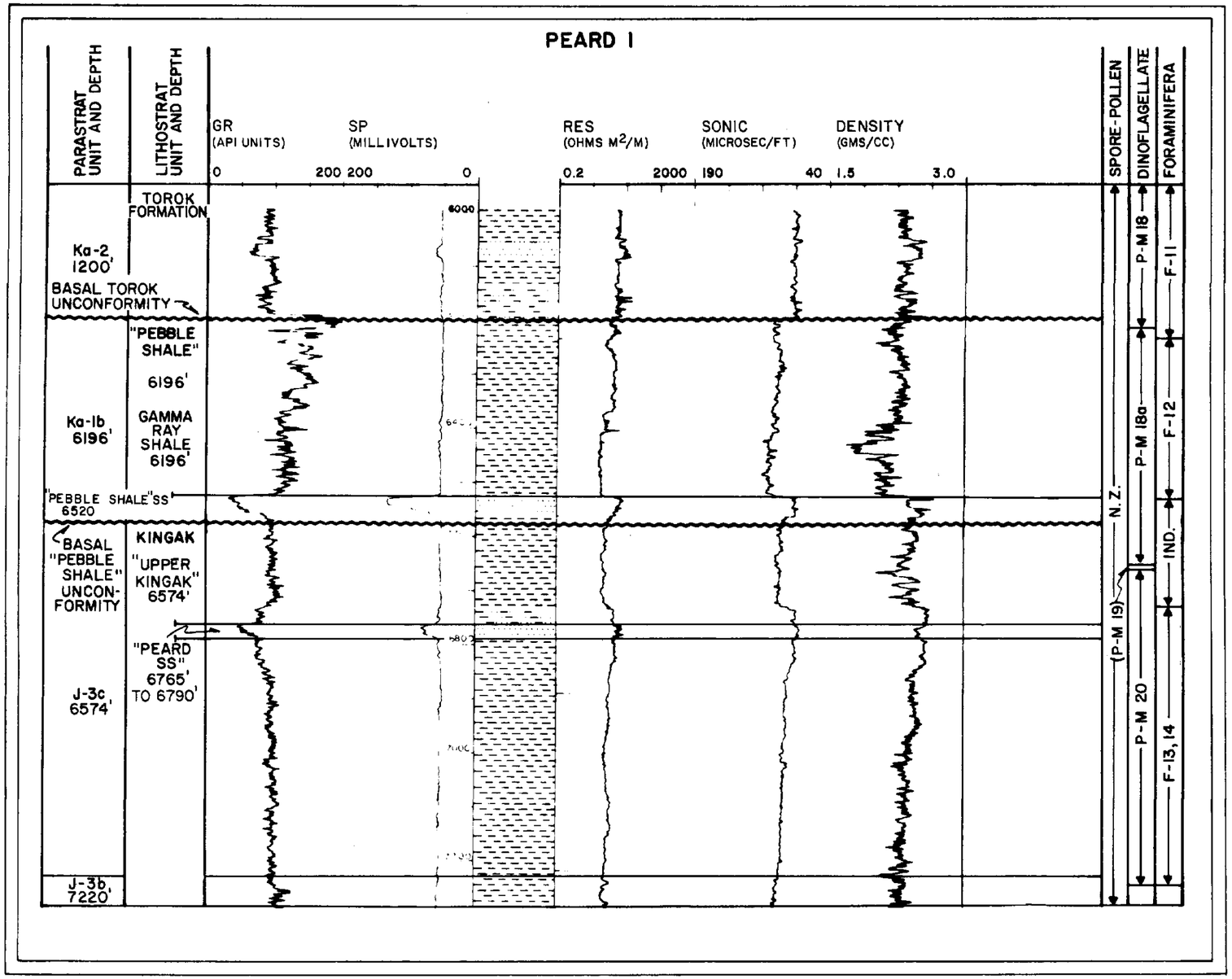
FIGURE 77

TYPE LOG OF "PEARD SANDSTONE,"
PEARD 1

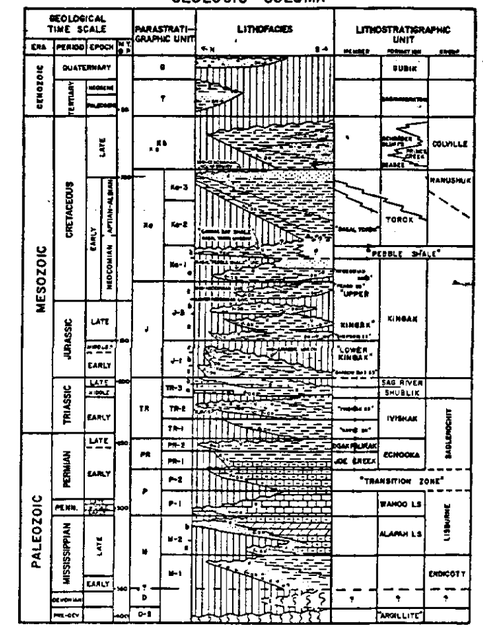
This figure shows the thickest and most typical section of the "Peard sandstone" at Peard 1.

This thin (less than 100 ft, or 30 m) sandstone is present at both Peard 1 and Kugrua 1. The "Peard sandstone" may thicken toward the "Pebble Shale" truncation northward, below the Chukchi Sea.

FIGURE 77



GEOLOGIC COLUMN



TETRA TECH, INC

HOUSTON, TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA, CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

TYPE LOG OF "PEARD SANDSTONE" PEARD I

NPR — ALASKA

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HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J. W. BRUYNZEEL		PROJECT NO. TC-7174
INTERPRETATION BY: STAFF		REVISED: DATE / INITIAL
DATE: SEPT., 1981	DATUM:	
CONTOUR INT:	SCALE:	DWG NO.

