

NATIONAL PETROLEUM RESERVE IN ALASKA

GEOLOGICAL REPORT

SEABEE TEST WELL NO. 1

HUSKY OIL NPR OPERATIONS, INC.  
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For the

U. S. GEOLOGICAL SURVEY  
Office of the National Petroleum Reserve in Alaska  
Department of the Interior  
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COMPOSITE LITHOLOGY LOG (In pocket)

## GEOLOGIC SUMMARY

### INTRODUCTION

The Seabee Test Well No. 1 is located in the SE 1/4 of protracted Section 5, T1S, R1W, Umiat Meridian (see Figures 1 and 2). The well is located within the "old" Umiat Field area on the south flank of the shallow east-west trending Umiat anticline. Drilling of the well commenced on July 1, 1979. The well was suspended from August 21, 1979, to October 21, 1979, due to labor problems. The total depth of 15,611 feet was reached on March 14, 1980, but the rig was not released until April 15, 1980, because of a drill stem test program.

There were common hydrocarbon shows in the Nanushuk Group and several gas shows of note in the Torok and Fortress Mountain Formations. There was one notable show of gas in the "Pebble Shale" which required an increase in mud weight from 16.9 ppg to 18.0 ppg to control. The gas shows encountered in the Torok, Fortress Mountain and "Pebble Shale" were essentially over-pressured, low volume and were associated with tight sandstones, siltstones and shales. A drill stem test through casing at 5366-5394' did recover gas at a maximum rate of 6.7 MMCFGPD, but pressure data indicated a depleting, limited reservoir.

### PRE-DRILLING PROGNOSIS

The Seabee Test Well No. 1 was drilled in order to test deeper possibilities on the previously drilled Umiat anticline. Minor shallow production had been established in several previously drilled "Umiat Field" wells (see USGS Professional Paper 305-B). Specifically, the Seabee Test Well No. 1 was to have investigated reservoir possibilities in the sands of the Fortress Mountain Formation (potentially gas productive in the Texaco East Kurupa No. 1, T7S, R6W, which tested gas at a maximum rate of 3.8 MMCFGPD). Additionally, the well was scheduled to penetrate the "Pebble Shale" and bottom at 15,200 feet (original prospect total depth) in the top of the Kingak Shale (Jurassic). The reason for drilling into the Kingak was to determine the reservoir potential of sandstones believed to be present at the "Pebble Shale"/Kingak contact.

Structurally, the well was to have encountered several thrust faults interpreted from seismic data and from the sparse Umiat Field well control.

### POST-DRILLING SUMMARY

The Seabee Test Well No. 1 was drilled to a total depth of 15,611 feet and bottomed in the "Pebble Shale" (Neocomian). The top of the "Pebble Shale" was encountered at 13,005 feet and the thickness of 2606+ feet is quite anomalous for wells drilled on NPRA. The extreme thickness of the unit is probably explainable on the basis of repeated section due to thrust faulting (see discussion in Wellsite Geologist's Report by Ronald G. Brockway).

A major thrust fault was encountered at approximately 9,170 feet resulting in a 1,400 foot repeated section from 9170-10,570' which correlated with the interval 7710-9170'. There were several minor thrusts with repeat sections from 2680-2810' and 8774-8830' correlating with the intervals 2530-2680' and 8716-8774', respectively. As previously mentioned, probable repeated section is present in the interval 13,005-15,611', but the absence of adequate electric logs (only a gamma ray through pipe) precludes the positive identification of such zones.

The Seabee Test Well No. 1 did not encounter any sandstones of sufficient thickness, porosity and permeability to be of economic significance. The most promising zone in the well was the previously mentioned tight, thin, over-pressured sandstone tested from 5366-5394' and indicating a restricted, depleting reservoir on the basis of test data.

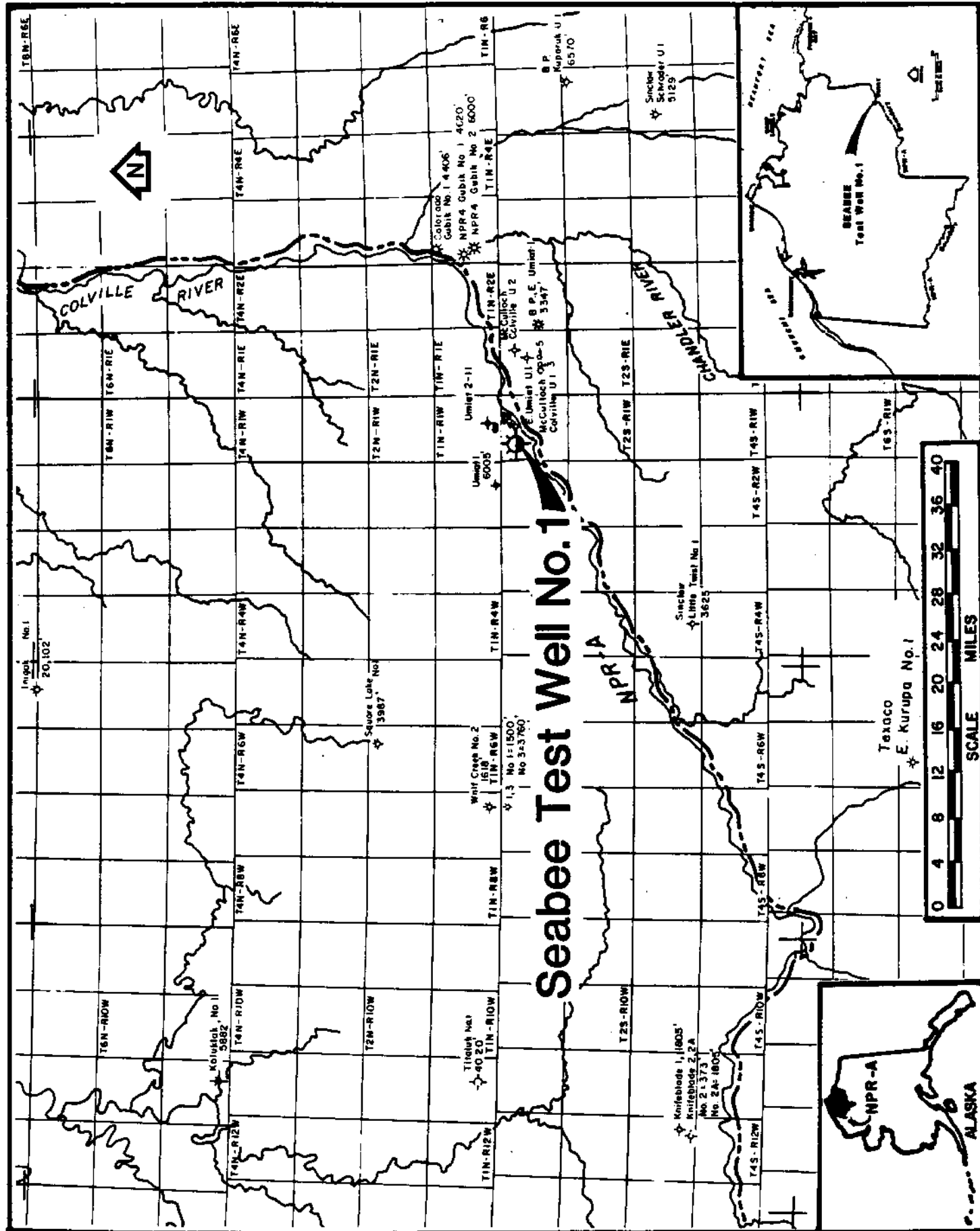
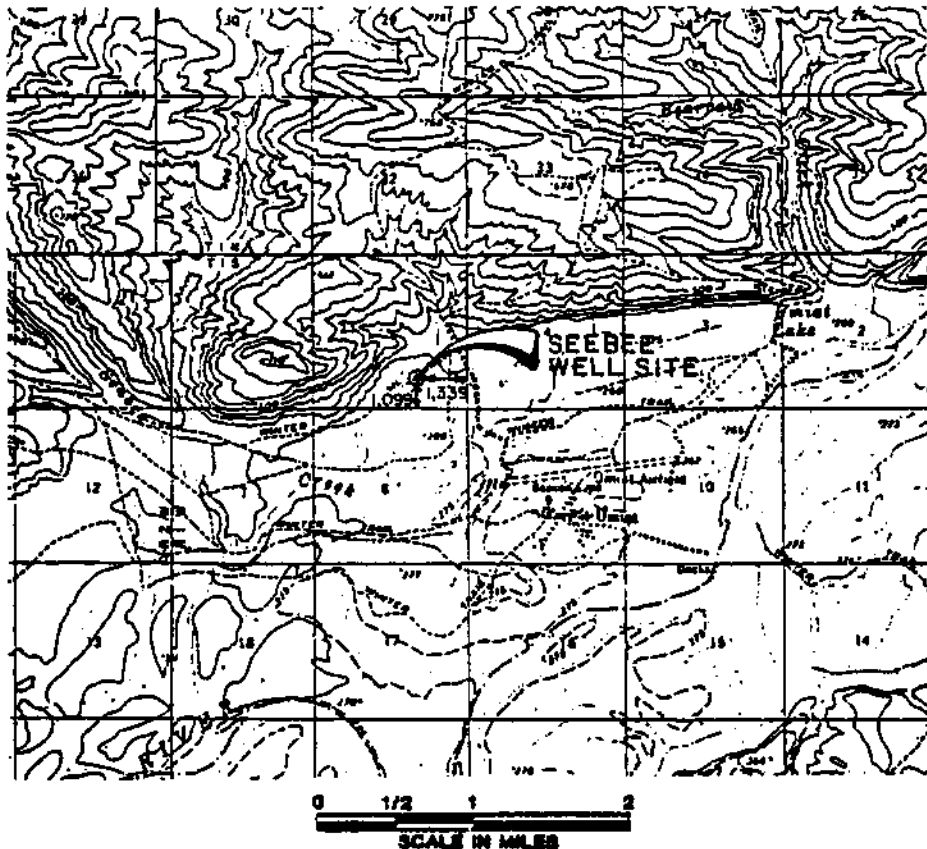


FIGURE 1 - LOCATION MAP - SEABEE TEST WELL NO. 1



**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.

SEPT. 27, 1978

FIGURE 2  
SURVEYOR'S CERTIFICATE



**SEABEE**

LAT. = 69° 22' 48.519"  
 LONG. = 152° 10' 31.291"  
 Y = 5,626,140.68  
 X = 735,330.26  
 ZONE 5

AS STAKED <b>SEABEE</b>
SE 1/4 PROTRACTED SEC. 5 T. 15 S. R. 1 W. USMAY MERIDIAN, AK
Surveyed for <b>HUSKY OIL</b> N.P.R. OPERATIONS INC.
Surveyed by <b>Bell, Herring and Associates</b> ENGINEERS AND LAND SURVEYORS 801 West Fireweed, Suite 102 ANCHORAGE, ALASKA 99503





WELLSITE GEOLOGIST'S REPORT  
BY  
RONALD G. BROCKWAY

SUMMARY

The Seabee Test Well No. 1, NE, SW, SE, protracted Section 5, T1S, R1W, Umiat Meridian, was spudded from under conductor casing on July 1, 1979, at a depth of 115 feet. Located approximately one mile north-northwest of the Umiat airstrip, the well was drilled on the south flank of the Umiat anticline in the National Petroleum Reserve in Alaska.

The well penetrated only the Cretaceous Nanushuk Group, Torok and Fortress Mountain Formations and the "Pebble Shale", bottoming at 15,611' in the "Pebble Shale" (Neocomian).

Zones of interest to be explored were the Nanushuk, Torok and Fortress Mountain sands and possibly the Kuparuk River sands, if present. Because of innumerable hole problems, the well was terminated in the "Pebble Shale".

Hydrocarbon shows were common in the Nanushuk Group, but only one zone was considered worthy of testing. A sandstone at 2654-2673' was tested but recovered only some slightly oil and gas-cut mud while reversing out. At 5328', a sand was encountered in the upper Torok with enough pressured gas to flow the well. Two drill-stem tests were attempted but the packers failed on each. This sand was later tested through casing and recovered a maximum of 6.7 million cubic feet per day, declining to 6.2 MMCFGPD after eight hours. Surface pressures decreased from 2,250 psi to 2,100 psi.

No other tests were performed although other hydrocarbon shows, predominantly gas, were observed below this sand. Reservoir qualities were considered poor in the remainder of the well and those shows that were encountered were presumed to be partially associated with fractures and faulting.

Examination of the information available shows that the well is highly faulted with a major thrust fault at 9170', where approximately 1400' of the Fortress Mountain Formation is repeated. Several other faults are distinguishable and short repeat sections were observed on the electric logs.

Extremely bad hole conditions prevented obtaining any electric logs below 12,772', with the exception of a gamma ray log, which was run through drill pipe.

Of interest is the extremely thick "Pebble Shale" section in the Seabee No. 1, where 2606+ feet have been drilled and in which the well was terminated. Possibly some of this thickness could be attributed to thrust

faulting with a corresponding repeated section, but the correlation limitations imposed by obtaining only a gamma ray log through this interval make it impossible to determine if this is true.

## STRATIGRAPHY

### WIRELINE TOPS

	DRILLED DEPTH (FEET BELOW <u>KELLY BUSHING</u> )	SUBSEA <u>KB 322'</u>
UPPER-LOWER CRETACEOUS		
Nanushuk Group	115' Samples start	+207'
LOWER CRETACEOUS		
Torok Formation	3,405'	-3,083'
Fortress Mountain Formation	7,644'	-7,322'
"Pebble Shale"	13,005'	-12,683'
TOTAL DEPTH	15,611'	-15,289'

### CRETACEOUS

#### Nanushuk Group: 115-3405'

The Nanushuk Group is composed of three units, an upper sandstone, a middle siltstone and a lower sandstone and siltstone.

