

NATIONAL PETROLEUM RESERVE IN ALASKA

GEOLOGICAL REPORT  
U. S. NAVY  
ATIGARU POINT NO. 1

HUSKY OIL NPR OPERATIONS, INC.  
Prepared by: Gordon W. Legg

For the

U. S. GEOLOGICAL SURVEY  
Office of the National Petroleum Reserve in Alaska  
Department of the Interior  
JULY 1983

## TABLE OF CONTENTS

|  | <u>Page</u> |
|--|-------------|
| <b>GEOLOGIC SUMMARY</b>                          |             |
| Introduction . . . . .                           | 1           |
| Pre-Drilling Prognosis . . . . .                 | 1           |
| Post-Drilling Summary . . . . .                  | 1           |
| Location Map (Figure 1) . . . . .                | 2           |
| Surveyor's Certificate (Figure 2) . . . . .      | 3           |
| <br><b>WELLSITE GEOLOGIST'S REPORT</b>           |             |
| Summary . . . . .                                | 4           |
| Stratigraphy                                     |             |
| Cretaceous-Tertiary (undifferentiated) . . . . . | 4           |
| Cretaceous                                       |             |
| Senonian . . . . .                               | 5           |
| Cenomanian to Turonian . . . . .                 | 5           |
| Nanushuk Group . . . . .                         | 5           |
| Torok Formation . . . . .                        | 5           |
| "Pebble Shale" . . . . .                         | 6           |
| Jurassic   |             |
| Kingak Formation . . . . .                       | 6           |
| Triassic   |             |
| Sag River Sandstone . . . . .                    | 6           |
| Shublik Formation . . . . .                      | 6           |
| Permian-Triassic                                 |             |
| Sadlerochit Group                                |             |
| Ivishak Formation . . . . .                      | 7           |
| Kavik Shale Member . . . . .                     | 7           |
| Echooka Formation . . . . .                      | 8           |
| Early Mississippian-Permian                      |             |
| Lisburne Group . . . . .                         | 8           |
| Endicott Group . . . . .                         | 9           |
| Indeterminate                                    |             |
| Argillite . . . . .                              | 9           |
| Oil and Gas Shows . . . . .                      | 9           |
| Conclusions . . . . .                            | 10          |
| <br><b>LIST OF FIGURES</b>                       |             |
| Figure 1 - Location Map . . . . .                | 2           |
| Figure 2 - Surveyor's Certificate . . . . .      | 3           |

PERTINENT DATA AND APPENDICES

Appendix

|    |   |        |
|----|---|--------|
| A. | Summary of Pertinent Data . . . . .                           | A-1-2  |
| B. | Drill Cuttings and Core Descriptions . . . . .                | B-1-22 |
| C. | Log Analysis<br>Report of March 26, 1977 . . . . .            | C-1    |
| D. | Core Analysis Report<br>Report of February 18, 1977 . . . . . | D-1    |

COMPOSITE LITHOLOGY LOG (In Pocket)

## GEOLOGIC SUMMARY

### INTRODUCTION

The Atigaru Point No. 1 is located in the NE 1/4 of protracted Section 19, T14N, R2E, Umiat Meridian (see Figures 1 and 2). The surveyor's plat located the well 1422' FNL and 1925' FEL of the section. The location is on the tip of Atigaru Point, which projects out into Harrison Bay, and is located approximately 80 miles west-northwest of the Prudhoe Bay Field and approximately 23 miles southeast of the U. S. Navy, Cape Halkett No. 1 well. The Atigaru Point No. 1 was drilled in 1977 just prior to the relinquishment by the Navy of the Naval Petroleum Reserve No. 4 (now designated the National Petroleum Reserve in Alaska).

### PRE-DRILLING PROGNOSIS

The Atigaru Point No. 1 was drilled on a location that was as far to the northeast as it was feasible to locate in order to maximize the possibility of approaching the updip erosional truncation of both the Sadlerochit Group sandstones and the Lisburne Group carbonates. By locating on the tip of Atigaru Point, it was hoped that the well would encounter the favorable Sadlerochit and Lisburne porosity which had been found in the Cape Halkett No. 1 well, and which, of course, exists in the Prudhoe Bay Field. This favorable porosity development appears to be related to the proximity to the erosional truncation.

The secondary objectives of the well were sandstones at or near the basal Cretaceous unconformity (Kuparuk Formation equivalent) and the Sag River Sandstone.

### POST-DRILLING ANALYSIS

Favorable porosity development, which had been anticipated in both the Sadlerochit Group sandstones and in the Lisburne Group carbonates, was not present at the Atigaru Point No. 1. The sandstones of the Sadlerochit Group contained a large amount of white clay filling in the matrix, which greatly inhibited their porosity. A core (Core No. 1) was taken in the Ivishak Formation from 8712-8742'. The porosities varied from a low of 1.1% to a high of 14.2%. The average for the 30-foot interval was about 10%. Shows in the sandstone were scattered, very spotty and yielded generally poor cuts.

The carbonates of the Lisburne Group also exhibited very poor porosities. The average was generally in the 1% range. No visible shows were noted in the Lisburne.

The Sag River Sandstone had fair porosity (20%), but calculated to be 100% water saturated. Sandstones of the Kuparuk Formation were not developed at this location.

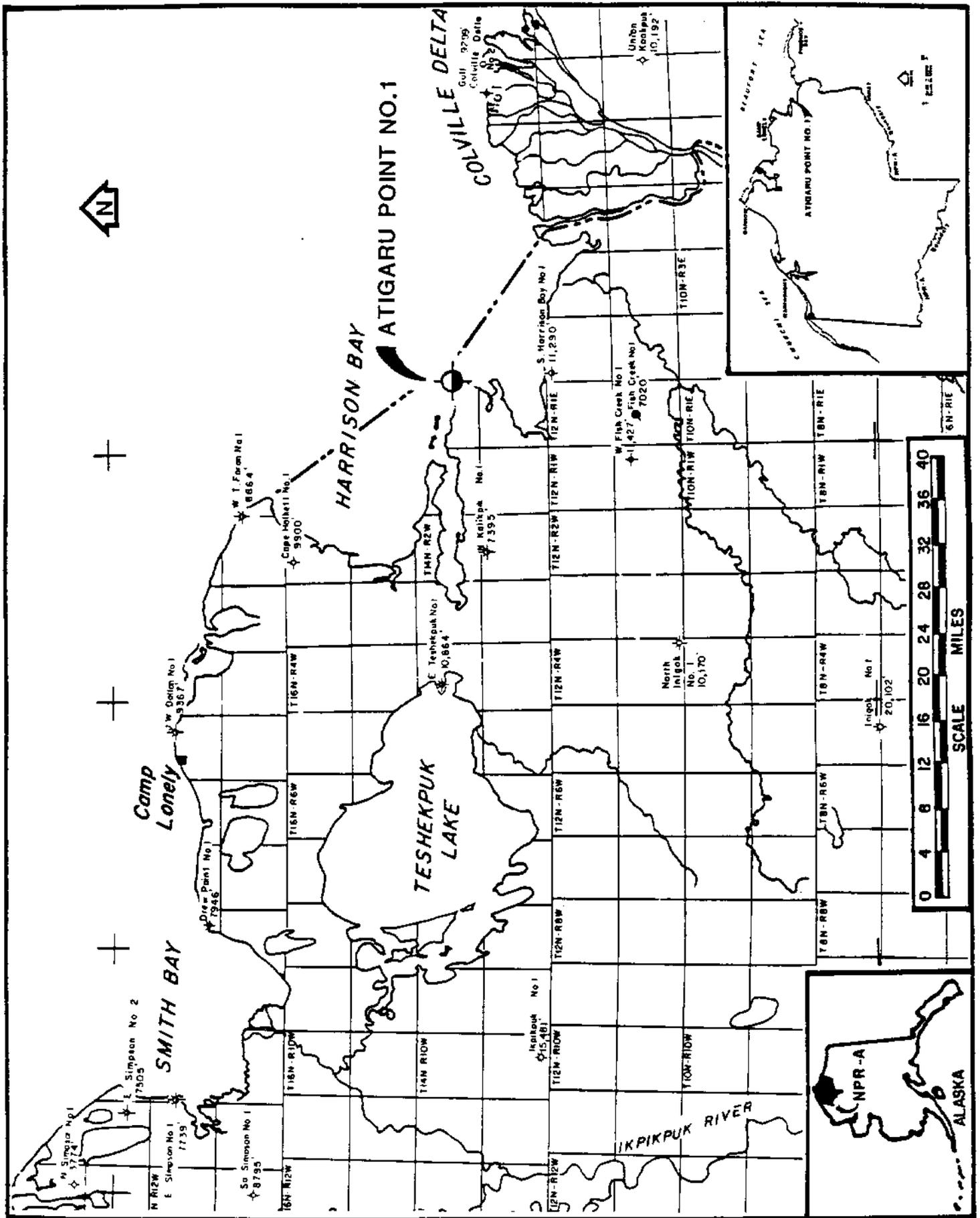
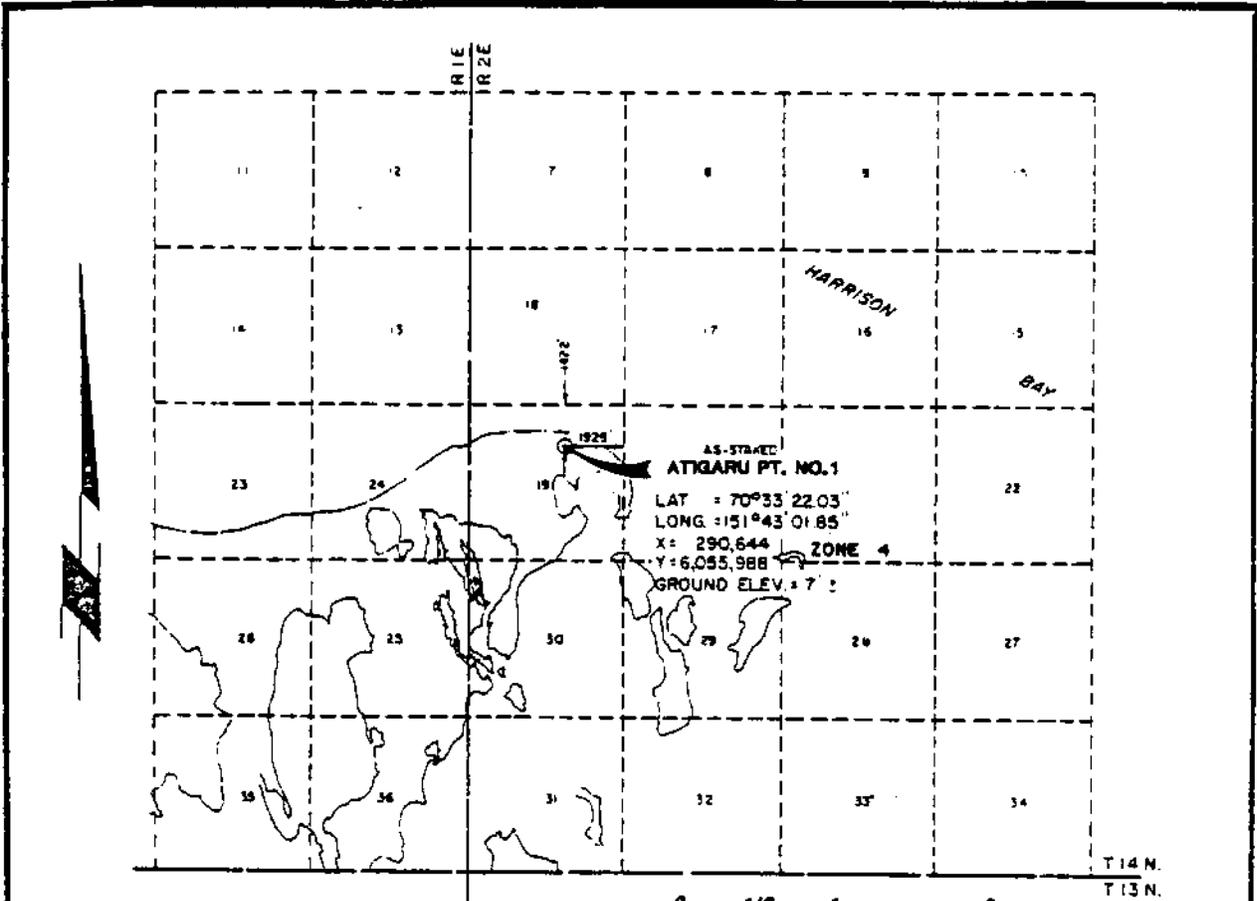