TETRA TECH REPORT NO. 8200

TGE-0170

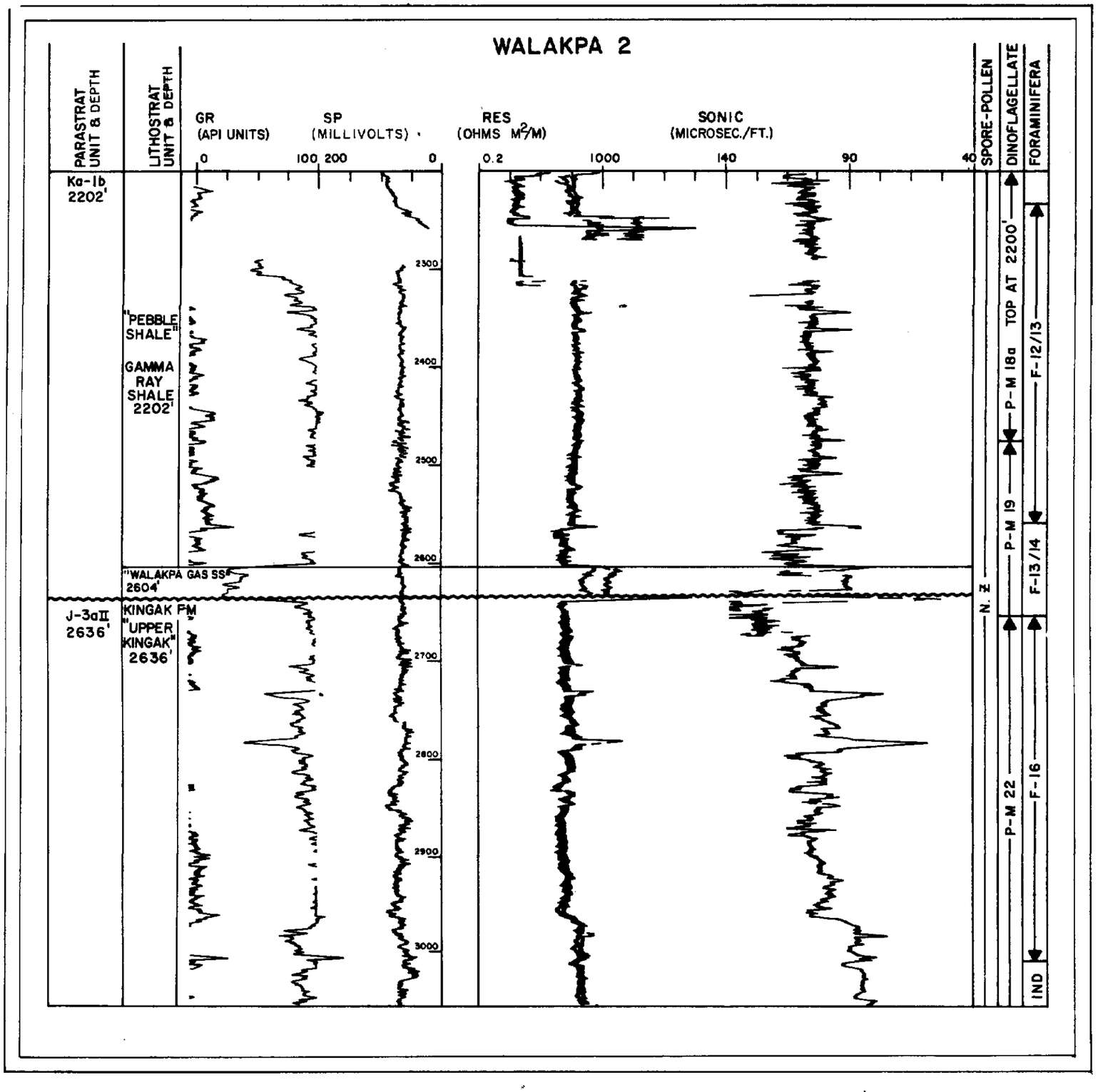
FIGURE 77

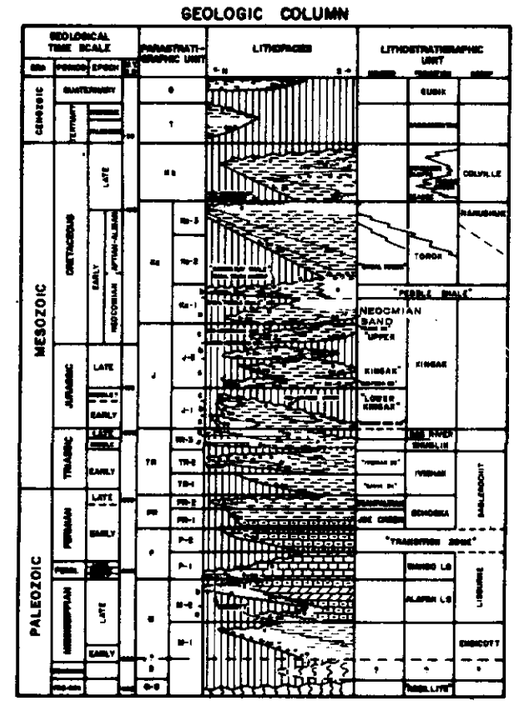
FIGURE 78

TYPE LOG OF "WALAKPA GAS SANDSTONE," WALAKPA 2

The "Walakpa gas sandstone," is present at Walakpa 1 and Walakpa 2 where it produces gas, and also at Kuyanak 1 where it was water-wet. This log segment is from Walakpa 2, which is typical of this gas-producing unit.

The "Walakpa gas sandstone" probably can be correlated to the "Pebble Shale" sandstone for two reasons. First, new section is added below, rather than above, the sandstone at Walakpa 2, which is a down-dip, step-out well. Second, biostratigraphic analysis indicates a Neocomian age, rather than an Oxfordian age, for rocks immediately on top of the sandstone.