The upper unit (115-1485') contains sandstone beds varying in thickness from a few inches to 120', with interbedded siltstones and shales reaching thicknesses of 75'. The sandstones are light gray to "salt and pepper", fine to very fine grained, subangular, and medium sorted. Scattered fossil fragments are present. Porosity ranges from 0 to 20%, but is generally in the 3% to 10% class. Hydrocarbon shows, predominantly confined to the upper 800' of the unit, exhibit good to poor staining, light bluish-yellow to dull yellow fluorescence with a predominantly slow cut in chloroethane under a black light, and some small gas readings on the chromatograph.

Beds associated with the sandstones are characterized by light gray to dark brownish-gray, slightly carbonaceous, micaceous siltstones and medium gray to gray-brown slightly carbonaceous, silty, slightly bentonitic shales with occasional siderite nodules.

The sands compose approximately 47% of the unit with siltstones equaling 30% and shale 23%.

Siltstone comprises about 78% of the middle unit (1485-2553') of the Nanushuk with about 15% being sandstone beds. The remaining 7% is shale. The siltstones are light to dark gray and gray-brown, micaceous,

carbonaceous and contain pyrite inclusions, scattered fossil fragments and foraminifera. The sands are mainly confined to three beds at 1636-1656', 1823-1863', and 2096-2161', and are light to medium gray, very fine grained, subangular, silty and clay filled with pyrite inclusions and scattered fossil fragments. Only slight porosity was observed, and only in the sand at 2096-2161' was any hydrocarbon indication detected. The shales are generally gray to gray-brown, micaceous, carbonaceous and silty.

The lower unit (2553-3405') is characterized by thin interbedded sandstones with thicknesses up to 25', siltstones, very thin bedded shales and occasional coal partings. The thicker sands are located in the upper 350'; sandstone beds become progressively thinner and siltier downward in the unit. These sands are very light gray to gray-brown, very fine grained with occasional fine grained streaks, subangular, medium sorted, carbonaceous, silty, rarely siliceous and calcareous, clay filled with rare glauconite and occasional chert pebbles. Calcite-filled fractures appear moderately common below 2640'. Hydrocarbon shows were observed throughout with gas detected in the upper 250'. Two zones, 2588-2614' and 2656-2675', had 1,360 and 1,720 units of gas, respectively. Fluorescence observed was of the spotty variety with a faint cut in chloroethane.

Only about 38% of the unit is sandstone; gray-brown, carbonaceous, micaceous clay-filled siltstones make up 42%. The shales (20%) are gray-brown to medium gray, fissile, micromicaceous, occasionally pyritic, silty, and slightly carbonaceous.

Thin lignitic coal partings and stringers are scattered throughout the lower unit.

No cores were taken in the Nanushuk Group. Paleontology reports by Anderson, Warren and Associates, Inc. (AWA) have placed the interval 115-2340' in Early Cretaceous (Albian) AWA F-9 and F-10. The interval 2340-4110' has been listed as Late Aptian to Early Albian F-10.

The contact between the Nanushuk and the top of Torok Formation has been placed at 3405' as electric-log correlations indicate a change at this point. Also at this point, there is a marked decrease in sandstone and an increase in shales and siltstones, although descriptions of the sediments are much the same as those described in the Nanushuk.

A small reverse fault zone is present at 2680' with a short repeat section in the intervals 2530-2680' and 2680-2810'.

#### Torok Formation: 3405-7644'

Two members are included in the Torok Formation--an upper siltstone and sandstone member and a lower shale member.

The upper member, encompassing an interval of 1975', is dominated by brownish-gray, occasionally medium and dark gray siltstones which are micaceous, slightly carbonaceous, and pyritic; the pyrite usually occurs as inclusions or nodules. The siltstones obtain thicknesses up to 60', but generally have thin shale and sandstone stringers and laminations within them. Interbedded with the siltstones are thin sandstones as much as 6' thick and generally confined to the upper 1000' of the member, except for a 52' basal sand. Some thin medium dark gray shales are also interbedded with the siltstones.

The sandstone beds are light to medium gray, occasionally "salt and pepper", very fine grained, subangular, medium sorted, silty, carbonaceous, micaceous and tight. Many of the sands exhibit a slight hydrocarbon show characterized by spotty dull fluorescence and a slow very faint cut in chloroethane under a black light.

A basal sandstone of the upper unit was encountered in the interval 5336-5400' (DIL), which has a 14' upper zone separated from the lower zone by a 12' siltstone and shale interval. The sands are light gray, "salt and pepper", fine to very fine grained, subangular to subrounded, medium sorted, partially clay filled, carbonaceous and partly silty. Porosities range from 0 to 16% with the higher porosities in the lower 15'. Electric log computations indicate approximately 10' with fair to good porosity. Gas was tested from this sand at a maximum rate of 6.7 MMCFGPD, but slowly dropping pressures during the test indicate a depleting reservoir.

The lower member is predominantly shale with minor sandstone and siltstone beds confined to the lower 900'. Two cores were cut in this lower member, one at 5390-5402' and the other at 6541-6551'. The upper core was predominantly shale with interlaminated and interbedded sandstones. Apparent dips of 33° to well bore and some fracturing was observed. The lower core was 100% shale with apparent bedding dips of 19°. The shales of the lower member are dark gray-brown to medium gray, fissile to flaky in the upper portion, becoming harder downward, and carbonaceous, micromicaceous, and partly silty. Scattered pyrite inclusions and chert granules are also present.

Hydrocarbon shows were detected only in one sand interval of the lower unit at 6752-6778' and these were minor.

#### Fortress Mountain Formation: 7644-13,005'

Interbedded sandstones, siltstones and shales with occasional thin coal beds comprise the Fortress Mountain Formation. The sandstone beds rarely exceed 10' in thickness, except in two intervals 8925-9060' and 9690-9830', where beds are as much as 50' thick, although even these thicker beds have siltstone and shale interbeds. The sands vary from light gray to gray-brown in color and are fine to very fine grained, subangular to subrounded, rarely angular, silty, carbonaceous, clay filled, partially calcareous or slightly siliceous, and are generally tight with occasional slightly porous streaks. Slight shows of gas were detected in zones 8935-9060' and 11,230-11,700'.

Siltstones in the Fortress Mountain are generally thin bedded, light gray to gray-brown, occasionally dark gray, micaceous, and carbonaceous.

Shales which occur as thin interbeds with the sandstones and siltstones also become thick bedded. Colors are darker than those of the upper formations and vary from medium to very dark gray and occasionally black. They are fissile to slightly blocky, carbonaceous, micromicaceous, pyritic, and contain scattered chert granules, predominantly very dark gray and black. The thickest interval (9860-11,360') contains scattered thin limestone and marlstone beds and laminations.

Lignitic to subbituminous coal beds and partings are scattered throughout the lower 2300' of the formation.

Three cores were cut in the Fortress Mountain at the following intervals: 10,068-10,098', 10,870-10,884', and 12,011-12,041'. The upper core contained interbedded siltstone and shale, and the second core consisted almost entirely of shale. Both had apparent bedding dips of 20°. The lower core had interbedded sandstone and shale with apparent dips of 13° to 15° in relation to the well bore.

The Fortress Mountain Formation is composed of about 22% sandstone, 33% siltstone and 45% shale.

Reverse faulting has occurred in this formation as exhibited by the thick repeated section observed in the interval 9170-10,500', which correlates with the interval 7710-9170'. It appears that a smaller fault is present within this section with a correlation of the interval 8774-8830' equal to 8716-8774'.

Anderson, Warren & Associates paleontology reports have placed both the Torok and Fortress Mountain in Early Cretaceous (probable Aptian) AWA Zone F-11.

#### "Pebble Shale": 13,005-15,611' Total Depth

The rocks of the "Pebble Shale" are almost entirely very dark gray to black shales that are fissile to slightly blocky, carbonaceous, micromicaceous, and occasionally slightly siliceous with pyrite inclusions and bands. One zone of 650' near the top of the formation has interbedded siltstones and sandstones. Scattered throughout the shales are foraminifera, floating rounded occasionally frosted quartz grains varying from fine sand to granule in size, light and dark chert granules and thin bentonite streaks. The bentonites are most prominent in the upper 180'. The top of the "Pebble Shale" was picked at 13,005' because of a definite change in the shales, high gamma ray readings and bentonite beds.

Conventional cores were taken at 13,207-13,236.6' and 14,577-14,607'. The first, taken in the interval with sandstone and siltstone interbeds, had bedding that was essentially horizontal to the core. Light gray, very fine

grained, glauconitic sandstone and gray-brown siltstones compose nearly all of the core. A slight show of hydrocarbons was detected in the sandstone stringers. Gas was encountered while circulating to come out of the hole with this core, necessitating a build-up of mud from 16.9 lbs. to 18.0 lbs. per gallon to control the gas.

The second core was entirely black shale with an apparent dip of approximately 20° to the core axis.

At the total depth of 15,611', the well was still drilling in these very dark gray to black shales.

Paleontology reports by Anderson, Warren & Associates, Inc. have placed the interval 13,100-15,610' into Early Cretaceous, Neocomian (undifferentiated).

It appears that some faulting may be present in this formation because of the excessive thickness of the Neocomian age strata in the Seabee No. 1 in comparison with other wells drilled in the NPRA. Only one electric log is available below 12,772', and it is a gamma-ray log which was run through the drill pipe. Bad hole conditions prevented the running of any other logs. There appears to be some repeat sections in the gamma-ray log.

#### STRUCTURAL DATA

The Seabee Test Well No. 1, drilled on the southern flank of the Umiat anticline in the southeast corner of NPRA, appears to be highly faulted as evidenced by the repeated sections occurring in the well. A major thrust fault was encountered at approximately 9170' where 1400' of section below this depth correlates with the interval 7710-9170'. Short repeat sections were observed in the intervals 2680-2810' and 8774-8830' correlating with the zones 2530-2680' and 8716-8774', respectively, on the Sonic and Dual Induction logs.

A study of the dipmeter log, which only reaches a depth of 9980', shows that there are four major changes of dip and several small reversals present. The beds dip in a south and slightly west direction at an average of 6-8° from surface to 2680'. At this point and extending to approximately 5000', dips change to a general north-northeast direction. Bedding dips vary from 12° to 35°. South and southwest dipping beds are indicated from 5300' to 8425' with an average of 6-7° in the lower 1000'. From 8425-8710', dip increases to 30-50° in a north direction. This high increase may be due to crossbedding in a siltstone-sandstone sequence. At 8710', dips decrease to 4-6° with a reversal to the southwest from 8774-8870'. Dips are somewhat scattered from 8870-9170' and vary in degrees, probably reading crossbedding in the sandstones present in this interval. Below 9170' to 9980', the strata dips to the north at 10-12°. It appears that there are four major faults at 2680', 5300', 8425' and 9170' with minor faulting occurring between them.

In the interval 2680' to 5300', there are three indications of faulting on the dipmeter, in addition to the repeat section already mentioned. These are at 3100', 3200' and 4700'. Some of the irregularities in dip and direction may be due to differential compaction, slump, distortion by faulting or crossbedding in the sandy sections.

The 745' interval between the faults at 8425' and 9170' appears to be highly faulted or distorted. Between 8600' and 8700', some change in direction and dip is noted and may indicate a questionable fault or slump. At 8774', a fault occurs as evidenced by the change in dip direction and a short repeated section. At 8870', another change in dip direction occurs and presumably another fault occurs here.

It is conceivable that after crossing the fault at 9170', a portion of the north-dipping flank of the Umiat anticline was drilled. This is somewhat supported by the change in direction of dip and by the even continuity of bedding dip from 9170-9980'. Although the general change in direction in dip occurs at 8425', the interval between 8425' and 9170' is highly faulted and the changes in dip may be attributed to this faulting or possibly a short section of the north flank may also have been present in this interval, depending on the positioning and movement of the fault at 9170'. With the large amount of faulting and movement evidenced by slickensides throughout the well, it is possible that the crest of the anticline has migrated to the north, possibly a mile or more.

No further dipmeter measurements were obtained below 9980'.

A study of the dual induction and sonic logs, which were the only logs available over the interval 9980-12,772', does not indicate any faulting or repeated sections.

Bad hole conditions limited the recovery of electrical logs below 12,772' to a gamma-ray log which was run through drill pipe. Because of the much greater thickness of the Neocomian age sediments over what was expected, it is concluded that faulting has probably occurred in the "Pebble Shale". This may be partially substantiated by the presence of open fractures observed in Core No. 6 (13,207-13,236.6') and common slickensides in Core No. 7 (14,577-14,607').

Very little correlation between the Seabee Test Well No. 1 and other wells in the Umiat area was established, other than the top of the Torok Formation, as most of the shallow wells were terminated in the basal part of the Nanushuk Group. Only the Umiat No. 1, NE NE SE, protracted Section 34, T1N, R1W, UM and Umiat No. 2, NE NE SE, protracted Section 3, T1S, R1W, UM, reached the Torok and these two wells did not drill the entire formation.

Correlation of the gas sand (5336-5400') in the Seabee No. 1 with the Umiat No. 1 or the Umiat No. 2 is questionable, but may correlate with either of two sands (3810-3834' or 4335-4365') in the Umiat No. 1 and a sand at 1870-1887', which is again repeated at 2425-2543' in the Umiat

No. 2. The only hydrocarbon shows in these sands were listed as a trace of gas on the indicator (USGS Prof. Paper 305-B, page 93) in the interval 3832-3834' in Umiat No. 1. The gas sand in the Seabee No. 1 is approximately three times thicker than the above-mentioned sands of the Umiat wells, which may be due to the fact that the fault noted at 5300' cuts this sand or has distorted it.