FIGURE 1 - LOCATION MAP - ATIGARU POINT NO. 1



**CERTIFICATE OF SURVEYOR**



I hereby certify that I am properly registered and licensed to practice land surveying in the State of Alaska and that this plat represents a location survey made by me or under my supervision, and that all dimensions and other details are correct.



7-22-76      Andrew S. Potts  
Date                      SURVEYOR

|  |
|--|
| AS-STAKED<br><b>ATIGARU PT. NO.1</b><br>Located in<br>NE 1/4 PROTRACTED SEC 19, T14N, R2E, UMIAT MERIDIAN, AK                              |
| Surveyed for<br><b>HUSKY OIL</b><br>N.P.R. OPERATIONS INC.   |
| Surveyed by<br><b>F.M. LINDSEY &amp; ASSOC.</b><br>LAND & HYDROGRAPHIC SURVEYORS<br>2502 West Northern Lights Boulevard Box 3<br>Anchorage |

FIGURE 2 - SURVEYOR'S CERTIFICATE - ATIGARU POINT NO. 1

WELLSITE GEOLOGIST'S REPORT  
BY: W. D. FENEX  
EDITED BY: GORDON W. LEGG

SUMMARY

The Atigaru Point No. 1 was drilled to test the entire stratigraphic section above the argillite basement on a seismic structural closure located on the southwest flank of the Barrow Arch. This structure is on trend with the larger "Eskimo Island" structure to the northwest and offshore within Harrison Bay.

The area of closure and the vertical relief, as mapped seismically on the top of the Sadlerochit Group, are about 4,145 acres, and 75', respectively. At the Lisburne level, closure and vertical relief are about 3,480 acres, and 150'.

Although the well was structurally low to the seismic estimates (as much as 300' at the Lisburne level), there is no reason to believe that structural closure does not exist at the location.

The Ivishak Formation contained some traces of scattered, very poor show near the top, but the very poor porosity observed in the samples, and confirmed by log analysis (10-12%), would have precluded the possibility of a productive reservoir. The Lisburne carbonates did not have any shows in the samples, and the Lisburne, also, had such low observed and calculated porosities (generally less than 1%), that it could not be considered as a potential reservoir at the drilled location. The Sag River Sandstone, which had fair to good porosity (up to 20%), was 100% water saturated.

Scattered oil shows were encountered in sandstones of the Nanushuk Group and in sandstones of the Torok Formation. All of these sandstones were thin, shaly, and very tight.

No zones encountered in drilling the Atigaru Point No. 1 were considered to be worthy of further evaluation.

STRATIGRAPHY

There were no samples caught from the surface down to a depth of 545'.

CRETACEOUS-TERTIARY (undifferentiated) 545-980'

The section from 545' to 980' is composed predominantly of gravel which contains large, subrounded fragments of quartz, chert, and unidentified metamorphic pebbles. The gravel is interbedded with thin beds of clay, which is soft and gummy. The percentage of clay increases toward the bottom of the interval along with occasional interbedded sandstones, which are gray, very silty, argillaceous, very fine to fine grained, and are poorly sorted and relatively unconsolidated.

## CRETACEOUS

### Senonian 980-2630'

The dominant lithology in this interval is clay, which is gray-brown, bentonitic, slightly silty in part, and soft and gummy. The apparent clay seen in the samples is probably poorly compacted claystone. Interbedded with the claystone are thin sandstone beds, which are gray, argillaceous, very fine grained to silty, poorly consolidated, and containing numerous thin seams of lignite. Below 1815', the clay becomes predominantly claystone, much like the clay above, but better consolidated and typically micaceous. The sandstones interbedded with the claystones are light gray and white to light gray-green, frequently "salt and pepper", with carbonaceous material and white clay. The sandstones are mostly fine to medium grained, calcareous, micaceous, and exhibit very poor visible porosity. Lignite is common in thin beds from 2300-2430'.

### Cenomanian to Turonian 2630-3410'

This interval consists of thin sandstones interbedded with siltstones and claystones. The claystones predominate. These rocks are similar to the zone above, but contain no lignite and probably represent somewhat more marine conditions, as evidenced by the occasional presence of glauconite.

### Nanushuk Group: 3410-5520'

The upper portion of this interval, down to approximately 4400', is quite sandy. The sandstones are gray, "salt and pepper" in appearance, and very fine grained to silty. A few beds are medium and coarse grained. The sandstones are typically micaceous and frequently glauconitic, and contain carbonaceous laminations and white clay filling; some are slightly dolomitic. All the sandstones have nil to very poor porosities. Interbedded with the sandstones are siltstones, which are light gray, argillaceous, micaceous, pyritic, carbonaceous, and frequently fossiliferous, and shale, which is gray-brown, fissile to subfissile, silty, pyritic, micaceous, carbonaceous, and grading in part to claystone. The remainder of the section (4420-5520') is predominantly shale with thinly interbedded siltstones and sandstones. Most of the rocks are micaceous and carbonaceous and contain thin beds of lignite coal from 5060-5090' and 5300-5350'.

### Torok Formation: 5520-7275'

The Torok Formation is composed predominantly of shale, which is gray, typically silty, and frequently micaceous. The section grades downward to a darker gray, becoming nearly brown or black toward the base of the interval. There are frequent interbedded sandstones and siltstones scattered throughout the Torok Formation, but the sandstones generally do not exceed 20' in thickness, and are invariably shaly, exhibiting poor porosity. These sandstones are gray, fine grained, "salt and pepper", glauconitic, and micaceous. The sandstones exhibit mostly poor visible porosity, which is largely choked by clay. Below a depth of 6480' and

continuing down to the contact with the Neocomian ("Pebble Shale") at 7275', were scattered oil shows in a number of tight shaly sandstones.

"Pebble Shale": 7275-7317'

A thin sequence identified as Late Jurassic to Neocomian by Anderson, Warren & Associates, Inc., is probably an equivalent of the "Pebble Shale". The electric-log interval is from 7275' to 7317', while the paleo interval is chosen from 7282' to 7340'. The base of the unit is picked on the electric log at the bottom of a thin sandstone, which is probably a remnant of the basal Cretaceous unconformity sandstone. The lithology is primarily a brown, smooth to splintery shale. Significantly, the shale did not contain any of the frosted and polished, rounded, "floating" quartz grains, which are characteristic of the "Pebble Shale".

## JURASSIC

Kingak Formation: 7317-8190'

The Kingak Formation is present in the interval 7317-8190' (chosen as 7340' to 8310' by Anderson, Warren & Associates, Inc.). The lithology is predominantly shale that is brown, smooth, splintery, soft to firm. There are thin interbedded siltstones, which are brown, very argillaceous, "salt and pepper", glauconitic, and micaceous. The siltstones grade, in part, to silty sandstone, which contains abundant white clay in the matrix. Slightly over-pressured conditions were encountered throughout the interval during drilling operations.

## TRIASSIC

Sag River Sandstone: 8190-8348'

The interval 8190-8348' is chosen from the electric logs as representing the Sag River Sandstone. Actually, the interval from 8190' to 8250' is a silty shale and siltstone, but is very hard and brittle. The zone is quite resistive on electric logs, differentiating it from shale of the Kingak Formation. This resistive zone is generally classified as a transitional facies from the Kingak Formation to Sag River Sandstone.

The Sag River Sandstone was one of the objective formations in the Atigaru Point No. 1. The sandstone body, encountered from 8250' to 8348' is white, very fine to medium grained, well sorted, subangular to subrounded, soft, friable, slightly dolomitic, and generally choked with white clay matrix. The sandstone contains approximately 10% bright green glauconite, has very poor to poor visible porosity, and has scattered fragments which exhibit dull gold fluorescence.

Shublik Formation: 8348-8595'

The Shublik Formation is composed primarily of resistive carbonates. The lithology is principally calcilutite, which is cream to tan, mottled brown,

chalky, cryptocrystalline to medium crystalline, and soft. Coarse black phosphate pellets are common. Some shell fragments are often present. Glauconite is rare, and some beds are silty. Thin shales are interbedded with the calcilutite. These shales are dark brown, blocky, silty, very calcareous, grading to limestone, and generally contain finely disseminated mica.