TETRA TECH, INC

HOUSTON, TEXAS — ENERGY MANAGEMENT DIVISION — PASADENA, CALIFORNIA

PETROLEUM EXPLORATION OF NPRA 1974-1981 (FINAL REPORT)

TYPE LOG OF
"WALAKPA GAS SANDSTONE"
WALAKPA 2

NPR — ALASKA

FOR
ONPRA
HUSKY OIL NPR OPERATIONS INC.

PROJECT MANAGER: J. W. BRUYNZEEL	PROJECT NO. TC-7174	
INTERPRETATION BY: STAFF	REVISED	
	DATE	INITIAL
DATE: SEPT, 1981 DATUM:		
CONTOUR INT: SCALE:	DWG NO.	

TETRA TECH REPORT NO. 8200 TGT-0170

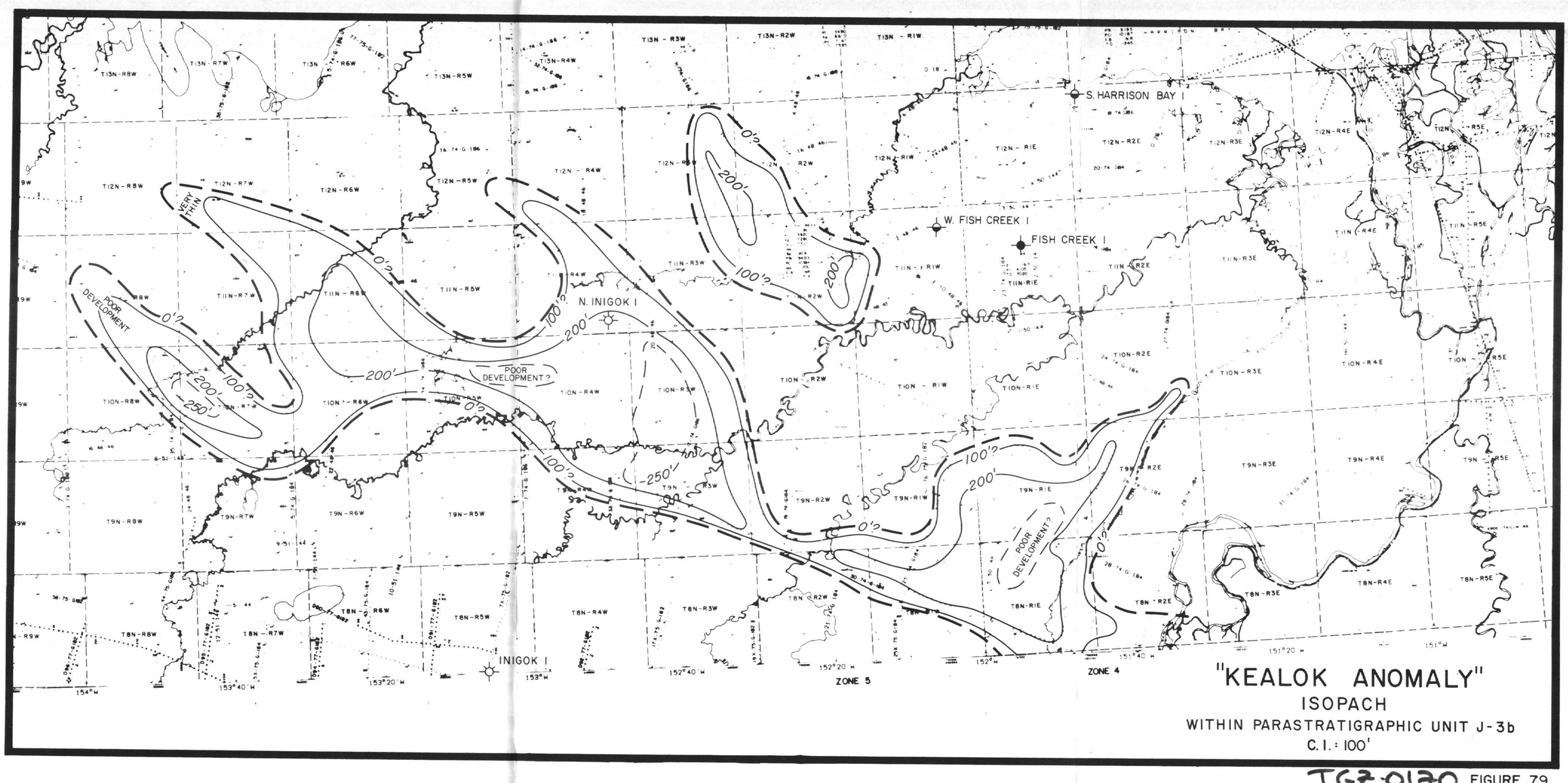
FIGURE 78

FIGURE 79

"KEALOK ANOMALY" ISOPACH WITHIN PARASTRATIGRAPHIC UNIT J-3B

The "Kealok anomaly" isopach map resembles a map view of present sand islands off the Texas Gulf Coast, with relatively straight basinward (seaward) "strand lines" facing toward the southward and northward (lagoonward) projecting lobes. An "island" is shown in the vicinity of West Fish Creek 1.

FIGURE 79



"KEALOK ANOMALY"
ISOPACH
WITHIN PARASTRATIGRAPHIC UNIT J-3b
C.I.: 100'

TGZ-0170 FIGURE 79

FIGURE 80

LINE 17-74-G-186, SHOTPOINTS 68-148

The Fish Creek Platform situated in the northeastern part of the NPRA is a large positive area trending southeasterly. Line 17-74, which extends northeasterly, shows this feature.