Correlation of deep wells in the area is limited to the Texaco No. 1 East Kurupa, NW SE SE, protracted Section 9, T7S, R6W, U.M., and the Inigok Test Well No. 1, SE SW NE, protracted Section 34, T8N, R5W, U.M., approximately 40 miles southwest and 55 miles north northwest, respectively (see Figure 1 & 4). The Torok top seems to be pretty well established, but the top of the Fortress Mountain is somewhat questionable. The Fortress Mountain, as picked in the Seabee No. 1, may be equivalent to the sandy zones which begin at approximately 8500' in E. Kurupa No. 1 and 7125' in Inigok No. 1. The "Pebble Shale" is readily distinguishable in both the Seabee and Inigok wells, but the Kurupa well was terminated before reaching this formation.

#### HYDROCARBON INDICATIONS

By use of microscope, ultraviolet light, chloroethane and hydrogen-flame chromatograph, the samples from the Seabee No. 1 were examined for hydrocarbon shows.

Hydrocarbon shows were detected throughout the Nanushuk Group with the better shows in the top 750' and lower 900'. Those of the upper zone were characterized by slight shows of gas, light to medium-yellow fluorescence, and generally slow to very slow cut in chloroethane with no visible staining. A sandstone from 285-332' had 300 units of gas and light-yellow fluorescence and appears to be the best of the upper zone. Although the lower 900' of the Nanushuk contained shows, only those in the upper 215' of this 900' merit mention. At 2552' interbedded sandstone and siltstone were encountered with gas shows of 410 units on the chromatograph. These increased to 1,360 units in a sand at 2588-2613' with faint light-yellow fluorescence, trace of light-yellow cut, and a very faint trace of staining. At 2656', a 19' slightly porous sand was penetrated that contained 1,720 units of gas with components of C<sub>1</sub> 60,000+ ppm, C<sub>2</sub> 8,400 ppm, C<sub>3</sub> 2,000 ppm, iC<sub>4</sub> 480 ppm, nC<sub>4</sub> 300 ppm. Bright-yellow fluorescence, fast to slow light-yellow streaming cut, and trace light-brown staining were also present. This sand (2654-2673') was later tested through casing with the only recovery being some slightly oil and gas-cut mud after reversing out.

Another sand at 2746-2768' contained 1,200 units of gas with fluorescence and cut as above, but it was not tested.

After penetrating these sands, the background gasses remained moderately high, 350-400 units. At 2950', the background gasses increased to 1,100-2,000 units and remained at that level until casing was set at 3983'.



Because the sands below 2768' are very thin bedded and have little or no porosity, it is assumed that the reason for the high background gasses below 2950' is bleeding gas from the upper sands or from the fault which has been postulated at 2680'.

Hydrocarbon shows in the Torok Formation were limited to two sandstones located at 5336-5400' and 6752-6777'. The upper sand, which had porosities up to 16% in the lower 15', had a gas kick of 2,990 units and caused the well to flow. The samples had spotty light and medium-yellow fluorescence, a slight cut, and no visible staining. Components of the gas were C<sub>1</sub> 60,000+ ppm, C<sub>2</sub> 10,000+ ppm, C<sub>3</sub> 3,610 ppm, iC<sub>4</sub> 998 ppm, nC<sub>4</sub> 1,085 ppm, and C<sub>5</sub> 122 ppm. Two drill-stem tests were attempted at the time of drilling, but the packers failed on each. Tests were performed through casing after drilling of the hole was terminated. A 28' interval (5366-5394'), which had approximately 10' of effective porosity, was perforated and tested. Maximum surface pressures recorded in Halliburton's Formation Testing Service Report were 2,900 psi on a 6/64" choke and 2,100 psi on a 17/64" choke with a maximum recovery of 6.7 MMCFGPD. It was later discovered that the chokes were washed out and these were then recalibrated (17/64" was actually 22.9/64") without any change in the maximum final recovery. This zone is apparently a high-pressure, low-volume depleting reservoir, as indicated by the slowly dropping pressures (2,200 psi to 2,100 psi in 4 1/2 hours) obtained during the test.

Scattered shows were observed throughout the Fortress Mountain Formation. These shows were almost totally gas and devoid of any fluorescence, cut, or staining, with the exception of an interval 12,680-12,800' where a very faint crush cut was observed. Starting at 9006', a 46' interbedded sandstone and siltstone interval was penetrated, which contained 2,500 units of gas. Because of poor reservoir qualities and lack of any shows other than gas, this zone was not tested.

Two thin (3-4') fractured limestones at 10,380' and 10,630' had 1,560 and 4,000 units of gas, respectively.

Hydrocarbon shows in the "Pebble Shale" were minor except for one occurrence which happened while circulating to come out of the hole with Core No. 6 (13,207-13,236.6'). Nine hundred seventy-seven units of gas were encountered; this required an increase of mud weight from 16.9 ppg to 18.0 ppg to kill the well. The very thin sandstones in the core were tight and dirty, therefore, it is presumed that the gas came from fractures which were observed at 13,207-13,209' and 13,222-13,223'.

In general, the reservoir qualities for hydrocarbon accumulation in the Seabee No. 1 are poor except for occasional sands in the upper 1200' of the Nanushuk Group and the one sand in the upper Torok.

## CONCLUSIONS

A study of the electric logs, lithology, drill stem tests and structural conditions of the Seabee No. 1, indicates that any hydrocarbons to be

produced would be from the Nanushuk group sediments and occasional sands in the upper part of the Torok Formation.

The better hydrocarbon shows observed below the Nanushuk Group are associated with fracturing and faulting and are being generated from the shales of the Torok, Fortress Mountain and "Pebble Shale". Possibly some reservoir at a greater depth has been fractured and faulted to allow the upward migration of hydrocarbons.

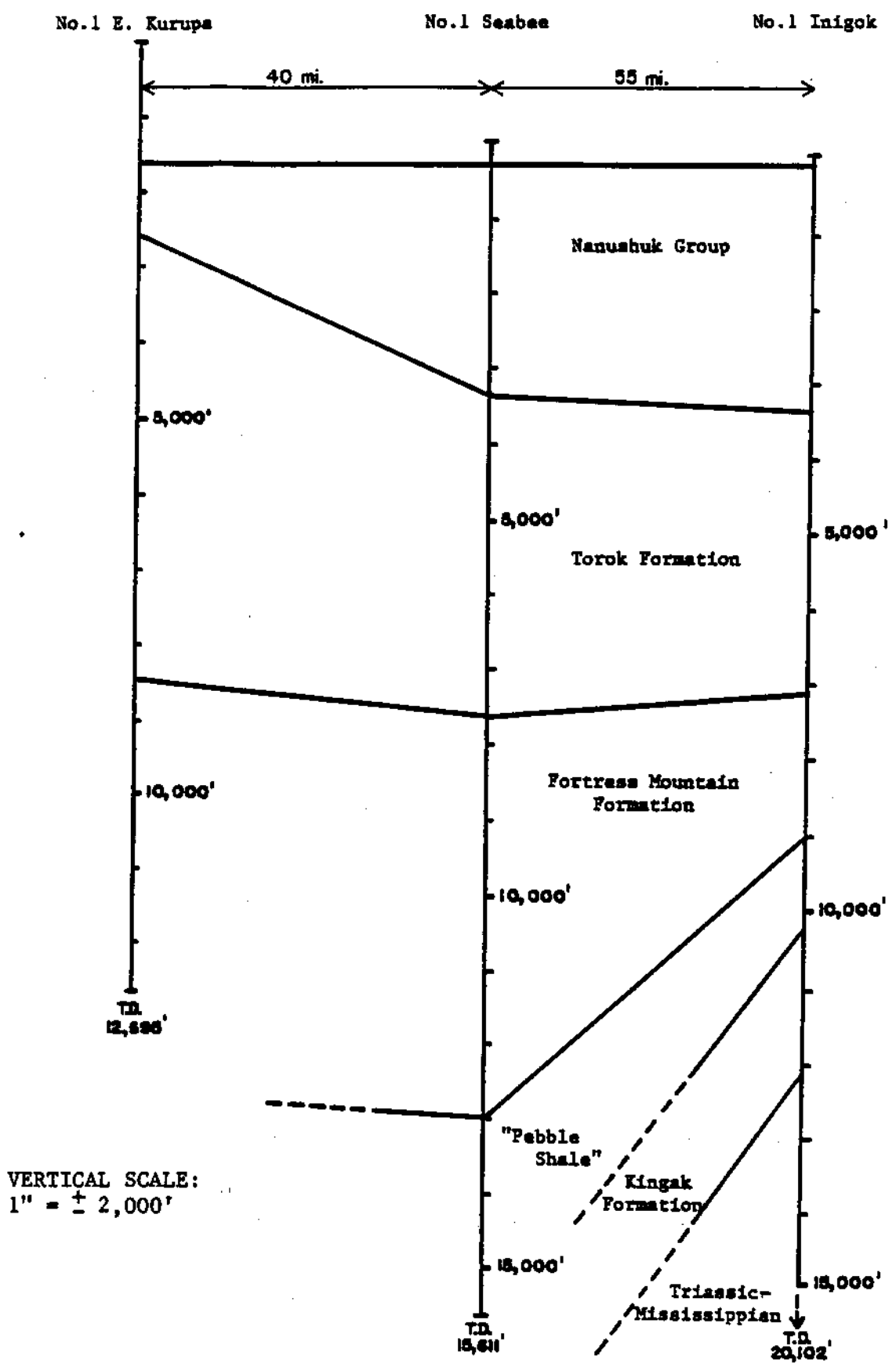


FIGURE 4 - CROSS SECTION - SEABEE TEST WELL NO. 1

## PERTINENT DATA/APPENDICES

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SUMMARY PERTINENT DATA, OPERATIONS & ANALYSIS\*

WELL NAME: Seabee Test Well No. 1

API NO.: 50-287-20007

OPERATOR: Husky Oil NPR Operations, Inc.

LOCATION: 1099' FSL, 1339' FEL  
(SE 1/4) protracted Section 5, T1S, R1W  
Umiat Meridian  
North Slope Borough, Alaska

COORDINATES: Latitude: 69°22'48.519" North  
Longitude: 152°10'31.291" West  
X = 735,330.26; Y = 5,626,140.68  
Zone 5

ELEVATION: 322' Kelly Bushing (KB); 292' Ground

CASING: 30" @ 115'  
20" @ 1617'  
13-3/8" @ 3983'  
9-5/8" @ 9980'  
7-5/8" @ 9661' to 12,814'

DATE SPUDDED: July 1, 1979

DATE SUSPENDED: August 21, 1979

DATE DRILLING  
RECOMMENCED: October 21, 1979

TOTAL DEPTH: 15,611 feet

DATE REACHED  
TOTAL DEPTH: March 14, 1980

DATE RIG RELEASED: April 15, 1980

LOGGING RECORD:

DIL/GR/SP, 2", 5"	125-13,172'
BHCS/GR/CAL/TTI, 2", 5"	125-12,772'
FDC/GR/CAL/RR	125-12,785'
CNL/FDC/GR/CAL	125-12,785'
HDT Dipmeter (Correlation Curves)	
Run 1	125- 1,618'
Run 2	1,618- 4,008'
Run 3	3,987- 9,987'

Temperature Log, Run 1	100-12,750'
CBL/VDL/GR/CCL, Run 2	9,600-12,690'
Perforating Record/CCL	2,652- 2,664'
Gamma Ray	12,700-15,490'
Geogram	Surface-12,772'
Saraband	4,004- 6,450'
Saraband Listing	4,004- 6,450'
Saraband	6,400- 9,940'
Saraband Listing	6,401- 9,932'
CBL/VDL/GR/CCL	3,800- 9,876'
Mudlog	125-15,611'
Pressure Analysis Log	125-15,611'
Wireline Data Pressure Log	125-15,611'
Drilling Data Pressure Log	125-15,611'
Temperature Data Log (Trend-Trend)	125-15,611'
Temperature Data Log (End-End)	125-15,611'
Data Tapes 1-11	
Misc. Data Tapes	
LIS Tape #60635	10-15,510'
LIS Tape #10707,60025	3,720-10,005'
HDT Dipmeter - Arrow Plot	1,634- 3,990'
	4,112- 9,983'
HDT Dipmeter - Cluster Listing	1,634- 3,990'
	4,112- 9,982'
Dipmeter Field Tapes, #10707,3602	4,002- 8,012'
Dipmeter Field Tapes #3410	
Dipmeter Field Tapes #3352	145- 1,591'
Salinity Saraband	130- 1,590'
Salinity Saraband, Tabular Listing	130- 1,590'
Saraband (Conventional)	1,628- 3,991'
Saraband (Conventional) Tabular Listing	1,628- 3,991'

SIDEWALL CORES: Run No. 1 - 24 shot, 23 recovered\*\*

CONVENTIONAL CORES:

<u>No.</u>	<u>Interval</u>	<u>Recovery</u>	<u>Rock Unit</u>
1	5,390- 5,402'	12.0'	Torok
2	6,541- 6,551'	7.3'	Torok
3	10,068-10,098'	29.5'	Fortress Mountain
4	10,870-10,884'	14.0'	Fortress Mountain
5	12,011-12,041'	30.0'	Fortress Mountain
6	13,207-13,236.6'	27.7'	"Pebble Shale"
7	14,577-14,607'	27.0'	"Pebble Shale"

TESTS: Four (4) Drill Stem Tests

Test No. 1	5340-5388'; Misrun
Test No. 2	5310-5402'; Misrun

Test No. 3            5366-5394'; Gas to surface in 4 minutes,  
maximum rate of 6.7 MMCFGPD  
with pressure declining 100 PSI  
in 4-1/2 hours (see Appendix E  
for pressure and other details).  
Test No. 4            2652-2664' Gas to surface in 9 minutes  
(TSTM); no fluid recovered (see  
Appendix E for pressures and  
other details).