## PERMIAN-TRIASSIC

Sadlerochit Group: 8595-9494'

Ivishak Formation: 8595-9412'

The Ivishak Formation (sandstone) was present in the interval 8595-9242'. The sandstone facies actually begins at 8605', with a 10' shale interval, which is much less resistive than the Shublik shales lying above the sandstone. This shale has been assigned to the Ivishak Formation. The interval from 9242-9412' is represented by the Kavik Shale Member of the Ivishak Formation.

The Ivishak is mainly sandstone, which is light gray, very fine grained, minutely "salt and pepper", fair to well sorted, and is subangular to subrounded. The cementing material is mostly silica and white clay. There is rare glauconite and interstitial pyrite, and occasional carbonaceous material. The observed porosity is very poor, and scattered, dull gold fluorescence, yielding a very weak crushed cut, was observed at 8670'. From 8670' to 8712', scattered fragments yielded a rare, slow, streaming cut. A core was taken in the interval 8712' to 8742', and 30' were recovered (see description in Appendix B). Porosities in the core were generally 10% or less, and only scattered dull gold fluorescence, yielding very weak cuts, was noted.

The formation includes scattered thin interbedded shales, which are brick-red, smooth to slightly silty, slightly fissile in part, and very finely micaceous. Also encountered from 8855' to 8925', are some gray to black shales, which are fissile, splintery, silty in part, and very finely micaceous. In the interval from 8925' to 9050', the sandstones are medium to coarse grained, poorly sorted, and contain some coarse gray and white chert pebbles. The rest of the Ivishak sandstone (9050-9242') is much as above, but interbedded shales are more common.

Kavik Shale Member: 9242-9412'

The lower 170' of the Ivishak Formation is composed of shale, which is the Kavik Shale Member. The shale is medium to dark gray, blocky, with finely disseminated mica. Generally, the Kavik is silty and firm, but it is less silty and has a smoother appearance in the lower part. Occasional thin siltstones are interbedded with the shale. The siltstones are medium gray, micaceous, blocky, hard, brittle, contained some carbonaceous laminations, and frequently had some medium grained black specks along laminae.

Echooka Formation: 9412-9494'

The lowermost part of the Sadlerochit Group consists of sandstone of the Echooka Formation. This sandstone is tan and speckled bright green with 10% to 15% glauconite. The sandstone is very fine to fine grained, subangular to subrounded, and contains abundant euhedral quartz crystals and some fine grained black chert grains. There is no observable porosity. Some dolomite rhombs were noted along fracture planes. No visible oil staining or fluorescence was observed in the Echooka Formation, but 2,400 units of gas were recorded from 9411' to 9425'.

EARLY MISSISSIPPIAN-PERMIAN

Lisburne Group: 9494-10,890'

Another primary objective of the Atigaru Point No. 1 was the carbonates of the Lisburne Group. The upper part of the Lisburne from 9494' to 9746' consists of calcilutitic limestone that is tan to buff, mottled, very fine to microcrystalline, and with finely disseminated pyrite. The limestone is stylolitic, chalky in part, hard and dense. The rock has no visible porosity and no shows. There is occasional chert and some bright green glauconite. Some oolites were noted.

From 9746' to 9798', the lithology is predominantly shale, which is variegated red (lateritic), bright green, and light gray. The shale is fissile to smooth, occasionally finely micaceous and firm. Some shale is silty in part and grades to siltstone.

From 9798' to 10,310', the lithology is predominantly calcilutite, with some oolitic, calcarenitic calcilutite. The calcilutite is buff to brown, mottled, very glauconitic, chalky in part, hard, brittle, with spar calcite cement and nil visible porosity or show. Interbedded with the calcilutite are thin shales. These shales are variegated red, green, and gray.

The interval from 10,310' to 10,623' is essentially oocalcarenitic calcilutite, as above, with cream to brown calcilutite, and with thin variegated shale, as above. This part of the Lisburne includes some thin sandstones that are red to pink, very calcareous, argillaceous, medium to occasionally coarse grained, subangular to subrounded, very hard and brittle, and with no visible porosity or show.

Dolomite is present in the interval from 10,623' to 10,750'. The dolomite is buff to cream, cryptocrystalline to microcrystalline to very fine crystalline, generally hard and dense, and cherty. Some of the dolomite is sucrosic in part with some pinpoint vuggy porosity, but no show. Interbedded with the dolomite are variegated shales, as above, and sandstone that is buff to cream, "salt and pepper", fine to medium grained, with buff dolomitic cement. The sandstone is hard and brittle, glauconitic, and has no visible porosity or show.

Anderson, Warren & Associates, Inc. reports the interval from 10,750' to 10,850' as being still in the Lisburne Group. Log correlations indicate the base of the Lisburne Group occurs at 10,890'. Originally, the wellsite geologist had assigned a "Kayak Shale" designation to this interval. The lithology is primarily red and pink sandstones, as above, with thin variegated shales, as above, and with some dolomites and calcilutites. Rocks of this interval appeared to be much more sandy than that above.

Endicott Group: 10,890-11,328'

The Endicott Group is represented in Atigaru Point No. 1 by a sequence of sandstones, shales, conglomerates, and limestones. The sandstones, shales and conglomerates are frequently pink and red, but also range to grays and greens. The variegated colors hint at a subaerial origin; however, the presence of limestones and coal beds in the interval 11,120-11,200' is marginal marine to marine.

INDETERMINATE

Argillite: 11,328-11,535'

Rocks encountered within this interval and collectively called "argillite" range from the typical black, shiny, siliceous, micaceous, pyritic low-grade metamorphosed shales having a submetallic luster to quartzitic sandstones and variegated shales. These rocks were not immediately recognized as argillites by the wellsite geologist because of their non-typical nature.

OIL AND GAS SHOWS

Fair shows of oil were observed in scattered sandstones of the Nanushuk Group of Early-Late Cretaceous age. The intervals with shows from 3755' to 3773' and 3781' to 3795' were composed of sandstone, very fine grained to silty, soft, friable, finely disseminated mica, but with generally poor porosity and permeability. There was good even staining, dull gold fluorescence and a streaming cut. Only slight increases in mud logger gas shows were noted through these intervals. From 3985' to 4011', very thin sands interbedded with gray shale carried mud logger gas shows. From 4045' to 4058', oil shows were observed in sandstone, which was gray, fine grained to silty, micaceous, glauconitic, very poorly sorted, and with generally very poor porosity and permeability due to white clay filling.

There were some poor, scattered shows in several sandstones from 6478' to 6725', which were very thin, and interbedded with dark gray, fissile shale. These sandstones exhibited dull gold fluorescence and a slow milky cut. These sands were generally gray, fine grained, soft, friable, micaceous, glauconitic, and with fair to poor sorting. Occasional medium to coarse grains were observed. Porosity and permeability were generally very poor because of white clay filling. These poor shows were in the middle portion of the Torok Formation.

Several argillaceous sands in the lower portion of the Torok carried scattered oil staining, with dull to occasional bright gold fluorescence, and fair to moderate streaming cut. Porosity and permeability in these sands is generally very poor. One sandstone (6948-6964') did exhibit bright gold fluorescence and slow, streaming cut. The sandstone, however, had very poor observed porosity.

A very poor show was noted in the zone from 8655' to 8712' (Ivishak Formation). The show consisted of scattered, dull gold fluorescence, and rare, slow, streaming cut in a sandstone, which was fine grained to medium grained, dolomitic cement, moderately soft and friable, containing interstitial pyrite, and having very poor to nil visible porosity.

No visible oil staining or fluorescence was noted in the Echooka Formation, but as much as 2,400 units of gas were recorded in the top of the formation from 9411' to 9425'. Lithology consists of tan sandstone, with about 10% to 15% bright green glauconite, very fine to fine grained, and with very poor to nil porosity due to argillaceous content.

## CONCLUSIONS

The Atigaru Point No. 1 was completely evaluated on the basis of sample analysis and log interpretation. The primary objectives of the well, both sandstones of the Sadlerochit Group and carbonates of the Lisburne Group, had insufficient porosity development to provide adequate potential reservoir rocks.

No other zones penetrated by the well had adequate thickness or porosity to be seriously considered to have potential as a possible reservoir.

PERTINENT DATA AND APPENDICES

Appendix

|    |   |        |
|----|---|--------|
| A. | Summary of Pertinent Data . . . . .                           | A-1-2  |
| B. | Drill Cuttings and Core Descriptions . . . . .                | B-1-22 |
| C. | Log Analysis<br>Report of March 26, 1977 . . . . .            | C-1    |
| D. | Core Analysis Report<br>Report of February 18, 1977 . . . . . | D-1    |

SUMMARY OF PERTINENT DATA \*

WELL NAME: Atigaru Point No. 1

API NO.: 50-103-20008

OPERATOR: Husky Oil NPR Operations, Inc.

LOCATION: 1422' FNL, 1925' FEL  
protracted Section 19, T14N, R2E  
Umiat Meridian, North Slope Borough, Alaska

COORDINATES: Latitude: 70°33'22.03"N  
Longitude: 151°43'01.85"W  
X = 290,644  
Y = 6,055,988  
Zone 4

ELEVATION: 27' Kelly Bushing; 7' ground

DATE SPUDDED: January 12, 1977

CASING: 20" @ 447'  
13-3/8" @ 2509'  
9-5/8" @ 8147'

TOTAL DEPTH: 11,535' driller; 11,523' Schlumberger  
(Note: Drilled 6', then cored 15' after log  
was run at a drilled depth of 11,514'.)