Horizon 0850 exhibits an east-west dip reversal off the southwest flank of the platform. Immediately overlying the southern portion of this reversal is a seismic event called the "Kealok anomaly." Seismic evidence for this is indicated by the development of a strong reflector immediately above horizon 0850 (shotpoints 113 to 149). This feature is composed of four lobes, totaling about 170 sq mi. North Inigok 1, drilled to test this anomaly, found a siltstone that produced a gas show.

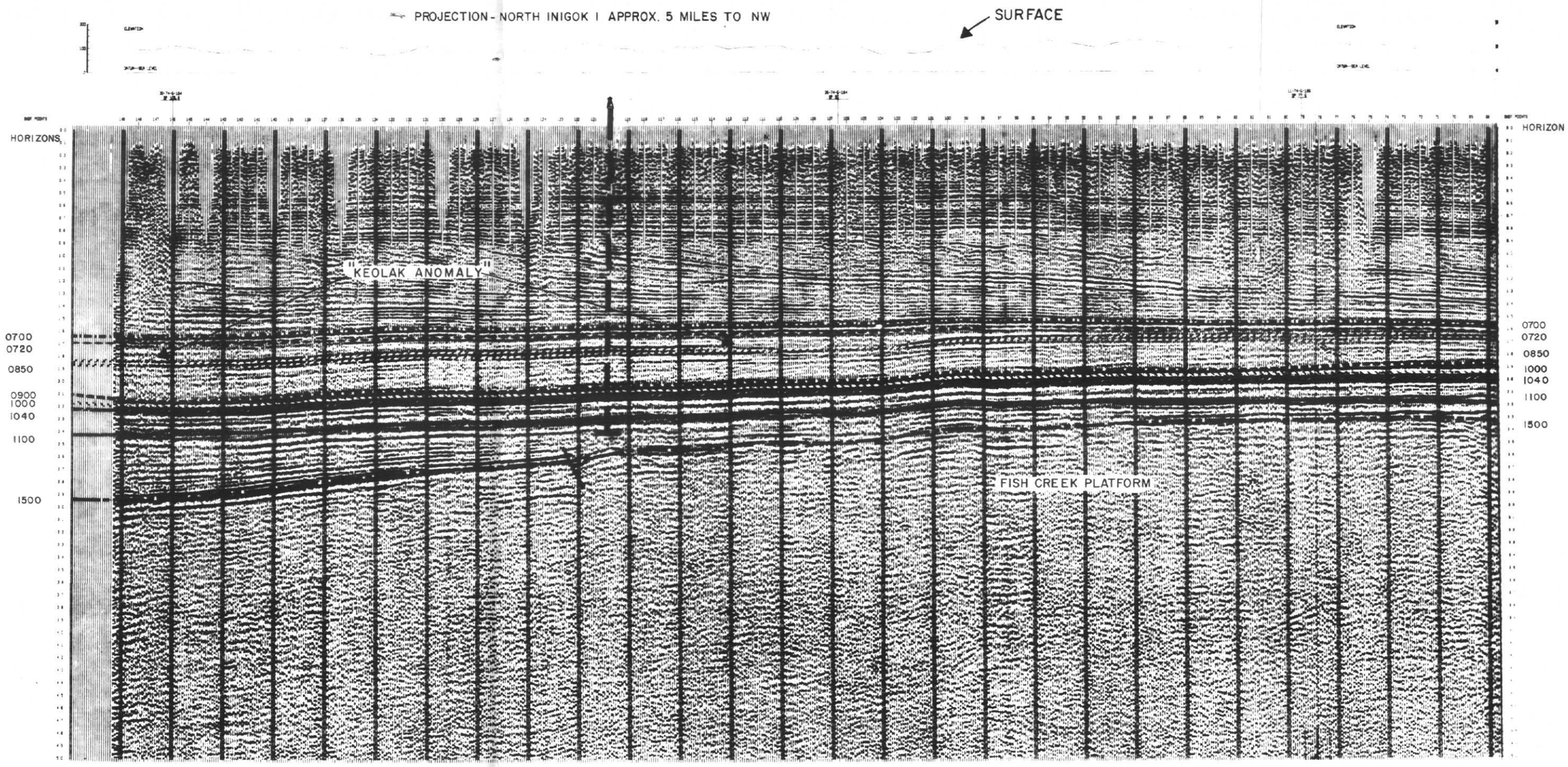
FIGURE 80

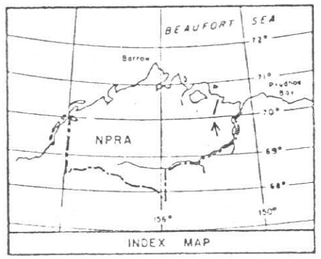
NORTHEAST

LINE 17-74-G-186
SHOTPOINTS 68 - 148
AREA ZONE A
LOCATION NAVAL PETROLEUM RESERVE NO. 4

DEPARTMENT OF THE NAVY

FIGURE 80





0 1.0 2.0
MILES

TETRA TECH REPORT NO. 8200

TGZ-0170

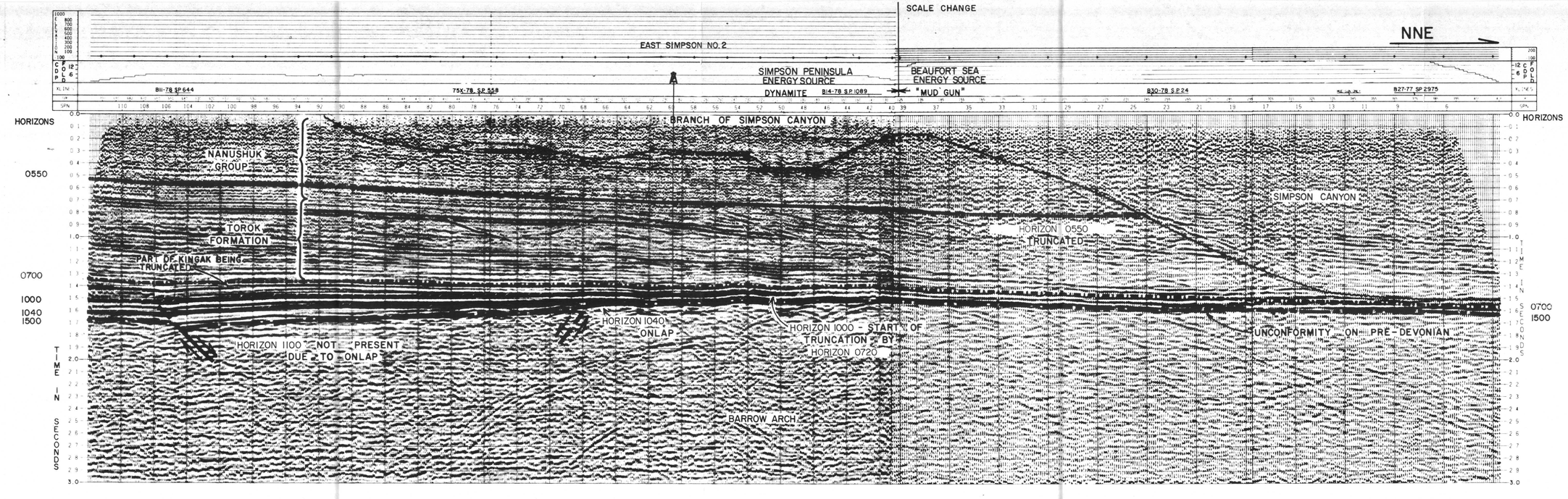
FIGURE 81

LINE B20-78-G-1182, SHOTPOINTS 6-110,
SCALED FINAL STACK

Line B20-78 is a northeasterly line on the Simpson Peninsula in the East Barrow and Teshekpuk Quadrangles. The Simpson canyon is the most prominent feature on this line. This submarine canyon was formed by erosion of the Nanushuk sediments with subsequent deposition of the younger Colville Group.

The Barrow Arch also is evident on this line. The relatively uniform regional southern dip that characterizes most horizons in the northern NPRA changes at the Barrow Arch to north-northeast regional dip. The Arch is an east-southeast trending structural feature lying mostly just offshore of the northeastern boundary of the Reserve. The northern limits of much of the pre-Cretaceous section are the result of either truncation by the basal "Pebble Shale" unconformity (horizon 0720) or onlap onto the Barrow Arch. Both are illustrated on this line.