STATUS:                    Dry and abandoned  
DRILLING FOREMEN:        J. L. Thompson  
                              Jim Brown  
WELLSITE GEOLOGISTS:    Ronald Brockway  
                              Arlen Ehm  
                              Richard V. Nelson  
WELL LOG ANALYST:        Armour Kane  
DRILLING CONTRACTOR:    Nabors Alaska Drilling, Inc., Rig 25  
MUDLOGGERS:              Exploration Logging  
BIOSTRATIGRAPHIC  
ANALYSIS:                  Anderson, Warren & Associates, Inc.

\* Copies and/or reproducibles of all  
geological data are available from:

National Oceanic and Atmospheric Administration  
EDIS/NGSDC (D62)  
325 Broadway  
Boulder, CO 80303

\*\* Sidewall cores were utilized  
for various analyses including:  
lithology, paleontology, and geochemical.

SEABEE TEST WELL NO. 1  
 DRILL CUTTINGS AND CORE DESCRIPTIONS  
 BY

R. BROCKWAY	-	0- 5,388' 10,004-11,510' 12,570-13,930' 14,185-14,565' 15,191-15,610'
A. EHM	-	5,388-10,004' 11,510-12,570' 13,930-14,185'
R. Nelson	-	14,565-15,191'

NOTE: Samples are not adjusted to mechanical control.

DEPTH DRILLED  
 (FEET BELOW  
 KELLY BUSHING)

0 -	115	No samples.
115 -	170	Siltstone: medium gray, moderately soft, micaceous, partly sandy, carbonaceous flakes, with thin interbedded sandstone and shale, <u>Inoceramus</u> prisms.
170 -	174	Sandstone: light to medium gray, very fine grained, subangular, silty, quartzose, trace of feldspar(?) grains, carbonaceous flakes, slightly calcareous, micaceous, argillaceous, slight porosity - 0-8%, good yellow-white fluorescence, slow yellow cut, no visible stain, 54-60 units gas.
174 -	270	Siltstone: medium to light gray, moderately soft, argillaceous, micaceous, with thin interbedded shale and sandstone, occasional bentonite beds and calcite veins.
270 -	284	Sandstone: light gray, "salt and pepper", fine grained, subangular, medium sorted, clay and silt cement, carbonaceous, coal partings and inclusions, noncalcareous, predominantly quartzose with coal and argillite grains, porosity 10%, good yellow-white fluorescence, some instant cut shows, predominately slow to moderately slow, light yellow; no visible stain.
284 -	288	Siltstone and Shale: medium to light gray, slightly brown, carbonaceous flakes.



- 288 - 330 Sandstone: light gray, "salt and pepper", as above, 10-15% porosity, fluorescence, as above, becomes duller at 300', slow light-yellow cut, no visible stain, 225 units of gas.
- 330 - 410 Sandstone: light gray, "salt and pepper", slightly brown, very fine to fine grained, with occasional medium grained streaks, subangular, silty and clayey to slightly siliceous, tight to slightly porous, zones up to 20%, good light-yellow to dull-yellow fluorescence, slight light-yellow cut, no visible stain, thin interbedded shale and siltstone; 100 units of gas.
- 410 - 425 Siltstone: brownish-gray, partly sandy, slightly shaly, carbonaceous flakes, pyrite inclusions, with interbedded gray-brown, carbonaceous, silty shale; thin subbituminous coal partings.
- 425 - 435 Sandstone: light gray, "salt and pepper" to tan, fine to very fine grained, calcareous to clayey, silty, partly sideritic, carbonaceous, partly micaceous, rare glauconite grains, porous to tight, streaks with 15% porosity, scattered mineral fluorescence; no cut, no visible stain, 50 units of gas.
- 435 - 445 Siltstone: tannish-gray to gray, partly shaly, partly sandy, and Shale: brownish-gray, silty, slightly carbonaceous.
- 445 - 520 Sandstone: light gray, salt and pepper to light brown, fine to medium grained, with very fine grained streaks, subangular to subrounded, calcareous to clayey, streaks slightly siliceous, carbonaceous, occasional chert grains, becomes slightly sideritic at 490', thin streaks with porosity up to 20%, friable, scattered light-yellow fluorescence, no visible stain or cut, interbedded with Shale: gray-brown, micaceous, carbonaceous, partly silty, and Siltstone: gray-brown, slightly carbonaceous, shaly to sandy; thin bentonite stringer 490-500'.
- 520 - 570 Sandstone: light gray, "salt and pepper", fine grained with occasional medium grained streaks, subangular, clayey, partly silty, carbonaceous, quartzose with chert and argillite grains, occasional green grains, noncalcareous, coal inclusions, 10-20% porosity, bright to medium-light-yellow fluorescence, no visible stain or cut.
- 570 - 676 Shale: gray-brown, slightly carbonaceous, partly silty, siderite partings and nodules, with Siltstone: brownish-gray, micaceous, shaly, slightly carbonaceous, and Sandstone: as above.

- 676 - 683 Sandstone: "salt and pepper", to light brown, medium to very fine grained, poor to medium sorted, silty, clayey, carbonaceous flakes and bands, partly micaceous, appears graded, partly iron stained, faint light-yellow fluorescence, slow to medium fast, medium-yellow cut, spotty light-brown stain.
- 683 - 695 Shale and Siltstone: gray-brown, carbonaceous, micaceous.
- 695 - 775 Sandstone: "salt and pepper" to gray, fine grained, subangular, partly siliceous, white clay cement, silty, argillite and coal grains, scattered chert grains, becomes fine to very fine at base, tight to slightly porous, occasional siderite nodules, very faint light-yellow fluorescence; no cut or visible stain, thin siltstone and shale beds at 760-780'.
- 775 - 846 Siltstone: gray to brown, sandy to shaly, carbonaceous flakes, partly sideritic, with Shale: gray, gray-brown, carbonaceous, micaceous, thinly interbedded with Sandstone: light gray to gray, fine to very fine grained, subangular, occasional tan, brown and green grains, partly very silty, rare chert granules, siderite nodules common, thin brown silty limestone stringer 840-850'; no shows.
- 846 - 856 Sandstone: light gray, fine to very fine grained, subangular, clayey, silty, micaceous, calcareous, rare chert granules, tight; no shows.
- 856 - 916 Thin interbedded Sandstone, Siltstone and Shale: as above.
- 916 - 946 Sandstone: gray, light gray, fine to very fine grained, subangular, clayey, silty, micaceous, slightly siliceous, carbonaceous flakes and grains, streaks with slight porosity, scattered mineral fluorescence; no cut or stain, thin interbedded siltstone and shale.
- 946 - 1033 Siltstone: light to dark brownish-gray, micaceous, partly sandy, slightly carbonaceous, scattered pyrite inclusions, siderite nodules, with thin interbedded sandstone and shale, decreasing sand downwards.
- 1033 - 1056 Sandstone: tannish-gray, gray, very fine grained, subangular, silty, clayey, micaceous, carbonaceous flakes, appears slightly siliceous, tight to slightly porous, occasional siderite grains, and Siltstone: light to dark gray-brown, tannish-gray, sandy, micaceous, slightly sideritic, rare Inoceramus prisms.

- 1056 - 1090 Sandstone: light gray, "salt and pepper", fine grained with thin very fine grained streaks, partly silty, carbonaceous, clay and silica cement, streaks with 20% porosity, faint medium-yellow fluorescence; no cut, appears slightly stained at top, spotty, light brown, with thin interbedded siltstone and shale in upper 50 feet.
- 1090 - 1160 Sandstone: "salt and pepper", fine grained with medium grains common, subangular, quartzose with argillite, chert and occasional coal grains, light clay and silica cement, friable, porosity 15-20%; no cut, stain or fluorescence, grades downward to very fine grained at 1140', becoming silty with thin siltstone streaks at 1150-1160'.
- 1160 - 1225 Sandstone: as above, becomes fine grained, increasing clay, porosity decreasing downward, 15% to less than 5%.
- 1225 - 1330 Sandstone: light gray, "salt and pepper" with gray streaks, fine to very fine grained, subangular, clayey, silty, slightly calcareous, carbonaceous, coaly partings, micaceous, siderite nodules, pyrite inclusions, rare glauconite, becomes partly tan and sideritic at 1270', tight to slightly porous; no fluorescence or visible stain, very slow faint dull-yellow cut, occasional siltstone stringers.
- 1330 - 1420 Sandstone: as above, becoming very fine grained, increasing silt and clay, slight increase in carbonaceous material, rare shell fragments and thin coal partings 1330-1340'.
- 1420 - 1450 Sandstone: gray, partly dark gray, very fine grained, subangular, silty to very silty, micaceous, shaly streaks, carbonaceous, trace of pyrite inclusions, dirty, tight; no shows, with thin gray to dark gray, sandy, shaly, carbonaceous siltstone and Shale: gray to dark gray, silty, micaceous, very slightly carbonaceous.
- 1450 - 1493 Sandstone: light to medium gray, with occasional dark gray streaks, predominantly very fine grained, with a few fine grained streaks, subangular, silty, clayey, carbonaceous, occasional tan and green grains, scattered pyrite inclusions, slightly micaceous, tight; no shows with thin interbedded and interlaminated siltstone and shale.
- 1493 - 1630 Siltstone: medium to dark gray to gray-brown, shaly, carbonaceous, micaceous, trace of glauconite pellets at 1600-1610', with interbedded and interlaminated Sandstone: as above, and Shale: gray to brownish-gray, micaceous, carbonaceous, partly silty, some very small gas peaks at 1565', 1583' and 1604'.

- 1630 - 1672 Sandstone: light gray, gray, very fine to fine grained, subangular, silty, argillaceous, appears bentonitic, micaceous, carbonaceous flakes, rare green grains, occasional coal stringers, rare chert pebbles, thin interbedded fine and very fine grained streaks, occasional siltstone beds, trace shale, scattered fossil fragments, tight; no fluorescence or cut, 175 units gas.
- 1672 - 1814 Siltstone: light gray, gray-brown, partly sandy, micaceous, slightly carbonaceous, pyrite inclusions, scattered fossil fragments, with thin interbedded Sandstone: light gray to gray-brown, very fine to fine grained, silty, and Shale: brownish-gray to gray-brown, micaceous.
- 1814 - 1852 Sandstone: light gray, gray-brown, brownish-gray, very fine to fine grained, subangular to subrounded, silty, argillaceous, carbonaceous, slightly micaceous, pyrite inclusions, very thin bedded, tight, no fluorescence or cut, 315 units gas, with thin interbedded siltstone and shale, trace clear calcite, fracture fill, fossil fragments.
- 1852 - 2094 Siltstone: brownish-gray to gray-brown, partly sandy, shaly, carbonaceous flakes, pyrite inclusions, fossil fragments, foraminifera, with thin interbedded Shale: gray-brown, micaceous, silty, carbonaceous flakes, and occasional Sandstone: thin, light gray to gray-brown, very fine to fine grained, subangular, rare chert granules, trace very light gray bentonite 1970-1990', increasing sandstone at 2080'.
- 2094 - 2103 Sandstone: light gray to tan, very fine to fine grained, subangular, calcareous, carbonaceous, micaceous, silty, tight, scattered dull-gold fluorescence, questionable cut; no visible stain, 385 units of gas, siltstone and shale beds at base.
- 2103 - 2180 Sandstone: light gray, light tannish-gray, very fine to fine grained, subangular, noncalcareous, carbonaceous, silty, argillaceous, very slight porosity, 2103-2130', light yellow-gold to medium-yellow fluorescence, slight medium yellow cut; no visible stain, 400-850 units of gas, thin siltstone and shale laminations, fluorescence becomes spotty and dull-yellow at 2130', and sandstone becomes very fine grained with increasing siltstone and shale at 2180'.
- 2180 - 2387 Sandstone: light gray to light brownish-gray, very fine grained, subangular, silty, argillaceous, micaceous, carbonaceous flakes, occasional pyrite inclusions, with thin interbedded and interlaminated Siltstone: light to