DATE REACHED  
TOTAL DEPTH: March 10, 1977

RIG RELEASED: March 18, 1977

STATUS: Plugged and abandoned

LOGGING RECORD:

|                |   |
|----------------|---|
| DIL/SP         | 447- 2,517'<br>2,507- 8,141'<br>8,157-11,517' |
| BHC/GR         | 447- 2,511'<br>2,507- 8,140'<br>8,157-11,518' |
| CNL/FDC/GR/CAL | 2,507- 8,145'<br>8,157-11,532'                |



ATIGARU POINT NO. 1  
DRILL CUTTINGS AND CORE DESCRIPTIONS  
BY: W. D. FENEX

DEPTH DRILLED  
(FEET BELOW  
KELLY BUSHING)

|            |   |
|------------|---|
| 0- 545     | No samples recovered.   |
| 545- 780   | Gravel: composed of quartz, white to clear, and metamorphics of phyllite and chlorite, and with some pyrite.                  |
| 780- 830   | Clay: gray to brown, soft, gummy, with interbedded Gravel: as above.  |
| 830- 840   | Clay: soft and gummy, as above.   |
| 840- 980   | Interbedded Clay and Gravel: as above.  |
| 980- 1060  | Clay: gray to brown, soft and gummy, with some black mineral specks, and with finely disseminated mica, carbonaceous in part. |
| 1060- 1100 | Sandstone: gray, very silty, argillaceous, very fine grained to fine grained, poorly sorted, unconsolidated.                  |
| 1100- 1160 | Clay: as above, with some finely disseminated mica, bentonitic in part.   |
| 1160- 1200 | Sandstone: very fine grained to silty, unconsolidated, poorly sorted, subangular to subrounded.                               |
| 1200- 1270 | Clay: gray to brown, as above, with Bentonite: light gray.  |
| 1270- 1310 | Sandstone: gray, argillaceous, very fine grained to silty, unconsolidated, with Clay: as above, and with thin coal seams.     |
| 1310- 1340 | Clay: as above, with thin coal seams interbedded with Sandstone: as above.  |
| 1340- 1400 | Clay: as above, slightly silty in part, soft, gummy, with Sandstone: as above.  |
| 1400- 1500 | Clay: as above, bentonitic, carbonaceous, silty, micaceous, with Sandstone: silty, unconsolidated, as above.                  |
| 1500- 1580 | Clay: as above, bentonitic, with bentonite.   |

- 1580- 1670 Clay: as above, slightly silty, very minutely micaceous, bentonitic, grades to siltstone in part.
- 1670- 1750 Clay: gray, slightly silty, very finely disseminated mica, bentonitic, soft, gummy.
- 1750- 1880 Clay: as above, soft, gummy, bentonitic in part.
- 1880- 2050 Claystone: gray to brown, slightly silty, some finely disseminated mica, generally firm, but soft and gummy in part.
- 2050- 2080 Sandstone: light gray, fine grained to medium grained, subangular to subrounded, poor to fair sorting, very slightly micaceous, calcareous cement, moderately indurated, nil to very poor visible porosity, no show.
- 2080- 2170 Claystone: gray to brown, slightly silty, finely disseminated mica.
- 2170- 2190 Sandstone: white to light gray to green, "salt and pepper", medium to coarse grained, subangular to subrounded, poorly sorted, slightly micaceous, glauconitic, calcareous cement, very poor to nil visible porosity, no show, with occasional black subrounded coarse pellets.
- 2190- 2250 Claystone: as above, firm.
- 2250- 2280 Siltstone: dark gray, argillaceous, minute black specks, very slightly calcareous, some carbonaceous plant remains.
- 2280- 2310 Claystone: gray to brown, as above.
- 2310- 2330 Sandstone: light gray, "salt and pepper", medium to coarse grained, subangular to subrounded, poorly sorted, slightly micaceous, glauconitic, calcareous cement, occasional black pellets, nil visible porosity, no show.
- 2330- 2380 Coal seams with Sandstone and Claystone: as above.
- 2380- 2420 Sandstone: white to light gray, "salt and pepper", calcareous cement, occasional pellets, nil visible porosity, no show.
- 2420- 2470 Claystone: gray to brown, slightly silty, finely disseminated mica, firm, blocky, bentonitic.
- 2470- 2520 Sandstone: white, medium to very coarse grained, poorly sorted, subangular to subrounded, glauconitic, some very coarse, ochre colored fragments, calcareous cement, nil visible porosity, no show.

- 2520- 2790 Claystone: gray to brown, soft, gummy, slightly carbonaceous, micaceous, silty, slightly bentonitic.
- 2790- 2840 Claystone: as above, but becoming more bentonitic.
- 2840- 2850 Claystone: gray, silty, finely disseminated mica, carbonaceous, firm.
- 2850- 2900 Siltstone: gray, "salt and pepper", argillaceous, micaceous, some carbonized plant fragments.
- 2900- 2970 Sandstone: gray, "salt and pepper", subrounded to subangular, fair sorting, very fine grained to silty, micaceous, glauconitic, carbonaceous, clay filling, nil visible porosity, no show; becomes finely laminated and grades to siltstone in part, with interbedded Claystone: as above.
- 2970- 2990 Sandstone: as above, becoming medium grained, with occasional coarse grained, clay filling, with interbedded Claystone: as above, and with some loose tar blebs.
- 2990- 3010 Claystone: gray, silty, finely disseminated mica, carbonaceous, with interbedded Sandstone and Siltstone: as above.
- 3010- 3030 Sandstone: gray, "salt and pepper", medium grained, glauconitic, subangular to subrounded, fair sorting, white clay filling, some carbonized plant debris, nil visible porosity, no show.
- 3030- 3050 Claystone: gray, as above, with Calcilutite: tan concretions.
- 3050- 3080 Siltstone: gray, "salt and pepper", finely laminated, finely disseminated mica, glauconitic, firm, with Claystone: as above.
- 3080- 3150 Claystone: gray, as above, bentonitic, silty, micaceous, carbonaceous.
- 3150- 3210 Interbedded Claystone: as above, and Siltstone: as above, but becoming sandy.
- 3210- 3280 Siltstone: gray, "salt and pepper", partly argillaceous, finely disseminated mica, glauconitic, sandy in part, with clay filling.
- 3280- 3310 Siltstone: as above, but grades to sandstone, white clay filling.
- 3310- 3340 Claystone: gray, silty, micaceous, bentonitic, pyritic, with shell fragments.

- 3340- 3370 Siltstone: gray, "salt and pepper", finely disseminated mica; glauconitic; firm, sandy in part.
- 3370- 3440 Claystone: gray, as above, bentonitic, occasional shell fragments (Inoceramus prisms).
- 3440- 3470 Siltstone: gray, argillaceous, finely disseminated mica, with finely carbonaceous laminae, and with Claystone: as above.
- 3470- 3500 Siltstone: gray, argillaceous, as above, interbedded with Claystone: as above.
- 3500- 3540 Sandstone: gray, "salt and pepper", very fine grained to fine grained, poor to fair sorting, subrounded to subangular.
- 3540- 3580 Siltstone: gray, argillaceous, carbonaceous in part, with Claystone: as above.
- 3580- 3600 Sandstone: gray, very fine grained to fine grained, fair sorting, finely disseminated mica; glauconitic, carbonaceous, white clay filling, slightly dolomitic, nil to poor visible porosity, no show.
- 3600- 3680 Claystone: gray to brown, micaceous, bentonitic, pyritic, silty.
- 3680- 3770 Siltstone: light gray, argillaceous, finely disseminated mica; pyritic, occasional fossils with interbedded Shale: fissile, minutely micaceous, moderately firm, pyritic.
- 3770- 3810 Sandstone: light brown, oil stained, very fine grained to silty, fair sorting, subrounded to subangular, soft, friable, finely disseminated mica, very poor visible porosity, good even oil stain, dull gold fluorescence, slow streaming cut.
- 3810- 3870 Shale: gray to brown, fissile, silty, pyritic, occasional shell fragments, micaceous, carbonaceous.
- 3870- 3960 Siltstone: gray, "salt and pepper", argillaceous, micaceous, firm, pyritic, glauconitic.
- 3960- 4000 Shale: as above, fossiliferous, pyritic, silty, with Siltstone: as above.
- 4000- 4030 Shale: as above, with a trace of amber.
- 4030- 4110 Sandstone: gray, fine grained, with occasional very fine grained, subangular to subrounded, poorly sorted, "salt and pepper", micaceous, glauconitic, white clay filling, some with light brown oil stain, dull gold fluorescence, fair streaming cut; grades to siltstone in part.

- 4110- 4130 Sandstone: as above, with some show.
- 4130- 4160 Shale: as above, micaceous, bentonitic, fossiliferous.
- 4160- 4190 Sandstone: gray, very fine grained to silty, fair sorting, subrounded to subangular, soft, friable, unconsolidated in part, "salt and pepper", micaceous, fair visible porosity, no show.
- 4190- 4350 Shale: as above, carbonaceous and pyritic in part, interbedded with Sandstone: as above.
- 4350- 4580 Sandstone: gray, "salt and pepper", fine grained to medium grained, unconsolidated in part, glauconitic, micaceous, with some white clay filling, poor visible porosity, no show, with interbedded Shale: as above.
- 4580- 4630 Shale: as above, with sandstone, unconsolidated quartz grains, very fine grained to silty.
- 4630- 4650 Sandstone: tan, fine grained, "salt and pepper", micaceous, glauconitic, moderately firm, white clay filling, with Shale: as above.
- 4650- 4800 Shale: gray, platy, soft, micaceous, bentonitic, pyritic, fossiliferous, with a trace of amber, and with minor interbedded Sandstone: as above.
- 4800- 4900 Sandstone: tan to gray, very fine grained to silty, "salt and pepper", micaceous, glauconitic, firm, white clay filling, very poor visible porosity, no show, with Shale: as above.
- 4900- 4980 Sandstone: as above, but grades to siltstone in part, with Shale: as above.
- 4980- 5060 Siltstone: gray, argillaceous, "salt and pepper", micaceous, glauconitic, firm, sandy in part, some white clay filling, with Shale: as above, some thin carbonaceous laminae, slightly silty, platy, with a trace of tan chert and bentonite.
- 5060- 5090 Siltstone and Shale: as above, with a trace of lignite.
- 5090- 5120 Claystone: gray, silty, soft, gummy, pyritic, carbonaceous.
- 5120- 5220 Claystone: as above, with calcilutite concretions: cream, cryptocrystalline, blocky, and with pyrite inclusions.
- 5220- 5280 Claystone: as above, soft, gummy, becoming bentonitic.

- 5280- 5300 Calcilutite: light gray, cryptocrystalline, blocky, hard, brittle, dense, nil porosity.
- 5300- 5330 Calcilutite: as above, light gray to cream, smooth; probably in the form of concretions rather than bedded.
- 5330- 5350 Sandstone: gray, "salt and pepper", some medium grained, but generally fine grained to very fine grained to silty; grades to siltstone.
- 5350- 5360 Calcilutite: as above, with Siltstone: as above.
- 5360- 5400 Shale: gray, very silty, pyritic; grades to siltstone.
- 5400- 5440 Sandstone: gray, "salt and pepper", very fine grained to medium grained, poorly sorted, subangular to subrounded, argillaceous, micaceous, glauconitic, some white clay filling, some carbonaceous laminae, nil visible porosity.
- 5440- 5480 Sandstone: as above, becoming silty in part.
- 5480- 5520 Shale: mostly as above, with some black, fissile shale.
- 5520- 5530 Sandstone: gray, "salt and pepper", fine grained, with occasional medium grained and coarse grained, subangular to subrounded, micaceous, glauconitic, with white clay filling.
- 5530- 5540 Sandstone: gray, "salt and pepper", fine grained, with occasional medium grained and coarse grained, subangular to subrounded, micaceous, glauconitic, with white clay filling, and with Shale: as above.
- 5540- 5690 Shale: gray, as above, with some black fissile shale, interbedded with occasional minor Sandstone: as above.
- 5690- 5810 Shale and minor Sandstone: as above, with a trace of chert.
- 5810- 5860 Sandstone: gray, "salt and pepper", micaceous, glauconitic, very fine grained to medium grained, firm, white clay filling, with Shale: as above, and with a trace of lignite.
- 5860- 6020 Shale: as above, with Sandstone: as above, but with poor to fair visible porosity.
- 6020- 6050 Sandstone: gray, "salt and pepper", very fine grained to silty, micaceous, glauconitic, white clay filling, nil to very poor visible porosity, becoming medium grained in part.