FIGURE 81



USGS
ONPRA

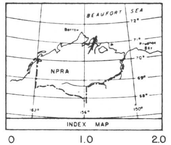
HUSKY OIL NPR OPRS. INC
NATIONAL PETROLEUM RESERVE ALASKA
BARROW AREA

B20-78-G-1182

SHOTPOINTS 6-110

SCALED FINAL STACK

FIGURE 81



0 1.0 2.0
MILES
PENINSULA

0 0.25
MILES
BEAUFORT SEA SCALE

TGZ-0170

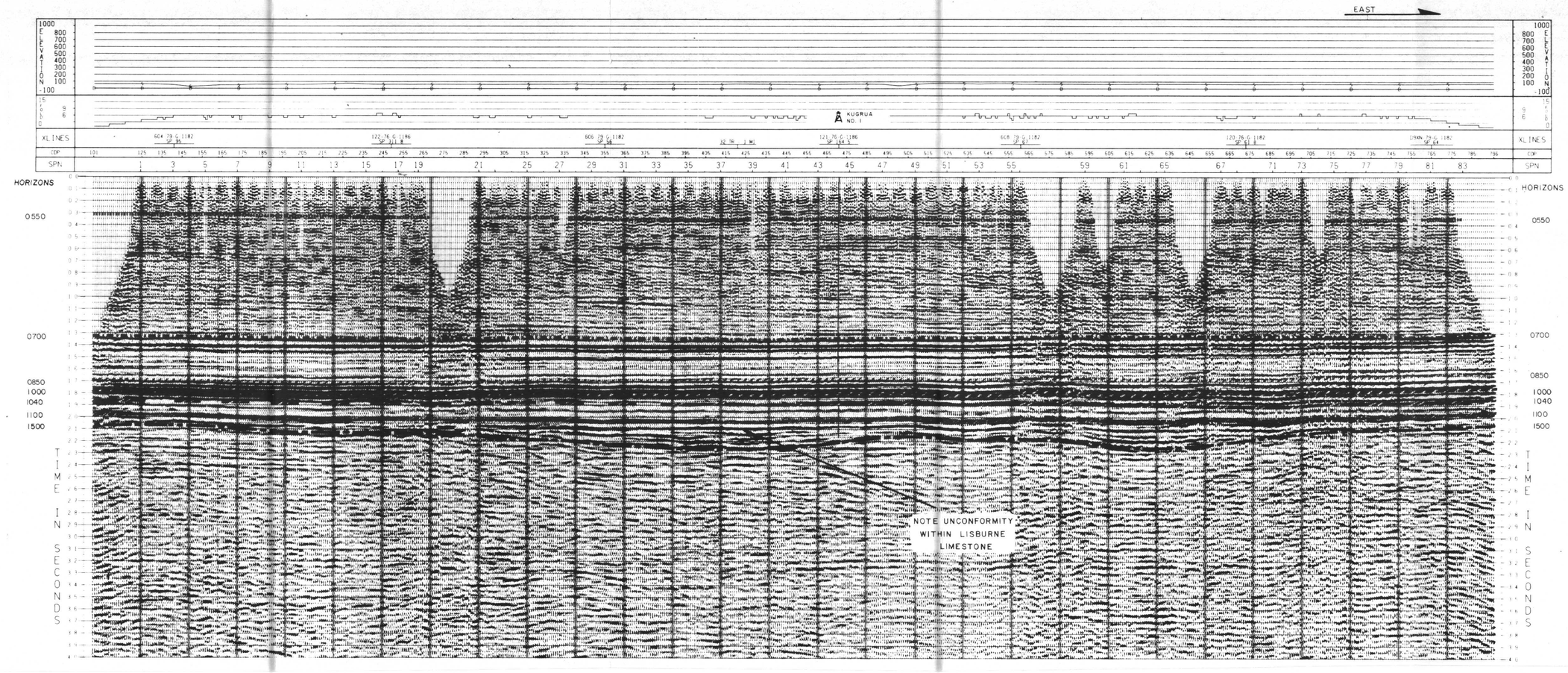
TETRA TECH REPORT NO. 8200

FIGURE 82

LINE 663-79-G-1182, SHOTPOINT 1-83,
SCALED FINAL STACK

Seismic horizon 1100 approximates the top of the Paleozoic sediments in the NPRA. Line 663-79 in the northern part of the Meade and Wainwright Quadrangles is a good example of a potential stratigraphic trap at this level. This line, oriented east-west, extending from T14N-R25W to T14N-R28W, is just north of the Meade Basin and between the Wainwright and Meade Arches. A prominent unconformity is present at about 2.1 seconds (two-way time), and Paleozoic sediments are truncated between shotpoints 20 and 71.

FIGURE 82



USGS ONPRA

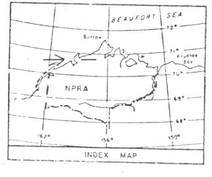