- medium brownish-gray, micaceous, shaly, siderite nodules, carbonaceous flakes, and Shale: medium to medium dark brownish-gray, micaceous, carbonaceous, partly silty.
- 2387 - 2540 Siltstone: brownish-gray, micaceous, argillaceous to shaly, slightly carbonaceous, occasional pyrite inclusions, with thin interbedded Sandstone: light gray, light brownish-gray, very fine grained, subangular, silty, argillaceous, slightly micaceous, rare glauconite, tight, and Shale: brownish-gray, micaceous, slightly carbonaceous, partly silty, trace clear calcite, thin veins.
- 2540 - 2585 Sandstone: light gray, gray, occasionally salt and pepper, very fine grained with occasional fine grained streaks, subangular to subrounded, silty, carbonaceous, rare glauconite, tight, faint light-yellow fluorescence; no cut or stain, becomes spotty and dull-yellow, with interbedded Siltstone: brownish-gray to gray, pyrite inclusions, micaceous, carbonaceous.
- 2585 - 2605 Sandstone: light to very light gray, very fine to fine grained, subrounded to subangular, micaceous, dark chert and argillite grains, occasional light altered grains, carbonaceous, argillaceous, appears tight, faint light-yellow fluorescence, trace light-yellow cut, very faint stain, 1,400 units of gas.
- 2605 - 2640 Sandstone: as above, with interbedded Siltstone and Shale: light-yellow fluorescence, spotty, very slight medium-yellow cut; no visible stain.
- 2640 - 2840 Sandstone: very light gray to medium gray, very fine to fine grained, thin bedded, subangular to subrounded, partly silty, carbonaceous, trace glauconite, appears slightly siliceous, streaks with slight porosity, bright-yellow and dull-yellow fluorescence, fast to slow medium-yellow cut, trace of light brown stain, 1,600 units of gas at 2640', thin shale and siltstone beds, calcite filled fractures or veins throughout, common below 2800', becomes siliceous at 2835'.
- 2840 - 2847 Sandstone: as above, becoming siliceous, occasional calcareous streaks, scattered chert chips, gray to very light gray, rare trace of quartzite.
- 2847 - 3009 Sandstone: brownish-gray, light gray, light brown, fine grained with very fine grained streaks, occasional medium grained stringers, subangular to subrounded, thin bedded, chert, argillite and carbonaceous grains, scattered glauconite and chlorite grains, occasional

- calcareous streaks, slightly silty, clayey, carbonaceous and coal partings, thin porous streaks up to 10%, bright to dull-yellow fluorescence, fast to slow light and medium-yellow cut, spotty light brown stain, thin interbedded and interlaminated Siltstone and Shale: brownish-gray, micaceous, slightly carbonaceous.
- 3009 - 3021 Sandstone: light gray to gray-brown, very fine to fine grained, subangular, silty, clayey, rare glauconite, slightly porous, bright and dull-yellow fluorescence, slight cut, spotty stain, 1,500 units of gas.
- 3021 - 3130 Sandstone: as above, with thin interbedded and interlaminated Shale and Siltstone: brownish-gray to gray-brown, scattered pyrite inclusions, micaceous, rare foraminifera, occasional coal partings, spotty medium and dull-yellow fluorescence, very slight cut, no visible stain, occasional calcite filled fractures.
- 3130 - 3144 Sandstone: light gray to light brown, very fine to fine grained, with occasional medium grained streaks, subangular to subrounded, partly calcareous, clayey, micaceous, scattered chert and argillite grains, rare glauconite, trace of porosity, spotty bright and medium-yellow fluorescence, slight cut; no visible stain, calcite filled fractures.
- 3144 - 3330 Sandstone: light brown to gray-brown, very fine grained with occasional fine grained streaks, subangular, micaceous, carbonaceous, clayey, occasional pyrite inclusions, scattered streaks with porosity, dull-yellow with occasional bright-yellow spotty fluorescence, slight cut, spotty stain, thin interbedded and interlaminated Siltstone and Shale: gray-brown, micaceous, carbonaceous, thin coal stringers and partings, occasional calcite filled fractures, increasing siltstone and shale at 3250'.
- 3330 - 3460 Sandstone: thin bedded and interlaminated, light gray to light gray-brown, very fine and fine grained streaks, subangular, clayey to shaly, silty, carbonaceous, micaceous, rare glauconite grains, tight, spotty dull-yellow fluorescence, spotty stain, very faint cut, with Siltstone: gray-brown, micaceous, carbonaceous, pyrite inclusions, and Shale: gray-brown to brown, micaceous, carbonaceous, partly fissile, with streaks of brown sideritic claystone, occasional calcite filled fractures, scattered light and dark chert granules, rare coal partings, thin bentonite stringers 3410-3460'.

- 3460 - 3470 Sandstone: very light to light gray, very fine to fine grained, rare chips with medium grains, subrounded to subangular, clayey, carbonaceous, trace of pyrite, slight porosity, friable, medium to dull-yellow fluorescence, slow cut, spotty stain, trace of gas.
- 3470 - 3560 Sandstone: very thin bedded and interlaminated, light gray to light brown, fine to very fine grained, trace of medium grained, subangular, silty, clayey, carbonaceous, occasionally slightly siliceous, spotty light to dull-yellow fluorescence, fast cut on light-yellow fluorescence, slow otherwise, spotty stain, with Siltstone and Shale: gray-brown to brown-gray, micaceous, slightly carbonaceous, scattered light and dark chert granules, pyrite inclusions, occasional thin bentonite stringers.
- 3560 - 3710 Siltstone: brownish-gray to gray-brown, micaceous, slightly carbonaceous, with thin interbedded Sandstone and Shale: as above, pyrite inclusions, scattered chert granules, occasional bentonite stringers and calcite veins.
- 3710 - 4009 Sandstone, siltstone and shale, very thin interbedded and interlaminated; Sandstone: light gray, gray, very fine to fine grained, rare medium grained streaks, subangular, silty, clayey, micaceous, carbonaceous, tight; Siltstone: gray-brown to dark brownish-gray, micaceous, slightly carbonaceous; Shale: gray-brown to dark brownish-gray, micaceous, slightly carbonaceous, pyrite inclusions throughout, occasional calcite veins or fracture fillings, trace bentonite stringers, scattered Inoceramus fragments, siderite nodules and light and dark chert granules, spotty light and dull-yellow fluorescence throughout, light yellow has light bluish-yellow streaming cut; no visible staining.
- 4009 - 4272 Siltstone: interbedded and interlaminated, gray-brown, trace of light gray, micaceous, carbonaceous, partly sandy, pyrite inclusions, with Shale: gray-brown to dark gray, micaceous, partly silty, and Sandstone: light gray to gray-brown, very fine to fine grained, subangular, silty, partly clayey, partly friable and porous, trace of coal, spotty light-yellow fluorescence, fair to slow medium-yellow cut, trace of light brown stain, small amounts of gas present; sample 75-80% cement.
- 4272 - 4295 Shale: medium dark gray, micromicaceous, fissile, partly silty, rare carbonaceous flakes, with interbedded Siltstone: medium to dark gray, slightly carbonaceous and occasional sandstone stringers.

- 4295 - 4310 Interbedded Sandstone: light gray, medium gray, very fine grained with occasional fine grained streaks, subangular, silty, clayey, occasional streaks with slight porosity, rare spotty fluorescence; no cut or stain, and Siltstone: as above.
- 4310 - 4570 Sandstone: very light to medium gray, very fine to fine grained, subangular, silty streaks, slightly siliceous, trace of mica, rare glauconite, carbonaceous flakes, pyrite inclusions, streaks with porosity up to 10%, spotty medium to dull-yellow fluorescence; no cut or visible stain, occasional thin interbedded and interlaminated siltstones and shales; thicker siltstone and shale interbeds 4510-4550', occasional fracture with very fine crystalline, anhydrite and quartz filling.
- 4570 - 4670 Sandstone: light to medium gray, very fine to fine grained, subangular, clayey to silty, slightly siliceous, carbonaceous, coal grains and occasional chips, scattered glauconite, occasional chert grains, scattered pyrite inclusions, streaks with slight porosity, trace of scattered dull-yellow fluorescence; no cut or stain, interbedded with Siltstone: medium gray to brownish-gray, micaceous, slightly carbonaceous, and Shale: medium dark gray, micromicaceous, partly fissile, occasional fractures with very fine crystalline, anhydrite or quartz.
- 4670 - 5027 Siltstone: medium to dark gray-brown, micaceous, carbonaceous, pyrite inclusions, interbedded with Shale: dark brownish-gray to dark gray, micromicaceous, carbonaceous flakes, fissile, and minor Sandstone: light gray to gray, very fine to fine grained, subangular, silty, clayey, carbonaceous, occasional coal grains, scattered light and dark chert granules; increasing sandstone at 4930'.
- 5027 - 5082 Sandstone and Siltstone: interbedded with minor shales, Sandstone: light gray to medium gray, very fine to fine grained, subangular, carbonaceous, argillaceous, silty, micaceous, occasional scattered chert granules; Siltstone: dark gray-brown to brownish-gray, micaceous, and Shale: dark gray-brown to dark gray, micaceous, fissile.
- 5082 - 5310 Siltstone and shale, with minor Sandstone: as above, scattered chert granules and pebbles, occasional loose medium and coarse quartz, chert and feldspar(?) grains, trace of coal, probably thin partings, pyrite inclusions.
- 5310 - 5340 Sandstone, siltstone and shale interbedded; Sandstone: light gray, "salt and pepper", gray, very fine to fine grained, subangular, silty, argillaceous, carbonaceous,



rare scattered fluorescence, faint light-yellow; no cut or stain, Siltstone and Shale: gray-brown, brownish-gray, micaceous, carbonaceous.

5340 - 5388 Sandstone: "salt and pepper", light gray, fine to very fine grained, subangular to subrounded, clay cement, partly silty, carbonaceous and argillite grains, occasional coal chips, friable, scattered medium to dull-yellow fluorescence, very slight cut; no visible stain, porosity varies from 0% to 15%, 2,990 units gas at 5376'; well flowed at 5388'.

5388 - 5390 As above.

5390 - 5402 Core No. 1: Cut 12', Recovered 12'

5390.0-5402.0' (12.0') Sandstone and shale, interbedded to interlaminated, highly fractured and brecciated; Sandstone: medium gray to light medium gray, fine to very fine grained, subangular to subrounded, poorly sorted, clay filled, "dirty" in appearance, silty in part, predominantly quartz with some dark rock fragments, hard, noncalcareous, fair to poor porosity; Shale: dark gray to black, blocky to platy, waxy luster, noncalcareous, moderately well indurated, firm to soft; core is predominantly small fragments and rubble; good bedding attitude of 33° measured at 5400', some tarry residue at 5393' with dull-gold cut fluorescence, no fluorescence, cut or odor; entire interval is approximately 40% sandstone and 60% shale.

5402 - 5470 As above, becomes more shaly and less sandy; shale constitutes from 60-90% of the rock.

5470 - 6100 As above, with 90% shale; 5% sandstone and 5% siltstone.

6100 - 6541 As above, with 60-70% shale, 10-20% sandstone and 10-20% siltstone.

6541 - 6551 Core No. 2: Cut 10', Recovered 7.3'

6541.0-6548.3' (7.3') Shale: dark gray, hard, well indurated, subfissile to platy, slightly carbonaceous, micromicaceous, silty, very slightly calcareous, very minor

slickensided surfaces, no other structural deformation, no depositional structures.

6548.3-6551.0' No recovery.  
(2.7')

- 6551 - 6768 Shale: medium gray, firm to hard, subfissile, micromicaceous, silty in part; trace of crystalline pyrite, some pyrite spheres, trace of gray, green, and black chert granules.
- 6768 - 6798 Shale: as above, Sandstone: medium gray to buff, fine to medium grained, very slightly calcareous, firm to hard, very poorly sorted, very slightly calcareous, slight scattered yellow fluorescence; no odor, stain or cut; maximum gas 1,350 units at 6785'; Siltstone: gray to brownish-gray, firm to hard, laminated with shale partings, micromicaceous; 50% sandstone, 40% shale and 10% siltstone.
- 6798 - 7600 Shale, Siltstone and Sandstone: as above; siltstone increasing in abundance, shale increasing in abundance, occasional trace of dead oil stain; no odor, fluorescence or cut, trace of pale yellow cut fluorescence; 10-20% sandstone, 10-50% siltstone, 10-50% shale.
- 7600 - 7935 Sandstone, Siltstone and Shale: as above; sandstone 10-70%, siltstone 15-45%, shale 15-45%; trace of light gray to grayish-green tuffaceous sandstone, occasional trace of dead oil stain, as above.
- 7935 - 8450 Shale, Siltstone and Sandstone: as above; shale 20-45%, siltstone 20-45%, sandstone 5-60%, generally 10-20%; no shows of hydrocarbons.
- 8450 - 8955 Shale and Siltstone: as above, with minor sandstone; shale 45-90%, siltstone 10-50%, trace to 20%, generally less than 5%; no shows of hydrocarbons.
- 8955 - 8975 Sandstone, Shale and minor Siltstone: as above; sandstone 40%, shale 40%, siltstone 20%, 480 units of gas from very slightly porous sandstone.
- 8975 - 9005 Shale, Siltstone and Sandstone: as above; shale 40-60%, siltstone 10-20%, and sandstone 20-40%; no gas shows.
- 9005 - 9010 Sandstone, Shale and minor Siltstone: as above; sandstone bed about 5' thick, 525 units of gas.
- 9010 - 9022 Shale and Siltstone with minor Sandstone: as above.