- 6050- 6110 Sandstone: as above, but becoming coarse grained, with interbedded Shale: as above.
- 6110- 6210 Claystone: gray, soft, gummy, bentonitic.
- 6210- 6230 Siltstone: gray, "salt and pepper", argillaceous, micaceous, glauconitic, sandy in part, firm.
- 6230- 6410 Claystone: gray, soft, gummy, bentonitic, pyritic.
- 6410- 6440 Siltstone: gray, "salt and pepper", argillaceous, micaceous, glauconitic.
- 6440- 6470 Shale and Claystone: as above, with siltstone and minor Sandstone: as above.
- 6470- 6540 Sandstone: gray, fine grained, soft, friable, micaceous, glauconitic, dull gold fluorescence, fair milky cut, with interbedded Shale: as above.
- 6540- 6620 Shale: dark gray, fissile, pyritic, finely disseminated mica.
- 6620- 6660 Sandstone: gray, "salt and pepper", medium grained, with some coarse grained, subangular to subrounded, poor to fair sorting, micaceous, glauconitic, some white clay cement, dull gold fluorescence, slow streaming cut.
- 6660- 6680 Sandstone: as above, some coarse grained, poorly sorted, poor visible porosity, poor slow milky cut.
- 6680- 6870 Shale: as above, with minor interbedded Sandstone: as above.
- 6870- 6930 Sandstone: gray, fine grained, as above, with fair to poor visible porosity, bright gold fluorescence, moderate streaming cut.
- 6930- 6960 Sandstone: as above, poor to fair visible porosity, bright gold fluorescence, fair streaming cut.
- 6960- 7000 Shale: gray, micaceous, silty, fissile.
- 7000- 7020 Sandstone: mostly as above, very poor visible porosity, very poor show.
- 7020- 7040 Shale: as above.
- 7040- 7070 Sandstone: as above, but becoming very argillaceous, very slow milky cut.
- 7070- 7090 Shale: gray, as above, becoming black, carbonaceous.

7090- 7100 Sandstone: as above.

7100- 7140 Shale: dark gray, blocky to platy, micaceous, silty.

7140- 7150 Sandstone: as above.

7150- 7180 Shale: dark gray, blocky, silty, micaceous.

7180- 7240 Sandstone: gray, as above, argillaceous, "salt and pepper", soft, friable, nil visible porosity.

7240- 7340 Shale: as above, with interbedded Shale: brown, smooth, splintery, pyritic, with occasional Sandstone: as above.

7340- 7390 Shale: brown, smooth, splintery, with a trace of Shale: black, carbonaceous.

7390- 7500 Shale: as above, with a trace of Siltstone: brown, very argillaceous, "salt and pepper", carbonaceous laminations.

7500- 7540 Shale: brown, splintery, as above; becoming pyritic.

7540- 7640 Siltstone: gray, very argillaceous, "salt and pepper"; becoming sandy.

7640- 7770 Shale: as above.

7770- 7790 Shale: as above, with a trace of Sandstone: gray, very fine grained, "salt and pepper", glauconitic, micaceous.

7790- 7880 Shale: brown, splintery, as above.

7880- 7940 Siltstone: brown, very argillaceous, "salt and pepper", glauconitic, micaceous, grades to Sandstone: soft, friable, nil visible porosity.

7940- 7970 Shale: brown, splintery, as above, with some black, carbonaceous shale.

7970- 8000 Siltstone: as above, grading to Shale: tan, silty.

8000- 8060 Shale: brown, splintery, as above, with some Shale: tan, silty, micaceous, pyritic.

8060- 8090 Shale: as above, with large glauconite fragments.

8090- 8130 Shale: as above, grades to Siltstone: as above, with some minor Sandstone: as above.

8130- 8150 Sandstone: gray, medium grained, "salt and pepper", micaceous, glauconitic, some white clay filling, nil visible porosity.

- 8150- 8160 Shale: brown, splintery, smooth, firm, as above.
- 8160- 8190 Shale: dark gray to black, silty, very finely disseminated mica; firm, fissile to blocky, grades to siltstone in part; trace of large quartz crystals.
- 8190- 8200 Siltstone: dark gray, argillaceous, finely disseminated mica; hard and tight, pyritic, very brittle.
- 8200- 8220 Shale: dark gray to black, fissile to blocky, finely disseminated mica; firm, silty, grades to siltstone.
- 8220- 8240 Interbedded Siltstone and Shale: as above, but with white clay speckling.
- 8240- 8290 Sandstone: white to light gray, very fine grained to medium grained, fair to well sorted, subangular to subrounded, glauconitic, soft, friable, white clay cement, slightly dolomitic in part, porosity generally poor to fair, occasional fragments with dull gold fluorescence, slow milky cut, leaves a moderate bright gold residue; glauconite is a bright green color.
- 8290- 8330 Sandstone: white to light gray, becomes very fine grained to silty, hard and tight, nil visible porosity, no show, with a trace of orange chert, and with some Siltstone: dark gray, sandy, argillaceous, very hard and tight, with some Sandstone: as above, glauconitic, white clay filling.
- 8330- 8360 Siltstone: dark gray to black, sandy, argillaceous, some carbonized plant remains, occasional calcite-filled veins; very hard and tight, with Shale: dark brown, fissile to platy, finely disseminated mica, some carbonaceous debris, with Sandstone: green to brown, very fine grained, with 50% glauconite grains, some coarse black phosphate grains; pyritic, micaceous, some white clay filling, firm.
- 8360- 8400 Calcilutite: cream, chalky, cryptocrystalline to very fine crystalline, coarse black phosphate pellets; soft, nil to very poor chalky porosity, some carbonaceous laminae with Calcilutite: dark brown to black, mottled, fine crystalline to very fine crystalline, with Sandstone: green to brown, glauconitic (50%), and with phosphate pellets, with Siltstone: dark gray to black, some carbonized plant remains, and with Shale: dark brown, fissile to platy, smooth to silty, as above.
- 8400- 8435 Calcilutite: cream, chalky, as above, with some Calcilutite: dark brown to black, mottled, fine crystalline to very fine crystalline, some sparry calcite cement,

- slightly intracalcarenitic in part, very coarse grained, argillaceous, with Calcilutite: cream, grades to Intracalcarenite: calciruditic, stylolitic, sparry calcite cement.
- 8435- 8455 Shale: dark brown, fissile, blocky, smooth, silty, soft, calcareous, finely disseminated mica, with Calcilutite: tan, speckled, chalky, as above, and Calcilutite: dark brown, glassy.
- 8455- 8475 Calcilutite: tan, speckled with phosphate pellets, and Calcilutite: dark brown to black, mottled, as above, with some shell fragments, and with Shale: dark brown, as above.
- 8475- 8495 Calcilutite: cream, mottled brown, slightly intracalcarenitic, minute black specks (phosphate), very fine crystalline, grades to Calcisiltite: gray to brown, argillaceous.
- 8495- 8535 Calcilutite: dark brown to black, glassy appearance, medium crystalline, some shell fragments, sparry cement in part, and Calcilutite: tan, as above, slightly intracalcarenitic, grades to Pelcalcarenite (black phosphate pellets): brown calcilutite matrix, argillaceous, chalky in part, some rare glauconite, and with Shale: dark brown, blocky, silty, very calcareous, almost a limestone, finely disseminated mica; hard, brittle.
- 8535- 8560 Calcisiltite: brown, as above, some phosphate pellets: very argillaceous, firm, with Shale: as above.
- 8560- 8630 Sandstone: light gray to brown, "salt and pepper", fine grained to medium grained, some conglomerate, with large gray opaque chert grains; subangular to subrounded, very poor sorting, very hard, almost an orthoquartzite, some glauconite, some dolomitic cement; bright orange mineral fluorescence, no cut, grades to very fine grained sandstone, and some light gray, clean Sandstone: subangular to subrounded, fair sorting, rare Glauconite; finely disseminated mica, dolomitic cement; moderately soft and friable, poor to very poor visible porosity, no show (one fragment with dull gold fluorescence, slow milky cut), becomes brown, argillaceous, silty, grades to Siltstone: dark brown to black, carbonaceous, sandy, with Shale: brown to black, carbonaceous, platy to splintery, finely disseminated mica, with Siltstone: dark brown to black, as above, with interstitial pyrite.
- 8630- 8650 Sandstone: brown, argillaceous, very fine grained to fine grained, glauconitic, hard and brittle, nil visible porosity, with Conglomerate: gray, large, very angular quartz fragments, large round hornblende, gray chert, interstitial pyrite; hard and brittle.

- 8650- 8655 Siltstone: brown, as above, and Shale: dark gray to black.
- 8655- 8690 Sandstone: light gray, very fine grained, very minute "salt and pepper", subangular to subrounded, well sorted, quartz filled fractures, very hard and brittle, nil porosity, grades to Sandstone: fine grained, occasionally medium grained, dolomitic cement, moderately soft and friable, interstitial pyrite, poor visible porosity, dull gold fluorescence, rare, slow, streaming cut, generally very weak crushed cut.
- 8690- 8712 Sandstone: light gray, as above, becomes medium grained with occasional coarse grained, "salt and pepper", rare glauconite; moderately soft and friable.
- 8712- 8742 Core No. 1, Cut 30', Recovered 30'
- 8712.0-8742.0' Sandstone: gray, "salt and pepper",  
(30.0') interstitial pyrite; fine grained, very hard and dense, nil visible porosity, dolomitic cement, vertical fracturing with some white clay filling, and with bright gold fluorescence (mineral), with occasional laminae of Shale: dark gray, finely disseminated mica; blocky to platy, occasional shale pebbles and nodules.
- 8742- 8775 Sandstone: white to light gray, medium grained to coarse grained, "salt and pepper", poorly sorted, subangular to angular, hard, poor to very poor visible porosity, some white clay, and some carbonaceous material, which occurs as fracture filling, trace of dull gold fluorescence, no cut, with thin Shale: dark gray to black laminations, and some interstitial pyrite, rare glauconite.
- 8775- 8810 Sandstone: as above, with nodules of Dolomite: buff, microcrystalline, blocky, hard, dense, thin black shale laminations, moderately soft and friable, poor visible porosity, no show.
- 8810- 8830 Sandstone: as above, with abundant white clay, with carbonaceous fracture filling, very poor visible porosity, no show, with Dolomite: buff nodules, and with interstitial pyrite.
- 8830- 8860 Siltstone: red to brown, argillaceous, very finely disseminated mica, grades to shale, in part, with Shale: brick-red, smooth to slightly silty, some fissility, very finely micaceous, firm, grades to Siltstone: lateritic.