HUSKY OIL NPR OPRS. INC
NATIONAL PETROLEUM RESERVE ALASKA
NORTH COASTAL PLAINS AREA

663-79-G-1182

SHOTPOINTS 1-83

SCALED FINAL STACK

FIGURE 82



0 1.0 2.0
MILES

TGZ-0170

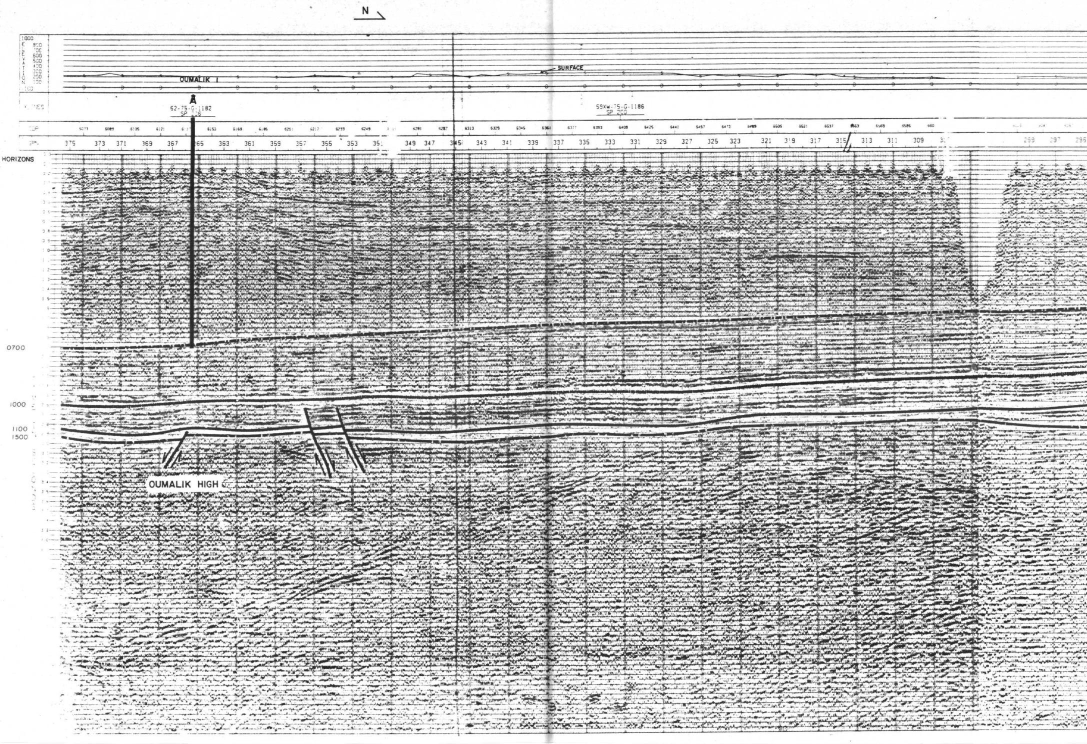
TETRA TECH REPORT NO. 8200

FIGURE 83

LINE 47-75-G-1186, SHOTPOINTS 105-375, FINAL STACK

Line 47-75 is a long north-south line through the central NPRA. It crosses the Oumalik High in the south and the Meade Arch in the north. The Oumalik structure is a basement feature showing many faults in the deeper levels. No seismic horizons exhibit onlap onto this feature, but thinning over the high is seen, especially in the deeper intervals (horizons 1000 to 1500). Northward along this line from the Oumalik High, a small basin interrupts the continued northward shallowing and thinning of the section along the Meade Arch. As the line approaches the Barrow Area, the continued shallowing of horizon 1500 results in onlap terminations of shallower horizons.