9022 - 9173	Sandstone and silty Shale: as above; sandstone 40-80%, silty shale 20-60%; 2,500 units of gas at 9050'; 4,900 units circulated up from trip at 9038'.
9173 - 9190	Silty Shale and minor Sandstone: as above.
9190 - 9205	Sandstone and silty Shale: as above.
9205 - 9237	Silty Shale and minor Sandstone: as above.
9237 - 9255	Sandstone, Shale and Siltstone: as above.
9255 - 9265	Shale, Siltstone and minor Sandstone: as above.
9265 - 9355	Sandstone, Shale and Siltstone: as above.
9355 - 9365	Shale, Siltstone and minor Sandstone: as above.
9365 - 9385	Sandstone, Shale and Siltstone: as above.
9385 - 9395	Shale, Siltstone and Sandstone: as above.
9395 - 9400	Sandstone, Shale and Siltstone: as above.
9400 - 9618	Shale, Siltstone and Sandstone: as above.
9618 - 9760	Sandstone, Siltstone and Shale: interbedded, as above.
9760 - 9800	Sandstone, Siltstone and Shale: interbedded, as above; sandstone becoming fine grained, moderately calcareous, with rare to common medium grained, loose grains, predominantly quartz, subangular to subrounded.
9800 -10,004	Sandstone, Siltstone and Shale: interbedded, as above, with minor Limestone: moderate brown to brownish-gray, very fine grained, lithographic, hard, argillaceous.
10,004-10,045	Shale: dark gray, slightly brown, micaceous, slight to moderately fissile, slightly carbonaceous, occasional black and dark gray chert granules, occasional quartz grains and granules, siltstone laminations; trace of sandstone.
10,045-10,068	Siltstone: dark gray, shaly, micaceous, slightly carbonaceous, interbedded shale, increasing sandstone stringers, thin sandstone beds 10,060-10,065', shale stringer 10,065-10,068'.
10,068-10,098	<u>Core No. 3: Cut 30', Recovered 29.5'</u>
	10,068.0-10,070.0' Shale: very dark gray, fissile, (2.0') micaceous, silty, disseminated

- crystals and very fine crystalline pyrite inclusions, large flakes of coaly, carbonaceous material, grades downward to siltstone.
- 10,070.0-10,073.9'  
(3.9') Siltstone: very dark gray, grading to gray at base, very shaly at top, grading to argillaceous at base, micaceous, carbonaceous debris and flakes, occasional pyrite inclusions.
- 10,073.9-10,078.5'  
(4.6') Shale: very dark and dark gray, partly silty, fissile, partly flaky, trace of pyrite inclusions, carbonaceous flakes, coaly carbonaceous material, micaceous, breaks on 20° planes.
- 10,078.5-10,080.0'  
(1.5') Siltstone: dark gray, shaly, micaceous, occasional pyrite inclusions, coarse carbonaceous material and flakes, shale inclusions at 10,079'.
- 10,080.0-10,082.2'  
(2.2') Shale: dark gray, very silty, micaceous, carbonaceous flakes common on bedding planes, pyrite inclusions.
- 10,082.2-10,083.0'  
(0.8') Siltstone: gray, firm, argillaceous, dark shale laminations.
- 10,083.0-10,095.0'  
(12.0') Shale: dark and very dark gray, very silty to slightly silty, carbonaceous, occasional siltstone laminations, fissile and slightly flaky, occasional pyrite inclusions, micaceous, some very large carbonaceous fragments, closed hairline fracture at 10,086.8'; Inoceramus prisms, 80° fracture with quartz filling at 10,090.4-10,092.3', shale becomes very silty at 10,092.0', fish(?) tooth at 10,094.0-10,095.0'.
- 10,095.0-10,097.0'  
(2.0') Siltstone: dark gray and gray, shaly, slightly siliceous, micaceous, slightly sandy, carbonaceous flakes, occasional pyrite inclusions, thin shale partings, appears to be very thin bedded, possibly crossbedded.

- 10,097.0-10,097.5' Shale: black, very carbonaceous,  
(0.5') micaceous, fissile, breaks on 20°  
plane.
- 10,097.5-10,098.0' No recovery.  
(0.5')
- 10,098-10,225 Shale, siltstone and sandstone, thinly interbedded; Shale:  
dark to very dark gray, fissile, micromicaceous, slightly  
carbonaceous, occasional light and dark chert pebbles;  
Siltstone: light to dark gray, micaceous, carbonaceous,  
partly shaly; Sandstone: light gray, very fine grained,  
subangular, silty, micaceous, carbonaceous, tight.
- 10,225-10,332 Sandstone: gray, slightly brown, very fine to fine  
grained, occasional medium grains, chert granules, very  
silty, subangular, calcareous, carbonaceous, micaceous,  
hard, tight, no fluorescence or cut; 158 units of gas.
- 10,332-10,387 Shale: dark gray to gray-black, micromicaceous, fissile,  
very slightly carbonaceous, trace of light gray bentonitic  
shales and very light gray bentonites, increasing  
sandstone at 10,330'.
- 10,387-10,391 Limestone: dark brownish-gray, hard, cryptocrystalline,  
very argillaceous, siliceous, fractures with quartz and  
calcite filling, dark brown staining on fractures, no  
fluorescence or cut; 1,560 units of gas.
- 10,391-10,635 Shale, siltstone, sandstone, limestone and mudstone  
interbedded; Shale: dark gray to gray-black, partly  
very carbonaceous, micromicaceous, fissile to slightly  
blocky, very slightly calcareous, trace of bentonitic  
shale; Siltstone: light to dark gray, slightly sandy to  
shaly, micaceous, carbonaceous flakes, slightly  
calcareous; Sandstone: light gray, very fine grained,  
subangular, very silty micaceous, calcareous,  
carbonaceous, tight, thin gray-brown, very argillaceous,  
limestone and marlstone stringers 10,460-10,490'.
- 10,635-10,640 Sandstone: light brownish-gray, light gray, very fine  
grained, subangular, quartzose, silty, calcareous,  
carbonaceous grains, trace of mica, tight, no shows.
- 10,640-10,648 Shale: dark brownish-gray to very dark gray,  
micaceous, very carbonaceous streaks, trace of coaly  
plant remains.
- 10,648-10,653 Limestone: gray-brown, cryptocrystalline to slightly  
earthy, argillaceous to very argillaceous, slightly  
siliceous, hard, tight, fractures with fine to medium

crystals, partly tabular, dolomite and quartz, trace of dark stain on fractures, no fluorescence, very slow faint light medium-yellow cut, trace of gilsonite, very faint medium-yellow cut, 4,000 units of gas.

- 10,653-10,704 Shale: dark to very dark gray with streaks of black, fissile, partly gray-brown and calcareous, trace of coal chips and pyrite, thin interbedded siltstones, trace of sandstone.
- 10,704-10,707 Limestone: as above.
- 10,707-10,712 Sandstone: gray, very fine grained, partly fine grained, subangular, silty, partly shaly, carbonaceous, slightly micaceous, tight, no show.
- 10,712-10,729 Shale: dark to very dark gray with black streaks and very carbonaceous, micaceous, fissile, occasional pyrite inclusions and limestone nodules.
- 10,729-10,737 Claystone and Siltstone: light gray-brown, calcareous, micaceous, disseminated pyrite, fractures with calcite and quartz filling, trace of coal, possible weathered zone.
- 10,737-10,763 Shale: brownish-gray to very dark gray with very carbonaceous black streaks, trace of coal, partly silty, trace of pyrite, interlaminated siltstone.
- 10,763-10,798 Shale: dark to very dark gray, gray-black, micaceous to very micromicaceous, pyrite inclusions, carbonaceous, fissile, rare coal chips, interbedded siltstone and sandstone, trace of very light gray bentonite.
- 10,798-10,803 Sandstone: light gray, gray, very fine to fine grained, subangular, silty, carbonaceous, very slightly calcareous, tight, no show.
- 10,803-10,870 Shale: as above, thin interbedded Sandstone: as above.
- 10,870-10,884 Core No. 4, Cut 14', Recovered 14'
- 10,870.0-10,884.0' (14.0') Shale: very dark gray, fissile to partly flaky, very silty streak at top, micromicaceous, fine carbonaceous residue and plant remains, partly pyritic, occasional scattered pyrite crystals and occasional very fine crystalline pyritized foraminifera  
10,877.0-10,878.0', dark gray

siltstone stringer with bentonite partings 10,873-10,873.4', apparent bedding dip approximately 20°.

- 10,884-10,898 Shale: very dark gray, fissile to partly flaky, micromicaceous, pyrite inclusions, gray-brown marlstone stringers 10,890-10,898', bentonite stringers.
- 10,898-10,906 Sandstone: light gray, gray, very fine grained, subangular, medium sorted, silty, calcareous, carbonaceous, clayey, slightly micaceous, predominantly tight, occasional streaks with slight porosity; no shows.
- 10,906-11,015 Shale: very dark gray, fissile, micromicaceous, carbonaceous, pyrite inclusions, occasional thin very light gray bentonite stringers, scattered partings of light brownish-gray marlstone 10,910-10,970', occasional coal chips 10,970-10,990', rare black chert granules, thin sandstone and siltstone interbeds, trace of clear angular quartz fracture fill.
- 11,015-11,033 Sandstone: light gray, gray, very fine to fine grained, subangular, medium sorted, silty, clayey, slightly calcareous, tight to very slightly porous streaks; no shows, trace of quartz filled fractures, siltstone stringers.
- 11,033-11,080 Shale: thin bedded, very dark gray, as above; Sandstone: as above; and Siltstone: gray to very dark gray, carbonaceous, very slightly calcareous, sandstone beds to 5' thick.
- 11,080-11,140 Shale: very dark gray, fissile, micromicaceous, carbonaceous, silty streaks, pyrite inclusions, scattered chert granules, thin siltstone beds, occasional sandstone stringer, trace of coal 11,100-11,120', shale becomes slightly blocky and moderately hard 11,120-11,130'.
- 11,140-11,152 Sandstone: gray to light gray, very fine grained, subangular to subrounded, clayey, slightly calcareous, silty, carbonaceous, argillite grains, micaceous, rare glauconite and fine pyrite inclusions, tight, shale and siltstone interbeds.
- 11,152-11,256 Shale: very dark gray, fissile to slightly blocky, micaceous, carbonaceous, occasional pyrite inclusions, interbedded with Siltstone: gray to dark gray, carbonaceous, partly slightly calcareous, slightly micaceous, occasional sandstone stringer, thin dark gray-brown and gray-brown, limestone and marlstone stringers 11,190-11,210', trace of light gray bentonite and coal partings 11,190-11,230'.

- 11,256-11,260 Claystone: light tannish-gray, calcareous, partly marly, firm, siliceous, carbonaceous flakes, scattered pyrite crystals.
- 11,260-11,336 Shale: dark to very dark gray, micaceous, carbonaceous, pyrite inclusions, with occasional dark brownish-gray, slightly calcareous stringers and black, very carbonaceous streaks, interbedded Siltstone: gray to dark gray, slightly carbonaceous, micaceous; thin dark gray-brown marlstone beds, trace of arenaceous foraminifera(?).
- 11,336-11,388 Siltstone: dark gray-brown, gray, very dark gray, slightly calcareous, carbonaceous, with interbedded Shale: very dark gray to dark gray-brown, fissile to slightly blocky, micaceous, partly calcareous, trace of marlstone, occasional black, very carbonaceous streaks, and Sandstone: gray, light gray, very fine grained, medium sorted, subangular, slightly calcareous, clayey, silty, rare glauconite, tight; no show.
- 11,388-11,396 Sandstone: light to medium gray, very fine grained, with occasional fine grains, subangular, medium sorted, silty, slightly siliceous, clay filled, carbonaceous, argillite grains, slightly porous streaks, trace of gas, no fluorescence or cut.
- 11,396-11,404 Siltstone: light to dark gray, and Shale: dark to very dark gray.
- 11,404-11,414 Sandstone: as above, with shale and siltstone laminations.
- 11,414-11,426 Siltstone and Shale: as above.
- 11,426-11,435 Sandstone: as above.
- 11,435-11,445 Shale: dark to very dark gray, trace of brownish-gray, partly silty, micaceous, carbonaceous, with interbedded Siltstone: light to dark gray, micaceous, slightly carbonaceous.
- 11,445-11,452 Sandstone: light gray, fine grained, partly very fine grained, subangular to subrounded, silty, argillaceous, siliceous, carbonaceous, argillite grains, slightly porous; no show or cut.
- 11,452-11,475 Interbedded Siltstone: light to dark gray, trace of gray-brown, slightly carbonaceous, micaceous, with Shale: dark to very dark gray, carbonaceous, pyrite inclusions, and minor Sandstone: as above.



- 11,475-11,483 Sandstone: as above.
- 11,483-11,497 Shale, Siltstone and Sandstone: interbedded, as above.
- 11,497-11,505 Sandstone: light gray, fine to very fine grained, subangular to subrounded, silty, slightly siliceous, argillaceous, slightly calcareous, carbonaceous, argillite grains, slight porosity.
- 11,505-11,510 Siltstone: light to dark gray, partly slightly calcareous, micaceous, slightly carbonaceous, and Shale: dark to very dark gray, partly silty, trace of coal.
- 11,510-11,815 Sandstone, shale and minor siltstone interbedded; Sandstone: light gray, fine to very fine grained, predominantly subrounded, generally poorly sorted, predominantly quartz, minor rock fragments, argillaceous, slightly to moderately calcareous, slightly porous, firm to friable, abundant loose medium sized quartz sand grains, Shale: medium gray to dark gray, hard, very slightly calcareous, micromicaceous, fissile, grading to siltstone; Siltstone: light to dark gray and minor brownish-gray, micromicaceous and carbonaceous in part; trace of well rounded dark chert granules to pebbles, trace of bentonite, trace of pyrite and trace of recrystallized brown limestone; no odor, stain, cut or fluorescence; shale ranges from 10% to 80%, generally 50%; sandstone ranges from 10% to 80%, generally 40%; siltstone 10%.
- 11,815-12,011 Shale, Sandstone and minor Siltstone: interbedded, as above; generally 70% shale, 20% sandstone and 10% siltstone; other constituents, as above.
- 12,011-12,041 Core No. 5: Cut 30', Recovered 30'
- 12,011.0-12,041.0' Shale and sandstone with minor  
(30.0') siltstone interbedded and interlaminated; Shale: dark gray to black and dark brownish-black, hard, fissile to blocky, micromicaceous in part, carbonaceous, noncalcareous, silty; Sandstone: light to medium gray, very fine grained, subangular to subrounded, moderately sorted, predominantly quartz with minor rock fragments, very hard, very slightly calcareous, carbonaceous, cross-stratified in part, very slightly porous; Siltstone: medium gray, hard, contact both gradational and abrupt; sandstone beds generally less

than 8" thick, maximum to 21", load casts, fossils (pelecypod?), near vertical fracture with secondary quartz crystals at 12,028', rare light gray-green tuff lamination; no odor, stain, cut or fluorescence.