- 8860- 8880 Sandstone: white to light gray, fine grained to medium grained, fair sorting, "salt and pepper", dolomitic cement, some white clay filling, moderately soft and friable, poor visible porosity, trace of fluorescence, no cut.
- 8880- 8890 Shale: brick-red, smooth, soft, gummy, lateritic.
- 8890- 8920 Sandstone: as above, with some red staining, and Shale: dark gray to black, fissile, splintery, slightly silty, finely disseminated mica; firm.
- 8920- 8930 Shale: very pale gray, smooth, fissile, and Shale: red, as above.
- 8930- 8960 Sandstone: white to light gray, "salt and pepper", medium grained to coarse grained, poorly sorted, subangular to angular, soft, friable, abundant white clay filling, poor visible porosity, no show, interstitial pyrite and occasional gray chert, becomes conglomeratic in part, some thin black shale laminae.
- 8960- 8980 Sandstone: as above, coarse grained, soft, friable, white interstitial clay filling, with Shale streaks: black.
- 8980- 8990 Sandstone: as above, "salt and pepper", medium grained, decrease in porosity.
- 8990- 9015 Sandstone: as above, with interstitial pyrite and clay filling.
- 9015- 9030 Shale: red to orange, soft, gummy, some fissility, with Siltstone: red to brown, argillaceous, micaceous, soft.
- 9030- 9045 Sandstone: as above, white interstitial clay; pyritic.
- 9045- 9060 Shale: dark gray to black, finely disseminated mica; platy, some fissility, firm, grades to medium gray color.
- 9060- 9075 Siltstone: dark gray to black, subrounded, firm to very hard, grades to sandstone, with Chert: black.
- 9075- 9100 Shale: black, as above, finely disseminated mica; slightly silty.
- 9100- 9130 Shale: black, as above, becomes smooth, less silty.
- 9130- 9145 Siltstone: dark gray, "salt and pepper", finely disseminated mica; firm, argillaceous, sandy, grades to sandstone.

- 9145- 9180 Sandstone: light gray to tan, slightly "salt and pepper", very fine grained to medium grained, poorly sorted, subangular to subrounded, moderately soft to firm, siliceous, white interstitial clay (white speck effect), with Chert: gray; sandstone becomes very fine grained in part, silty.
- 9180- 9215 Sandstone: tan, as above, with white clay specks, "salt and pepper", very fine grained to silty, nil visible porosity, no show.
- 9215- 9240 Shale: dark gray, finely disseminated mica; blocky, firm, silty.
- 9240- 9250 Siltstone: medium gray, micaceous, blocky, hard, brittle, with medium grained black specks along laminations, argillaceous.
- 9250- 9270 Shale: medium to dark gray, as above.
- 9270- 9280 Siltstone: "salt and pepper", as above, becomes very hard.
- 9280- 9340 Shale: gray, as above, slightly silty, generally smooth.
- 9340- 9360 Siltstone: light gray, "salt and pepper", as above.
- 9360- 9380 Shale: gray, as above.
- 9380- 9390 Siltstone: gray, as above, with carbonaceous laminations.
- 9390- 9415 Sandstone: bright green to dark gray, composed of up to 50% bright green glauconite; very fine grained to medium grained, subangular, with abundant euhedral quartz crystals; poorly sorted, very argillaceous, pyritic, noncalcareous, hard, nil visible porosity, no show, grades to Siltstone: glauconitic.
- 9415- 9450 Sandstone: tan, with 10-15% bright green glauconite; very fine grained to fine grained, subangular to subrounded, abundant euhedral quartz crystals, becomes very argillaceous in part, poorly sorted, with some fine grained black chert grains, nil visible porosity, no show, some Dolomite: clear to white, large rhombic crystals, which form along fractures.
- 9450- 9465 Sandstone: dark gray, very argillaceous, glauconitic, very fine grained, hard and brittle, nil visible porosity, grades to siltstone in part.
- 9465- 9485 Sandstone: tan, bright green, glauconitic; fine grained to medium grained, poor to fair sorting, subangular to subrounded, some finely disseminated pyrite; firm, nil visible porosity.

- 9485- 9500 Dolomite: dark gray, very fine crystalline, argillaceous, hard and dense, with a trace of Shale: gray, fissile to platy, micaceous, pyritic.
- 9500- 9540 Calcilutite: tan to buff, mottled, very fine crystalline to microcrystalline, finely disseminated pyrite; stylolitic, chalky in part, hard, dense, nil visible porosity, no show, with Calcilutite: brown, cryptocrystalline, subtranslucent, hard, brittle, nil visible porosity, with Chert: clear, gray, bright green, glauconitic.
- 9540- 9575 Calcilutite: intracalcarenitic, tan, very fine to fine grained, glauconitic, pyritic, stylolitic, sandy appearance, hard, dense, nil visible porosity, with interbedded Calcilutite: as above.
- 9575- 9615 Calcilutite: oocalcarenitic, tan, sparry calcite cement, glauconitic, pyritic, hard, dense, nil visible porosity.
- 9615- 9640 Calcilutite: brown, cryptocrystalline, subtranslucent, glauconitic, hard, brittle, nil visible porosity, becomes Calcilutite: cream, chalky, moderately firm.
- 9640- 9660 Calcilutite: cream, chalky, as above, with some intrabiocalcarenite, some sparry calcite cement, occasional oolites.
- 9660- 9680 Calcilutite: cream, chalky, as above, slightly oolitic, becomes Calcilutite: brown, subtranslucent, as above; glauconitic.
- 9680- 9700 Calcilutite: as above, with Intraooliticcalcarenite: as above.
- 9700- 9710 Calcilutite: as above, with some Biocalcarenite: as above, sparry calcite cement, glauconitic, pyritic, nil visible porosity.
- 9710- 9725 Calcilutite: as above, with a trace of Chert: clear, smoky, milky.
- 9725- 9740 Calcilutite: brown, subtranslucent, glauconitic, hard, brittle, nil porosity.
- 9740- 9765 Shale: red-brown, lateritic, bright green, gray, fissile, smooth, occasional fine mica; firm, with Siltstone: red-orange, red clay matrix, some interstitial white clay; sandy, firm, nil visible porosity.
- 9765- 9785 Calcilutite: cream and brown, chalky to subtranslucent, with chert, glauconite and pyrite, and with a trace of oolites; nil visible porosity.

- 9785- 9795 Shale: variegated red, green and gray, as above.
- 9795- 9840 Calcilutite: oolitic calcarenitic in part, spar calcite cement; glauconitic, soft, becomes chalky in part, nil visible porosity; 20% Chert at 9830'; clear to smoky.
- 9840- 9865 Calcilutite: brown to tan, mottled, medium crystalline, glauconitic, hard, dense, calcite filled fractures, chalky in part, nil visible porosity, with thin interbedded Shale: red, green, gray, smooth, firm, abundant chert.
- 9865- 9900 Intracalcarenite: slightly oolitic, very calcilutitic, coarse grained, glauconitic, some sparry calcite cement, hard, dense, nil visible porosity, interbedded with Calcilutite: brown, cryptocrystalline to medium crystalline, subtranslucent, hard, brittle, blocky, with a trace of dolomite on fractures, grades to Calcilutite: tan, buff, chalky, nil visible porosity.
- 9900- 9930 Calcilutite: brown to buff, mottled, very glauconitic, chalky in part, nil visible porosity, interbedded with Calcilutite: brown, cryptocrystalline, subtranslucent, hard, brittle, cherty, nil visible porosity.
- 9930- 9950 Calcilutite, oolitic; calcarenitic (replaced by phosphate); gray, smoky matrix, subtranslucent, hard, brittle, nil visible porosity, and with Biocalcarenite: brown to buff, chalky in part, glauconitic, cherty, nil visible porosity.
- 9950- 9960 Calcilutite: oolitic calcarenitic, buff, microcrystalline; oolites replaced by phosphate; as above, and with Biocalcarenite: as above.
- 9960- 9980 Shale: red, green, gray, smooth, firm, with Calcilutite: as above, chalky in part, with Dolomite: tan, fine grained to medium grained, moderately soft, rhombic, glauconitic, some phosphate pellets, nil to very poor visible porosity.
- 9980-10,010 Calcilutite: cream, chalky, microcrystalline, moderately firm, nil visible porosity, interbedded with Calcilutite: brown, cryptocrystalline, subtranslucent, hard, brittle, some glauconite; stylonitic, cherty, nil visible porosity, with occasional Shale: red, green and gray.
- 10,010-10,020 Shale: red, lateritic, green, gray, smooth.
- 10,020-10,040 Calcilutite: brown and cream, chalky, as above, becomes Intrabiocalcarenite: glauconitic, stylonitic, oolitic, with Shale: red, green and gray, as above.