FIGURE 83


N
1000
ELEVATION
800
700
600
500
400
300
200
100
SURFACE
OUMALIK 1
62-75-G-1182
SP 226
59XW-75-G-1186
SP 200
CDP
SPN
375
373
371
369
367
365
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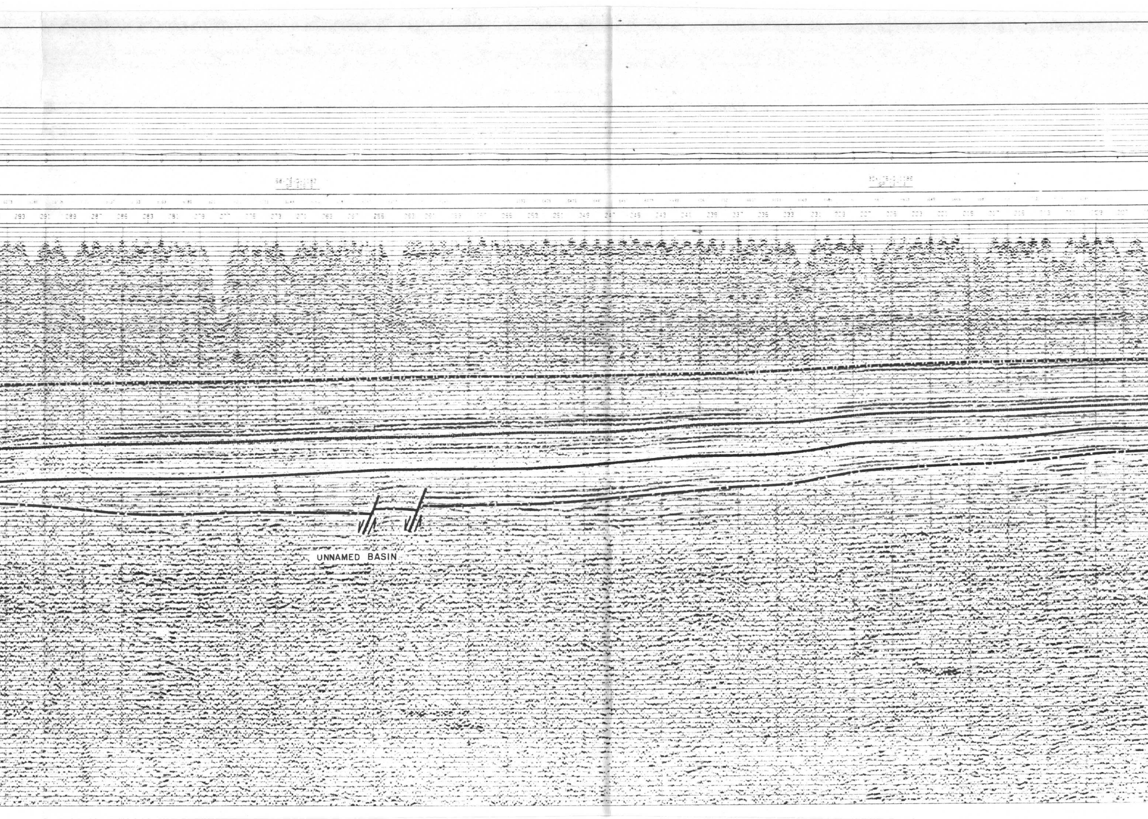
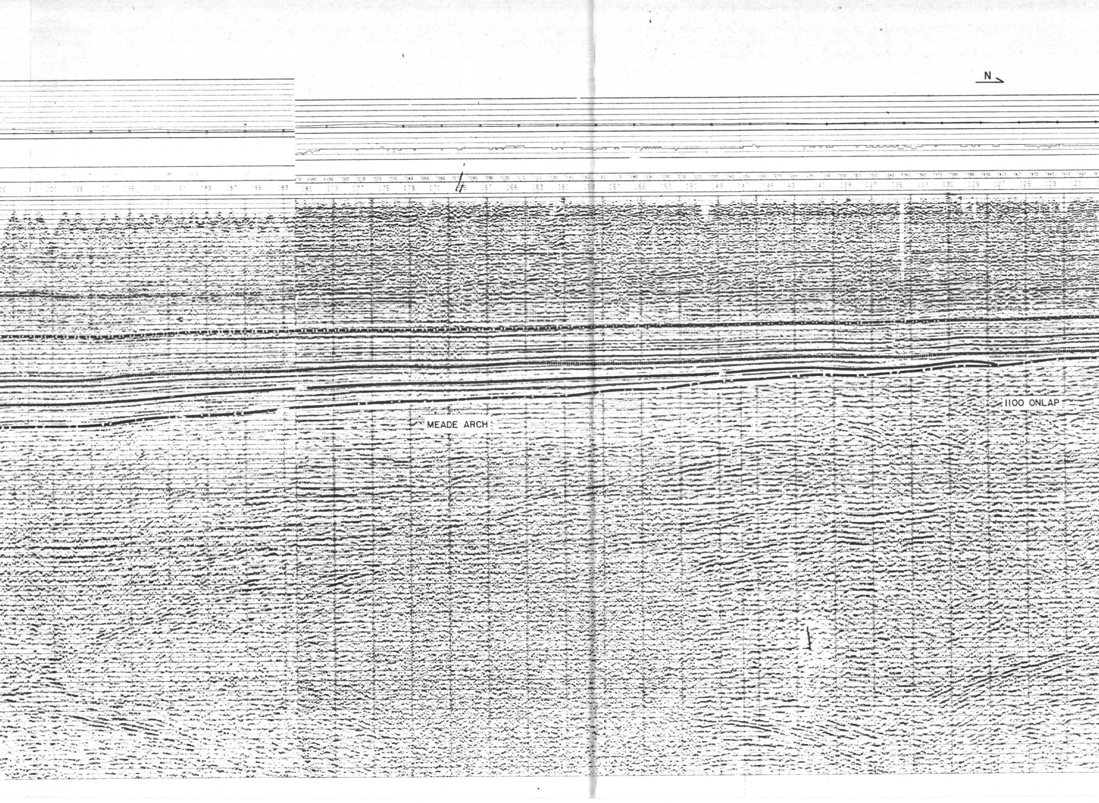
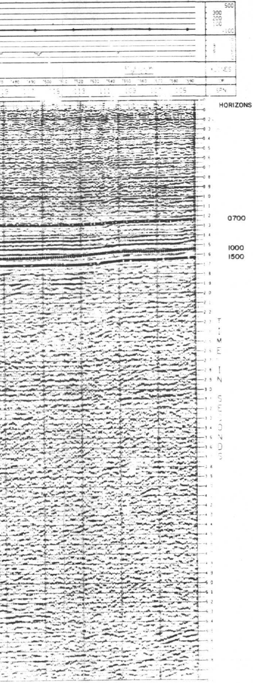
HORIZONS
0700
1000
1100
1500
OUMALIK HIGH