- 12,041-12,395 Shale, Sandstone and Siltstone: interbedded, as above; sandstone 10-60%; shale 30-80%; siltstone 10%; no odor, stain, cut or fluorescence.
- 12,395-12,570 Shale, Sandstone and Siltstone: interbedded, as above; apparently in well developed beds of sandstone 5-10' thick.
- 12,570-12,667 Shale: very dark gray, micromicaceous, fissile to slightly blocky, trace of fine shell fragments and possible foraminifera, pyrite inclusions, with thin interbedded and interlaminated Sandstone: light gray, very fine to fine grained, subangular, micaceous, slightly carbonaceous, silty, white clay cement, beds to 7' thick; and Siltstone: medium to very dark gray, micaceous, partly shaly, slightly carbonaceous.
- 12,667-12,725 Shale: very dark gray to black, occasionally dark brownish-gray, partly carbonaceous, micromicaceous, fissile to slightly blocky, slightly silty, fractures with angular quartz crystal filling, appears to be slightly porous along fractures, occasional chips with slickensides, occasional chip very slowly bleeding gas, slight light medium yellow crush cut fluorescence, 1,300 unit gas kick at 12,667', thin coal stringers 12,665-12,670', occasional rounded chert granules, light gray to black, trace of very fine grained sandstone and siltstone.
- 12,725-12,745 Sandstone: very thin interbedded and interlaminated, light to dark gray, very fine grained, occasional fine grains, subangular, clayey, silty, partly carbonaceous, slightly micaceous; no shows, with Shale: dark to very dark gray, micaceous, fissile to slightly blocky, occasional quartz filled fracture; and Siltstone: dark and very dark gray, micaceous, slightly carbonaceous.
- 12,745-12,770 Shale: dark and very dark gray, trace dark brownish-gray, micaceous, fissile to slightly blocky, with interbedded Sandstone: light gray and gray, very fine grained, subangular, silty, carbonaceous, micaceous, very slightly calcareous, shaly in part; no fluorescence or stain, very faint crush cut fluorescence, thin siltstone and sandstone beds to 4'.

- 12,770-12,814 Shale: as above, becoming slightly calcareous, slight increase in brown colors, trace of quartz filled fractures, faint crush-cut fluorescence, occasional chips bleeding gas, thin light to dark gray sandstone and siltstone stringers.
- 12,814-12,900 Shale: very dark gray, occasionally slightly brown, fissile to slightly blocky, micromicaceous, carbonaceous, scattered, very fine crystalline pyrite inclusions, occasional thin Sandstone: light gray and gray, subangular, micaceous, very fine to fine grained, silty, clayey, disseminated pyrite, tight, and Siltstone: dark to very dark gray, carbonaceous, micaceous; shale becomes partly gray-black at 12,880'; occasional calcareous and marly streaks at 12,890'.
- 12,900-13,020 Shale: very dark gray to gray-black, fissile to slightly blocky, micromicaceous, carbonaceous, scattered very fine pyrite inclusions, some thin sandstone stringers, light gray and gray, very fine grained, subangular, clay cement, silty, carbonaceous, scattered glauconite and thin siltstones, occasional quartz filled fractures, scattered calcareous and marly streaks, thin very shaly limestone at 12,954-12,956', light and dark chert granules throughout.
- 13,020-13,040 Shale: very dark gray, gray-black, fissile to blocky, partly siliceous, micromicaceous, dolomite inclusions and stringers, chert granules, thin coal bed at top, scattered coal and pyritized wood fragments, pyrite common, with light and very light gray bentonite stringers, flaky to partly siliceous, occasional chips appear fractured.
- 13,040-13,207 Shale: very dark gray to black, partly siliceous, fissile, pyritic, with very light and light gray bentonite stringers, thin gray-brown siliceous, hard, claystone stringers 13,040-13,100', dark gray and black chert pebbles and rounded, frosted quartz grains; thin brown and dark brown dolomite and dolomitic siltstone 13,185-13,187', occasional fracture with soft, white mineral filling, quartz or anhydrite(?).
- 13,207-13,236.6 Core No. 6, Cut 29.6', Recovered 27.7'
- 13,207.0-13,209.0' Sandstone: light gray, very fine  
(2.0') grained, subangular to angular, very silty, clayey, soft to medium firm, disseminated pyrite, occasional very fine crystalline pyrite aggregates, glauconitic, tight, appears very slightly stained, no fluorescence, very slow medium-yellow cut,

- occasional thin shale parting with black carbonaceous residue; vertical fracture, open; no show.
- 13,209.0-13,214.0'  
(5.0') Siltstone: gray-brown, gray, sandy, hard and dolomitic in top 1-1/2', then clayey, scattered pyrite crystals, glauconitic, coarse rounded, frosted quartz and dark chert grains, appears very slightly stained, questionable very faint dull-yellow fluorescence, slow, very faint light-yellow cut.
- 13,214.0-13,215.0'  
(1.0') Sandstone: gray-brown, very fine grained, subangular, very silty, clayey, slightly micaceous, glauconitic, occasional pyrite inclusion, coarse and very coarse, subrounded to rounded, frosted quartz and dark chert grains, tight, appears very slightly stained, no fluorescence, very faint dull-yellow crush cut.
- 13,215.0-13,216.0'  
(1.0') Siltstone: brownish-gray, slightly sandy, glauconitic, pyrite inclusions and partings, quartz grains, as above, rare green shaly partings.
- 13,216.0-13,217.0'  
(1.0') Sandstone: brown-gray, very coarse to very fine grained, rounded, poorly sorted, with sandy, clayey, siltstone matrix, occasional pyrite inclusions and chert pebbles, glauconite common, coarse and very coarse rounded quartz grains compose approximately 40-50% of sandstone, possible very slight porosity, questionable very faint, dull-yellow fluorescence, appears slightly stained, very faint, slow, light-yellow cut.
- 13,217.0-13,223.0'  
(6.0') Siltstone, sandstone and shale, interbedded; Siltstone: gray-brown to brownish-gray, sandy, shaly, occasional crossbedding, scattered pyrite inclusions, very thin beds and laminations, irregular bedding and lensing, thin, black shale partings

and laminations, carbonaceous, micaceous, flaky, slickensides on some shale laminations, vertical and random fractures 13,222-13,223'; Sandstone: brownish-gray to gray-brown, very fine grained, subangular, very silty, clayey, tight, trace of crossbedding, fine shale partings and laminations, irregular bedding, occasional slickensides in shale partings; Shale: very dark gray and black, micaceous, carbonaceous, fissile, thin siltstone laminations and partings, 1/2 to 5 mm, pyrite banding; bedding appears 1-2°.

13,223.0-13,224.5' (1.5') Sandstone: gray-brown, very fine grained, subangular, silty, very siliceous, partly quartzitic, hard, very fine shale partings with mica.

13,224.5-13,234.7' (10.2') Siltstone: gray-brown, sandy, hard, siliceous, partly quartzitic, irregular bedding, appears partly crossbedded, occasional lenses, irregular shale partings and bands, black, micaceous, carbonaceous, becomes shaly and clayey at 13,227', occasional very fine and hairline vertical fractures with soft, white mineral filling, quartz or anhydrite(?), slickensides at 13,231.7', becoming siliceous.

13,234.7-13,236.6 (1.9') No recovery.

13,236.6-13,343 Sandstone: very light brown to brown, occasionally very light gray, very fine grained, subangular, siliceous, argillaceous, silty, occasional round, frosted quartz grains and dark chert pebbles, tight to slightly porous, trace of pyrite; no stain or fluorescence, very faint, medium-yellow crush cut in upper 30', thin shale beds and laminations, black, very dark gray, fissile to slightly blocky, pyrite inclusions, partly carbonaceous, occasionally appears slickensided; and Siltstone: very light brown to brown, siliceous, slightly sandy, argillaceous, partly pyritic, trace of very fine, very tight quartz filled fractures.

- 13,343-13,443 Sandstone, Siltstone, and Shale: thinly interbedded and interlaminated, as above, rounded quartz grains common, scattered dark chert pebbles, increasing sandstone 13,410-13,440', rare foraminifera.
- 13,443-13,490 Sandstone: very light to medium gray, very fine grained, subangular, silty, argillaceous, streaks with slight porosity; no show, interlaminated Siltstone and Shale: as above, becomes thin bedded at 13,456'.
- 13,490-13,650 Sandstone: light gray, gray, very fine grained, subangular, silty, siliceous, argillaceous, tight, thinly interbedded with Siltstone: light to dark gray, slightly carbonaceous, partly sandy, partly shaly, and Shale: black, very dark gray, carbonaceous, micaceous, occasional rounded quartz grains and granules.
- 13,650-13,673 Siltstone: light to dark gray, partly shaly, slightly carbonaceous, siliceous streaks, argillaceous with sandstone and shale stringers.
- 13,673-13,686 Sandstone: light to medium gray, very fine grained, subangular, silty, siliceous, very slightly calcareous, thin shaly partings, siltstone laminations, tight; no shows.
- 13,686-13,708 Sandstone and Siltstone: interbedded, as above, with Shale: black, very dark gray, fissile, partly silty, carbonaceous.
- 13,708-13,717 Sandstone: light to dark gray, very fine grained, subangular, silty, siliceous, argillaceous, shaly streaks, slightly carbonaceous, scattered rounded quartz grains and granules, tight; no show.
- 13,717-13,736 Siltstone: light to dark gray, partly shaly, slightly siliceous and carbonaceous, thin interbedded sandstone and shale.
- 13,736-13,746 Sandstone: light to dark gray, as above, light and dark chert granules common.
- 13,746-13,837 Sandstone: light gray, gray, very fine grained, occasional fine grained streaks, subangular, argillaceous, silty, partly siliceous, trace of clear, quartz, fracture fill(?); no show, thinly interbedded with Siltstone: gray to very dark gray, partly shaly and sandy, slightly carbonaceous, and Shale: black, very dark gray, fissile, micromicaceous, partly silty, carbonaceous to very carbonaceous, decreasing sandstone and increasing shale at 13,790', rare foraminifera.

- 13,837-13,930 Shale: black, very dark gray, fissile, micromicaceous, carbonaceous, occasionally very carbonaceous, partly silty, pyrite inclusions, some pyrite banding, scattered rounded quartz grains and chert granules, thin interbedded Siltstone: gray to very dark gray, partly shaly, trace of very light gray bentonite, rare foraminifera, occasional fracture with soft white, very fine crystalline filling, secondary quartz(?).
- 13,930-13,970 Shale: very dark gray to black, fissile to blocky, micromicaceous, very slightly calcareous, very slightly silty in part, crystalline pyrite same as inclusions in the shale; scattered well rounded quartz and dark chert granules, occasional loose fine to medium grains of sand, well rounded, moderately sorted; rare white tuff(?) with quartz(?) inclusions.
- 13,970-13,980 Shale: as above, with an increase of loose sand grains to 10%; no odor, stain, cut or fluorescence.
- 13,980-14,040 Shale: as above, without significant sand fraction.
- 14,040-14,105 Shale: as above, and sand grains, as above, with up to 10% calcite grains, some well developed, some well rounded, probably fracture filling; trace of Inoceramus prisms; no odor, stain, cut or fluorescence.
- 14,105-14,175 Shale: as above, becoming medium gray, in part micromicaceous, silty in part, and Shale: dark gray to black and waxy, rare calcite fragments; well rounded, frosted, floating quartz grains common; slickensides common; few well rounded dark chert granules; rare white tuff; decrease in pyrite; increase in siltstone to 30%.
- 14,175-14,185 Shale: as above, with marked increase in loose sand grains, medium grained, subrounded to rounded, no apparent cement.
- 14,185-14,327 Shale: black, very dark gray, fissile to slightly blocky, micromicaceous, pyrite inclusions, occasional pyritic worm tubes, trace of light gray and light gray-brown, subwaxy, slightly bentonitic shale, fractures with soft, white mineral filling, secondary quartz(?), occasional chips with slickensides, thin siltstone stringers.
- 14,327-14,345 Sandstone: light gray and gray, very fine grained, subangular, predominantly quartz grains, silty, calcareous, argillaceous, slightly siliceous, slightly carbonaceous, moderately hard, tight, occasional siltstone laminations; no fluorescence or cut, trace of gas.