- 10,040-10,060 Calcilutite: as above, becomes predominantly brown, cryptocrystalline, subtranslucent, some calcite filling fractures, cherty, pyritic.
- 10,060-10,080 Biocalcarenite: calcilutitic, brown to buff, microcrystalline, glauconitic, chalky in part, oolitic in part, nil visible porosity, cherty, with Shale: red, green and gray, as above.
- 10,080-10,115 Calcilutite: brown, cryptocrystalline, subtranslucent, hard, brittle, nil visible porosity, grades to Calcilutite: cream, chalky, dolomitic, microcrystalline, firm, nil visible porosity, becomes intrabiocalcarenitic in part, cherty, oolitic.
- 10,115-10,120 Shale: red, pale green and gray, smooth, slightly fissile.
- 10,120-10,140 Calcilutite: brown to buff, slightly dolomitic, intrabiocalcarenitic in part, chalky, cherty, nil visible porosity.
- 10,140-10,160 Calcilutite: as above, with gray mottling, trace of oolites; dolomitic in part, nil visible porosity.
- 10,160-10,185 Calcilutite: dolomitic, brown, occasionally buff, grades to Intraooliticcalcarenite: chalky in part, microcrystalline to very fine crystalline, nil visible porosity.
- 10,185-10,190 Shale: red, pale green, gray, smooth, firm.
- 10,190-10,210 Calcilutite: buff, fine crystalline to medium crystalline, glauconitic, grades to Intraooliticcalcarenite: brown, subtranslucent, hard, brittle, cherty, nil visible porosity.
- 10,210-10,240 Calcilutite: intraoolitic, calcarenitic, becomes chalky in part, glauconitic, cryptocrystalline to very fine crystalline, argillaceous in part, cherty.
- 10,240-10,260 Shale: red, pale green and gray, as above, with Calcilutite: slightly oolitic, calcarenitic, gray to brown, cryptocrystalline to microcrystalline, chalky in part, argillaceous in part, nil visible porosity.
- 10,260-10,300 Oolitic Calcarenite: brown, cryptocrystalline, subtranslucent, some bioconstituents, hard, brittle, nil visible porosity, grades to tan in color with brown oolites; chalky, firm, cherty, nil visible porosity, with some Shale: variegated, as above, becomes intrabiocalcarenitic in part, grades to Calcilutite: brown, subtranslucent towards base.

- 10,300-10,320 Siltstone: green and red-brown, argillaceous in part, grades to Sandstone: green, very fine grained, well sorted, clean, soft, friable, with Shale: red-brown, green and gray.
- 10,320-10,345 Oolitic Calcarenite: calcilititic, brown, cryptocrystalline matrix, subtranslucent, becomes chalky in part, glauconitic, cherty, nil visible porosity, grades to Calcilitite: buff, chalky, glauconitic.
- 10,345-10,370 Calcilitite: buff, chalky, intrabiocalcarenitic in part, oolitic in part, glauconitic, firm, nil visible porosity.
- 10,370-10,385 Calcilitite: as above, becomes brown, subtranslucent, hard, brittle, blocky, nil visible porosity.
- 10,385-10,400 Calcilitite: introbiocalcarenitic, slightly dolomitic, chalky, moderately soft, some sparry calcite cement, cherty, becomes brown, subtranslucent, nil visible porosity.
- 10,400-10,410 Calcilitite: as above, abundant glauconite, some black phosphate pellets.
- 10,410-10,425 Sandstone: red-brown to pink, dolomitic, very fine grained to silty, firm, with Shale: variegated red, green and gray.
- 10,425-10,450 Calcilitite: intracalcarenitic, buff, very glauconitic, chalky, as above, with oolitic Calcarenite: brown, subtranslucent, hard, brittle, blocky, becomes chalky in part, glauconitic, nil visible porosity.
- 10,450-10,480 Sandstone: red to pink, very calcareous, argillaceous, subrounded to subangular, medium to coarse grained, occasionally very coarse grained, pink and clear, very hard, brittle, some black grains, becomes conglomeratic in part, nil visible porosity, interbedded with oolitic Calcarenite: brown, subtranslucent, hard, brittle, grades to Calcilitite: chalky in part, nil visible porosity, cherty.
- 10,480-10,490 Sandstone: pink, as above, becoming very fine grained to fine grained.
- 10,490-10,530 Oolitic Calcarenite: calcilititic, buff to cream, chalky cement, brown oolites, occasional black specks, grades to Calcilitite: buff to pink, occasional biofragments, some black phosphate specks, glauconitic, nil visible porosity, with Sandstone: red to pink, as above, very fine grained to fine grained.

- 10,530-10,550 Sandstone: red to pink, as above, argillaceous, fine grained to very fine grained, some black specks, firm, becomes very silty, with oolitic Calcarenite: calcilutitic, as above.
- 10,550-10,580 Calcilutite: light gray to brown, cryptocrystalline, some microcrystalline to very fine crystalline, hard, brittle, blocky, becomes chalky in part, dark gray, argillaceous in part, glauconitic, trace of pyrite, occasional shell fragments, nil visible porosity.
- 10,580-10,590 Shale: red, lateritic, pale green, gray, firm.
- 10,590-10,605 Calcilutite: light gray to buff, as above.
- 10,605-10,615 Shale: red, lateritic, green to gray, smooth.
- 10,615-10,640 Dolomite: buff to cream, microcrystalline to very fine crystalline, occasionally finely sucrosic, hard, dense, nil visible porosity, with some Shale: as above, and with some chert.
- 10,640-10,650 Shale: pale green, gray and red, lateritic, firm.
- 10,650-10,680 Dolomite: buff to cream, cryptocrystalline to microcrystalline, generally hard, dense, cherty, nil visible porosity, with Dolomite: as above, becoming fine crystalline, moderately soft.
- 10,680-10,715 Dolomite: buff, cream, microcrystalline to very fine crystalline, hard, dense, nil visible porosity, occasional pin-point vugs, trace of pyrite and chert, with Dolomite: as above, becomes fine crystalline to medium crystalline, stylolitic, finely sucrosic in part, nil visible porosity.
- 10,715-10,730 Sandstone: buff, "salt and pepper", subangular to subrounded, buff, dolomitic cement, fine grained to medium grained, hard, brittle, glauconitic, nil visible porosity.
- 10,730-10,750 Shale: pale green to gray, smooth, splintery, firm; finely disseminated pyrite and banded pyrite interbedded with Dolomite: brown, very finely sucrosic, some microcrystalline, finely disseminated pyrite; carbonaceous laminae and inclusions, nil porosity.
- 10,750-10,770 Sandstone: black to dark brown, very coarse grained to conglomeratic, clear to gray, siliceous cement, subangular to subrounded, hard, brittle, pyritic, large black chert granules, nil visible porosity.

- 10,770-10,800 Conglomerate: sandy, gray, with large dark gray to black chert pebbles, very coarse grained quartz; subangular to subrounded, glauconitic, dolomitic cement, nil visible porosity, with Dolomite: brown, argillaceous, finely sucrosic, as above, and with Calcilutite: very sandy, fine crystalline, with medium grained quartz inclusions; buff to cream, chalky, firm, some black phosphate pellets; grades to brown, microcrystalline, nil visible porosity.
- 10,800-10,810 Dolomite: brown, very finely sucrosic, becomes fine to medium sucrosic, calcareous fracture filling, with 20% Chert: gray.
- 10,810-10,830 Calcilutite: cream to buff, dolomitic, very sandy, fine crystalline, with fine to medium quartz grains; chalky in part, becomes hard, brittle, gray to brown, blocky, nil visible porosity, with Shale: pyritic, as above.
- 10,830-10,845 Sandstone: red to pink, glauconitic, occasional large black chert pebbles, fine grained to coarse grained, poorly sorted, subangular to subrounded, clear to pink grains, some white clay filling, nil visible porosity.
- 10,845-10,855 Shale: variegated, red, green, gray and chocolate brown, pyritic, grades to predominantly red, silty towards base.
- 10,855-10,880 Sandstone: white to light gray, calcareous cement, clear to occasionally pink grains, fine grained to coarse grained, poorly sorted, subangular to subrounded, occasional black chert; firm, brittle, nil visible porosity with Calcilutite: dolomitic, gray to brown, cryptocrystalline, smooth, blocky, with Shale: variegated, pyritic, as above.
- 10,880-10,895 Sandstone: conglomeratic, pink cast, composed of large subangular to subrounded, clear to pink, quartz grains, some black chert pebbles, some red jasper, dolomitic cement, nil porosity, with Shale: variegated, as above.
- 10,895-10,905 Sandstone: red clay matrix, fine grained to medium grained, silty, grades to siltstone in part, very shaly.
- 10,905-10,920 Sandstone: gray to white, medium to coarse grained, conglomeratic, calcareous cement, black chert nodules (15-20%), pyritic, hard, nil porosity, grades to fine grained to very fine grained.
- 10,920-10,930 Shale: variegated green, gray, red and brown, as above.

- 10,930-10,940 Siltstone: red clay matrix, sandy, grades to Shale: silty in part, with calcilutite and dolomite nodules.
- 10,940-10,965 Sandstone: as above, with red jasper.
- 10,965-11,000 Chert Pebble Conglomerate: composed of equal parts milky white chert and dark gray chert; angular, with clear to pink quartz grains; subangular to subrounded, 10-15% disseminated pyrite; hard, brittle, nil visible porosity, calcareous cement at top, becoming unconsolidated with apparent good porosity, questionable dead oil stain, no fluorescence or cut, only black residue, with Shale: gray to green, pyritic.
- 11,000-11,020 Sandstone: conglomeratic, red, pink and green (imparted by glauconite), very coarse grained to medium grained, poorly sorted, siliceous to dolomitic cement, clear to pink quartz grains, occasional black chert; hard, brittle, quartzitic, nil visible porosity.
- 11,020-11,035 Shale: red, smooth to occasionally silty, some gray to green, pyritic, smooth, platy.
- 11,035-11,050 Shale: red, becomes clayey, soft and gummy.
- 11,050-11,080 Claystone: red, soft, gummy.
- 11,080-11,100 Sandstone: white, pink, green, medium grained to coarse grained, conglomeratic, glauconitic, pyritic, dolomitic cement: subangular to subrounded, nil porosity.
- 11,100-11,110 Calcilutite, oolitic; calcarenitic, dolomitic, hard, brittle, nil visible porosity.
- 11,110-11,120 Shale: pale green, gray, brown, smooth, platy, slightly pyritic, with occasional Shale: red, as above.
- 11,120-11,145 Calcilutite: dark gray to black, microcrystalline to fine crystalline, argillaceous, silty, dolomitic, some carbonaceous plant debris, finely disseminated pyrite; hard, brittle, nil porosity, grades to Siltstone: dark gray to black, 30% disseminated pyrite, with Shale: black, carbonaceous.
- 11,145-11,150 Coal: black, bituminous, firm.
- 11,150-11,160 Siltstone: black, as above.
- 11,160-11,170 Sandstone: gray, medium grained to coarse grained, subangular to subrounded, poorly sorted, "salt and pepper", black chert, 15% disseminated pyrite; siliceous to dolomitic cement.