NORTHEAST

DEPARTMENT OF
THE NAVY

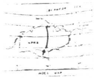
NAVAL PETRO RESERVE-4
COASTAL ZONE

47-75-G-1186

SHOTPOINTS 105 - 375

FINAL STACK

FIGURE 83



0 1.0 2.0
MILES

TGZ-0170

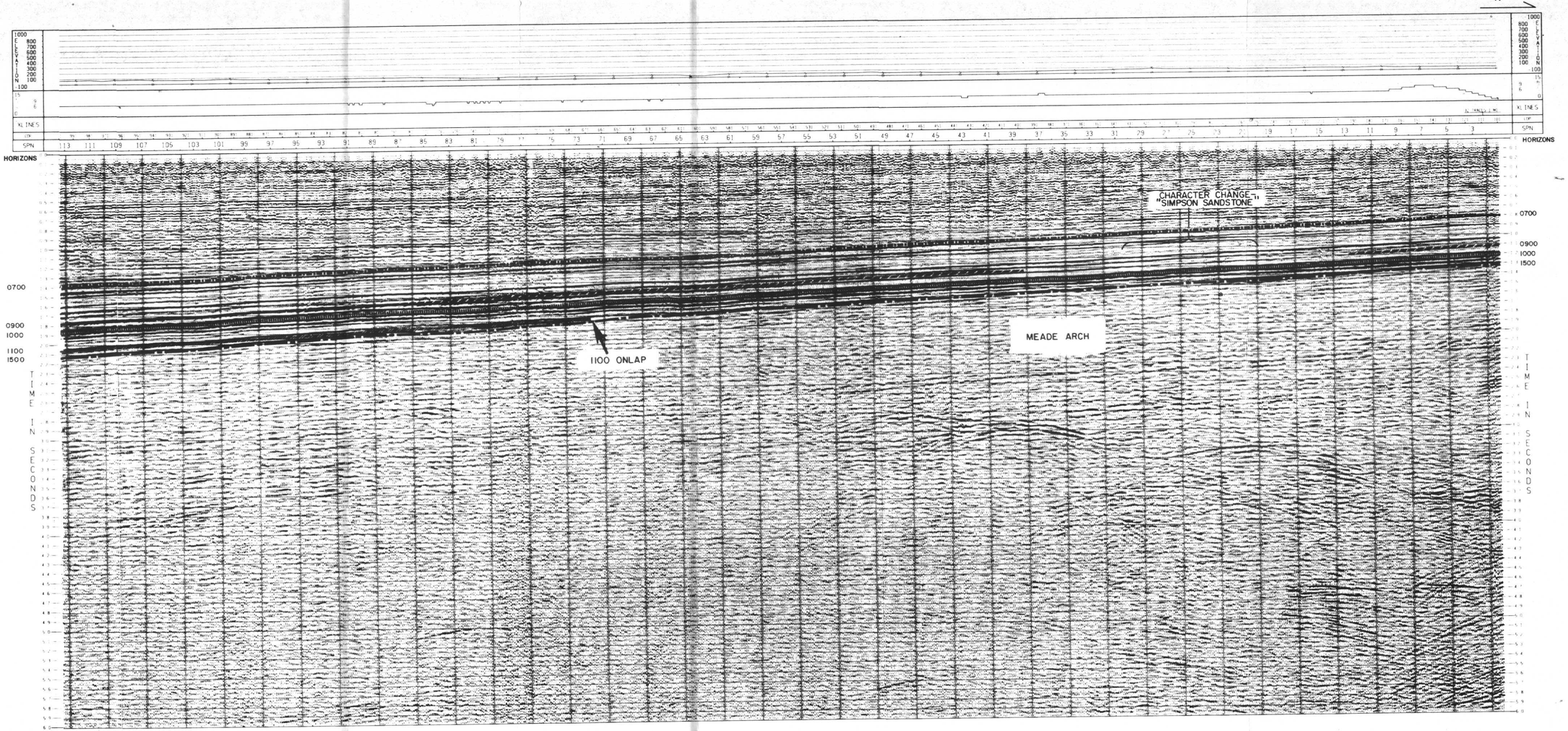
TETRA TECH REPORT NO. 8200

FIGURE 84

LINE 612-79-G-1182, SHOTPOINTS 1-113,
SCALED FINAL STACK

The Jurassic Kingak Shale contains several interbedded sandstone units. Of these, the "Simpson sandstone" seems to be the thickest and most widespread. The regional south dip of this unit terminates to the north where it is truncatedby the basal "Pebble Shale" unconformity near the Barrow High. Line 612-79, extending north-south in the center portion of the Meade River Quadrangle, shows a character change in the "Simpson sandstone" level near shotpoint 25. This is interpreted to be a facies change to the north from sandstone to shale or siltstone.

FIGURE 84



NORTH

USGS ONPRA

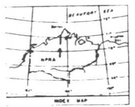
HUSKY OIL NPR OPRS. INC
NATIONAL PETROLEUM RESERVE ALASKA
NORTH COASTAL PLAINS AREA

612-79-G-1182

SHOTPOINTS 1 - 113

SCALED FINAL STACK

FIGURE 84



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MILES

TETRA TECH REPORT NO. 8200

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