- 11,170-11,175 Coal: black, bituminous, firm.
- 11,175-11,185 Sandstone: as above, becomes very conglomeratic, large angular quartz grains, white chert, siliceous cement, pink in part, some black chert.
- 11,185-11,190 Coal: black, bituminous, firm.
- 11,190-11,195 Shale: variegated, as above; pyritic.
- 11,195-11,200 Sandstone: conglomeratic, as above.
- 11,200-11,210 Calcilutite, oolitic; calcarenitic, tan to brown, glauconitic, chalky in part, nil visible porosity, with Shale: variegated, as above.
- 11,210-11,220 Sandstone: conglomeratic, as above, pyritic.
- 11,220-11,230 Shale: red, pale gray, green, brown, pyritic, smooth.
- 11,230-11,250 Sandstone: conglomeratic, brown to gray, angular, siliceous, glauconitic, quartzitic, some black Chert: pyritic, hard, brittle, with interbedded Shale: variegated, as above.
- 11,250-11,290 Shale: variegated red, pale gray, green, brown, pyritic, smooth, cherty.
- 11,290-11,340 Shale: variegated red, pale gray and green, pyritic, as above, with increase in Shale: dark gray, very finely micaceous, fissile to platy, cherty, tan, gray.
- 11,340-11,360 Sandstone: buff with some pink grains, white clay filling in part, medium grained to occasional coarse grained, poorly sorted, subrounded to subangular, hard, brittle, nil visible porosity.
- 11,360-11,375 Shale: variegated, as above, some Shale: black, carbonaceous, soft, platy, hard and brittle.
- 11,375-11,395 Argillite: black, shiny, siliceous, amorphous, some pyrite, rare calcite filling fractures, very finely micaceous, with quartzitic Sandstone: gray to green, very glauconitic, pyritic, "salt and pepper", subangular, hard, dense.
- 11,395-11,420 Argillite: as above, submetallic luster, with quartzitic Sandstone: as above.
- 11,420-11,440 Sandstone: quartzitic, gray, essentially as above, but becomes very fine grained to silty, "salt and pepper", fair sorting, subangular to subrounded, moderately firm, nil visible porosity.

|                               |  |
|-------------------------------|--|
| 11,440-11,455                 | Argillite: black, shiny, submetallic luster, hard, dense, calcareous fracture filling, blocky.   |
| 11,455-11,465                 | Sandstone: gray, quartzitic, as above, medium grained, "salt and pepper".  |
| 11,465-11,475                 | Argillite: black, submetallic luster.  |
| 11,475-11,480                 | Sandstone: quartzitic, as above.   |
| 11,480-11,520                 | Argillite: as above.   |
| 11,520-11,535                 | <u>Core No. 2, Cut 15', Recovered 13'</u>  |
| 11,520.0-11,533.0'<br>(13.0') | Argillite: black, shiny, submetallic luster, highly fractured, calcareous filling in fractures, hard, dense, occasional zones of thin vertical partings. |
| 11,533.0-11,535.0'<br>(2.0')  | No recovery.   |
| 11,535'                       | Total Depth  |

Log Analysis

## ARMOUR KANE

Formation Evaluation

Well Log Analyst  
18360-6 Cantara St.  
Reseda, Ca. 91335  
(213) 993-0586  
March 26, 1977

Mr. Gordon Legg  
Husky Oil-NPR Operations, Inc.  
3201 C Street  
Anchorage, Alaska 99503

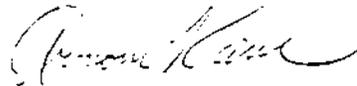
Dear Mr. Legg:

Final log runs at Atigaru Point #1 were run on March 10 and March 13, 1977 and included Dual-Induction, Sonic, Neutron/Density, Dipmeter and sidewall cores. All the logs were definitely sub-standard; the 2"/100' induction was run on a linear rather than a logarithmic scale and the spontaneous potential was useless, the Density was run four times, not one of which is correct and no two of which repeat, the dipmeter was of very poor quality with numerous "dead" correlation curves and the core guns were plagued with numerous misfires.

The Sag River sand was topped at 8253 feet and exhibits an average porosity from neutron and sonic of 20% and is 100% water-bearing, the water calculating to be about 18,000-20,000 ppm which compares favorably with other wells in the area. Porosity in the Shublik averages 6-8% and cross-plots indicate a sand and limestone matrix, while in the Sadlerochit porosities were in the 10-12% range. The Echooka porosity appears to be about 14% and neutron-sonic cross-plots indicate about 75% limestone. In the Lisburne porosity is very low (1% and less) and cross-plots 100% limestone. Argillite porosity is in the neighborhood of 10% and cross-plots shale. No evidence of hydrocarbon accumulation could be found.

Thank you for the opportunity of serving you.

Very truly yours,



Armour Kane



# CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

TELEPHONE (907) 279-4014

P.O. BOX 4-1276

2603 ARCTIC BLVD.

ANCHORAGE, ALASKA 99509

## CORE ANALYSIS REPORT

Company Husky Oil Company Date February 18, 1977 Lab. No. 5451  
 Well No. Atigaru #1 Location \_\_\_\_\_  
 Field NPR #4 Formation Sadlerochit  
 County \_\_\_\_\_ Depths \_\_\_\_\_  
 State Alaska Drilling Fluid \_\_\_\_\_

**LEGEND**  
 C—Crack  
 F—Fracture  
 H—Horizontal  
 O—Open  
 NF—No Fracture  
 IS—Insufficient Sample  
 S—Slight  
 St—Stale  
 V—Vertical  
 Vg—Vugs

| SAMPLE NO.                                   | LEGEND | DEPTH, FEET | EFFECTIVE POROSITY PERCENT | PERMEABILITY MILLIDARCIES |          | SATURATIONS               |                          | CONNATE WATER | SOLUBILITY |         |
|--|--------|-------------|----------------------------|---------------------------|----------|---------------------------|--------------------------|---------------|------------|---------|
|  |        |             |                            | HORIZONTAL                | VERTICAL | % PORE SPACE RESIDUAL OIL | % PORE SPACE TOTAL WATER |               | MUD ACID   | 1% ACID |
| CORE NUMBER 1(8712-42) CUT 30' RECOVERED 30' |        |             |                            |                           |          |                           |                          |               |            |         |
| 1  | VF     | 8712-13     | 10.5                       | 0.82                      | 0.80     | 0                         | 33.9                     |               |            |         |
| 2  | VF     | 8713-14     | 12.3                       | 0.54                      | 0.43     | 0                         | 34.3                     |               |            |         |
| 3  | VF     | 8714-15     | 11.0                       | 0.51                      | 0.51     | 0                         | 32.6                     |               |            |         |
| 4  | VF     | 8715-16     | 12.4                       | 0.82                      | 0.70     | 0                         | 34.0                     |               |            |         |
| 5  | VF     | 8716-17     | 11.0                       | 0.14                      | 0.08     | 0                         | 42.4                     |               |            |         |
| 6  | VF     | 8717-18     | 10.7                       | 0.80                      | 0.51     | 0                         | 39.4                     |               |            |         |
| 7  | VF     | 8718-19     | 6.1                        | 0.03                      | <0.01    | 0                         | 36.3                     |               |            |         |
| 8  | VF     | 8719-20     | 10.3                       | 0.25                      | 0.11     | 0                         | 38.8                     |               |            |         |
| 9  | VF     | 8720-21     | 4.4                        | 0.02                      | 0.02     | 0                         | 40.4                     |               |            |         |
| 10   | VF     | 8721-22     | 13.7                       | 8.48                      | 2.18     | 0                         | 60.0                     |               |            |         |
| 11   | VF     | 8722-23     | 10.6                       | 5.00                      | 2.26     | 0                         | 64.1                     |               |            |         |
| 12   | VF     | 8723-24     | 14.2                       | 7.03                      | 70(Frac) | 0                         | 64.2                     |               |            |         |
| 13   |        | 8724-25     | 6.6                        | 0.29                      | 0.11     | 0                         | 50.4                     |               |            |         |
| 14   |        | 8725-26     | 2.6                        | 0.02                      | 0.02     | 0                         | 75.4                     |               |            |         |
| 15   |        | 8726-27     | 1.1                        | <0.01                     | <0.01    | 0                         | 80.6                     |               |            |         |
| 16   |        | 8727-28     | 4.3                        | 0.03                      | 0.02     | 0                         | 56.7                     |               |            |         |
| 17   |        | 8728-29     | 6.4                        | 0.12                      | 0.06     | 0                         | 55.6                     |               |            |         |
| 18   |        | 8729-30     | 13.1                       | 13                        | 4.29     | Trace                     | 72.1                     |               |            |         |
| 19   |        | 8730-31     | 13.1                       | 8.08                      | 7.52     | Trace                     | 80.5                     |               |            |         |
| 20   |        | 8731-32     | 12.4                       | 7.43                      | 2.40     | Trace                     | 76.3                     |               |            |         |
| 21   |        | 8732-33     | 10.8                       | 6.20                      | 2.88     | 0                         | 31.9                     |               |            |         |
| 22   | VF     | 8733-34     | 12.0                       | 0.16                      | 0.07     | 0                         | 32.0                     |               |            |         |
| 23   | VF     | 8734-35     | 10.5                       | 0.20                      | 0.18     | 0                         | 35.3                     |               |            |         |
| 24   | VF     | 8735-36     | 10.7                       | 0.09                      | 0.07     | 0                         | 34.9                     |               |            |         |
| 25   | VF     | 8736-37     | 10.3                       | 0.62                      | 0.59     | 0                         | 38.8                     |               |            |         |
| 26   | VF     | 8737-38     | 9.1                        | 1.02                      | 0.05     | 0                         | 39.1                     |               |            |         |
| 27   | VF     | 8738-39     | 9.6                        | 0.09                      | 0.08     | 0                         | 41.6                     |               |            |         |
| 28   |        | 8739-40     | 10.5                       | 0.13                      | 0.03     | 0                         | 39.2                     |               |            |         |
| 29   |        | 8740-41     | 10.7                       | 0.08                      | 0.08     | 0                         | 39.4                     |               |            |         |
| 30   | VF     | 8741-42     | 9.6                        | 0.71                      | 0.14     | 0                         | 39.8                     |               |            |         |

Notes: General core condition, vertical fractures 8712-13, vertical fractures 8713-18.5 with horizontal bedding, vertical fractures 8719-24, horizontal bedding to 8729.5, 15° bedding 29.5 2-5° bedding 30-33. Vertical fractures 8734-35, horizontal bedding 34-42 with some cross bedding at 10°.