- 14,345-14,393 Sandstone: as above, interbedded with Siltstone: light to dark gray, argillaceous to shaly, carbonaceous, slightly calcareous and siliceous, and Shale: black, very dark gray, fissile to slightly blocky, carbonaceous, pyrite inclusions, fractures as above, trace of bentonic shale, scattered rounded, frosted quartz grains and light and dark chert granules, trace of coal, scattered foraminifera.
- 14,393-14,440 Shale: black, very dark gray, fissile, partly blocky, micromicaceous, carbonaceous, pyrite inclusions, scattered rounded quartz grains and chert granules as above, trace of very light gray bentonite, thin siltstone beds and laminations, occasional sandstone stringers, fractures with soft, white mineral filling, rare foraminifera.
- 14,440-14,550 Shale: very dark gray to black, silty with thin dark gray siltstones, occasional white mineral filled fractures, traces of pyrite and rounded quartz grains.
- 14,550-14,577 Shale: very dark gray to black, slightly silty, slightly calcareous with occasional well rounded, medium to coarse sized quartz grains; traces of fine grained pyrite, occasional white siliceous fracture filling material.
- 14,577-14,607 Core No. 7: Cut 30', Recovered 27'
- 14,577.0-14,604.0' Shale: fairly uniform, very dark gray to black, firm, poorly to moderately well developed fissility, very fine detrital micaceous flakes throughout, occasional thin irregular fine pyrite laminations; slip surfaces are common; this is low angle or along bedding with some 1-2 mm thick siliceous slickenside surfaces forming; bedding is at approximately 20° to the core, but hole deviation is about the same.  
(27.0')
- 14,604.0-14,607.0' No recovery.  
(3.0')
- 14,607-14,720 Shale: black to very dark gray, micromicaceous, slightly pyritic, silty, carbonaceous with scattered well rounded quartz sand grains; occasional fractures with filling of white siliceous material.
- 14,720-14,745 Shale: as above, with thin Siltstone: medium to dark gray, argillaceous to moderately clean, calcareous, occasionally grading in size to very fine sandstone; trace of Limestone: dark gray, hard, argillaceous.



- 14,745-14,790 Shale: very dark gray to black, firm to hard, slightly silty with scattered detrital mica, fractures with white chert and quartz fillings are common, traces of finely crystalline pyrite, scattered medium to coarse quartz grains.
- 14,790-14,810 Siltstone: dark gray, argillaceous, micaceous, slightly calcareous.
- 14,810-14,850 Shale: as above, with a slight increase in more silvery gray shale, possibly coming from up the hole or from slickenside zones; scattered well rounded quartz grains.
- 14,850-14,880 Shale: as above, with thin Siltstone: dark gray, very argillaceous, micaceous.
- 14,880-15,130 Shale: dark gray to black with occasional dark silver gray, carbonaceous, hard, less silty, more even textured, fracture filling material slightly coarser with some clear quartz; occasional well rounded, dark gray chert granules, occasional fine to medium sized quartz grains.
- 15,130-15,190 Shale: as above, but with slightly more of a dark brown cast.
- 15,190-15,380 Shale: black to very dark gray, fissile to slightly blocky, micromicaceous, carbonaceous, occasional silty streaks and thin partings of siltstone, scattered fine to medium sized rounded quartz grains, some very thin brownish-gray marlstone and marly claystone stringers, fractures with soft white mineral filling, possibly secondary quartz.
- 15,380-15,490 Shale: gray-black, black, very dark gray, carbonaceous, micaceous, fissile to slightly blocky, silty streaks, pyritic, scattered rounded quartz grains, fractures with soft, white mineral filling, with increasing very fine quartz crystals and becoming harder; thin light to very dark gray siltstone laminations (5-10%), partly calcareous, rare glauconite grains, trace of foraminifera; trace of Sandstone: light to dark gray, very fine to fine grained, subangular, occasional gray chert pebbles and granules 15,410-15,430'.
- 15,490-15,610 Shale: gray-black, black with occasional dark gray streaks, fissile, carbonaceous, partly silty, micromicaceous, pyrite inclusions, scattered rounded quartz grains and gray chert pebbles, fractured at 50°, white mineral filling, secondary quartz(?), occasional foraminifera.

## ARMOUR KANE

Well Log Analyst  
18380-8 Cantara St.  
Redwood, Ca. 91335  
(213) 993-0588

August 6, 1979

Mr. S. L. Hewitt  
Husky Oil/NFR Operations, Inc.  
2525 C Street  
Anchorage, Ak 99503

Dear Mr. Hewitt:

Logging operations were begun by Schlumberger at Seabee Test Well No. 1 at 2000 hours on July 25, 1979, and DIL, CNL/FDC, BHC, HRD and Velocity Survey were completed at 1300 hours on July 26. No lost rig time was experienced except for a minor malfunction of one of Birdwell's tools. Log quality was good except for a magnetized SP curve and the fact that the SP curve failed to "dot" on the 2" film.

Top of the Torok was tentatively picked at 3455.

A number of interesting zones appear on the logs with water saturations ranging from 32% to 100% and porosities from 6% to 16%. (See attached data tabulation sheet). As usual, determination of water resistivity was a problem, especially since the SP curve shows practically no activity even though the mud filtrate was unusually fresh. This response is difficult to explain. An  $R_{wa}$  of 0.12, derived from density porosities, was used in the attached computations. Four intervals yielded  $R_{wa}$  values of 0.11 to 0.12 which is probably lower than the true value but can be used with some confidence in the ratio method of computing Sw. The sands appear quite shaly as witness the gamma ray minimum value of 40 API units and the shale value of 70 API units, the wide separation between neutron and density porosities and the difference between sonic and density porosities. Possibly the density should have been run using grain density of 2.68 instead of 2.65 but this would have resulted in a porosity of only 2 porosity units. In any event, the intervals 2588-94, 2656-60 and possibly 2122-26, while thin, are of definite interest. The two major cycle skips on the sonic log were run a number of times at different logging speeds and panel settings and repeated each time both as to depth and magnitude. This I cannot explain.

Very truly yours,



A. Kane

## ARMOUR KANE

Well Log Analyst  
18360-8 Canters St.  
Reseda, Ca. 91335  
(213) 993-0586  
August 27, 1979

Mr. S. L. Hewitt  
Husky Oil/NFR Operations, Inc.  
2525 C Street  
Anchorage, Ak 99503

Dear Mr. Hewitt:

Logging began at Seabee Test Well No. 1 at 0130 hours on August 19, 1979, and at 0830 hours of the same day Schlumberger had completed DIL and CNL/FDC which was the total logging program for this run. Log quality was good on both runs and no lost rig time was incurred although the CNL/FDC stuck badly enough coming off bottom to require a 5000 pull to free it. There is a peculiar response of the caliper from about 6000 to 6300 where it is essentially a straight line at 13 to 13.5 inches. It repeated, however, so is probably valid. The formation remains Torok.

The sand from 5340-5400 which produced the gas "kick" appears to be very shaly from the gamma ray response which ranges from a minimum value of 42 API Units to above 60 Units with the shale line at about 80 Units. By cross-plotting Density vs. Neutron values an approximation of shale percentage can be made, the results of which are shown on the attached tabulation. With shale percentages this high the effective porosity will, of course, be lowered considerably as can be seen in the column headed " $\phi_e$ ". These calculations are not as precise as with a computer run but can be used as an estimation.  $R_w$  computed from the SP is 0.24 which is probably too high due to suppression of the curve by the shaliness.  $R_{wmin}$  is 0.18 and  $S_w$  computed from both values is in the attached tabulation. Porosity from 5380-92 ranges from 11% to 18% with an average of 14% and the  $S_w$  range is 42% to 74% averaging 58%. The corresponding figures for  $S_w$  using  $R_w$  are 37-70% averaging 53%. Because of the high shale content permeability is probably too low for commercial production.

Very truly yours,



A. Kane

## ARMOUR KANE

Well Log Analyst  
18360-6 Cantara St.  
Redeada, Ca. 91335  
(213) 993-0586

November 29, 1979

Mr. S. L. Hewitt  
Husky Oil/NFR Operations, Inc.  
2525 C Street  
Anchorage, Ak 99503

Dear Mr. Hewitt:

Logging operations were begun by Schlumberger at SeaBee Test Well No. 1 at 0030 hours on November 21, 1979, and by 0630 hours November 22 DIL, CNL/FDC, BHC, HFD, Birdwell Velocity Survey and sidewall cores had been completed. All logs were of good quality except that the DIL was recorded ten feet shallow with a badly drifting SP curve. The validity of the  $IL_{\alpha}$  and  $IL_{\beta}$  are suspect since both curves read considerably lower than on the previous run, part, but not all of which, could be attributed to the badly washed out borehole. However, the  $IL_{\alpha}$  was an exact layover so it was decided not to re-run the log. All other logs were of good quality although a few "spikes" and skipped cycles are seen on the BHC. 23 of 24 sidewall cores were recovered.

Three zones looked to be of interest from a resistivity standpoint: 7658-65, 8890-8900 and 9020-60, but proved to be of low porosity ranging from 7% to 9%. Porosity values from a CNL/FDC cross-plot were verified by BHC computations using a matrix velocity of 19,500 ft/sec. Caliper logs indicated the hole size to be in excess of 18" from casing to 7550 with the exception of a very few feet.

The Fortress Mountain formation was topped at 7720' (sample), 7654' (log).

Engineer Larry Nelson and his crew are to be commended for an excellent job performance under trying hole conditions.

Very truly yours,

  
A. Kane

## ARMOUR KANE

Well Log Analyst  
 18380-8 Cantara St.  
 Reseda, Ca. 91335  
 (213) 993-0586  
 April 10, 1980

Mr. S. L. Hewitt  
 Husky Oil/NPR Operations, Inc.  
 2525 C Street  
 Anchorage, Ak. 99503

Dear Mr. Hewitt:

The logging operation at ~~XXXXXX~~ Test Well No. 1 is probably one of the worst fiascos I have seen on the North Slope. Schlumberger began with a temperature survey at 0430 hours, March 30, 1980, but the tool failed at 10,000 feet and was replaced by the back-up tool which resulted in a successful log completed at 1145 hours March 30. Temperature at 12,750 was 226°F. The DIL was then attempted but the tools stopped some 20 feet below the casing shoe and a clean-out run was begun at 1600 hours on March 30 and was completed at 1130 hours, March 31. The second DIL was begun at 1200 hours, March 31, but the tools stopped at 13,173. About 200 feet of log was recorded before the tools stuck at 12,900 and required 3700 pounds pull over normal to get loose. The second clean-out run was begun at 1600 hours, March 31, and was completed at 1130 hours, April 1.

The third DIL attempt was begun at 1200 hours, April 1 and stopped at 13,044. Pulled out of the hole and went back in with combination DIL and BHC which stuck at 12,900 but finally pulled loose. The third clean-out run commenced at 1800 hours and was completed at 0900 hours, April 2 and the fourth DIL with BHC began at 0930, April 2, and reached 14,305 but an "O" ring failure flooded the tools with mud rendering them inoperative and on the way out of the hole the tools stuck at 13,320 and 12,915 but eventually pulled loose and came out of the hole at 1430 hours, April 2.

Next, the CNL/FDC was run through casing and was finished at 2000, April 2. the log was of good quality but cannot be used quantitatively for porosity determination, although the CNL correlates very well with the previously run open hole BHC. Birdwell Velocity Survey was completed at 0330 hours, April 3. The GR/TDT was run through drill pipe but another "O" ring failure flooded the tools thus ruining them. Went back in the pipe with a gamma ray only but the tool failed at 9400. Another GR and weights were flown in from Dead Horse and the log was completed at 0400, April 4. The fifth attempt with ~~bit/cmn~~ was begun but stopped at 12,900 and required 8,000 pounds pull to get loose. Came out of the hole at 1300 hours, April 4 and ceased logging operations after six days.

No zones of interest were seen and the top of the Pebble Shale was found at 13,068 feet.

Very truly yours,



A. Kane



# Log Analysis

COMPANY: HUSKY OIL/NPR OPERATIONS, INC. WELL: SEABEA TEST WELL N#1  
 FIELD: NPRA COUNTY: NORTH SLOPE STATE: ALASKA

DEPTH	RT	$\phi_D$	$\phi_N$	R <sub>W</sub>	Buf <sup>SP</sup> S <sub>w</sub>	R <sub>W</sub> S <sub>w</sub>	GR	* V <sub>SH</sub>	$\phi_C$	** V <sub>SH</sub>	REMARKS
5340-50	18	9.5	22.5	.18	100+	100	61	48	4	65	
5360-70	20	9	23	.18	100+	100	60	51	3	63	
5390-78	25	9	23	.22	98	90	51	51	3	49	
5380	29	11	24	.37	74	70	50	48	5	45	
5382-84	35	15	24	.90	49	45	45	35	11	36	
5386	34	18	24	1.3	42	37	43	24	15	32	
5388	32	15	24	.81	52	49	45	35	11	36	
5390	32	11	25	.42	71	65	52	50	5	49	
5392	30	12	27	.49	67	61	52	55	5	49	
AVERAGE 5380-92	14				58	53			9		

\* V<sub>SH</sub> DERNED FROM  $\rho_D$  VS.  $\phi_N$  CROSSPLOT -  $\phi_C$  FROM SAME CROSSPLOT

\*\* V<sub>SH</sub> DERNED FROM GR EQUATION BUT GR<sub>W</sub> HAD TO BE ESTIMATED - RESULTS ARE QUESTIONABLE

# Log Analysis

COMPANY HUSKY OIL/NPR OPERATIONS, INC.		WELL SEABEE #1
FIELD ONPR #4	COUNTY NORTH SLOPE	STATE ALASKA

DEPTH	RT	$\phi_D$	$\phi_N$	DT	$\phi_S$	GR	R <sub>WD</sub>					REMARKS
6760-90	25	7	18	75	15	50	.13					
7656-68	25	3	15	68	9	30	-					
7720-40	20	4	19	72	12.5	50	-					
7820-35	20	7	19	73	13	45	.11					
8150-54	12	3	22	75	15	55	-					
8174-86	20	3.5	18	68	10	50	-					
8190-8210	18	3	22	72	12.5	50	-					
8236-50	25	3	19	67	9	45	-					
8240-8310	20	3	18	67	9	45	-					
8360-70	20	4	19	67	9	45	-					
8840-8900	40	3	15	74	14	45	-					
8940-60	20	6	20	74	14	50	.09					
9032-50	30	2	18	64	7	40	-					
9110-10	18	5	18	70	11	40	-					
9680-9710	20	4	21	72	12.5	48	-					
9760-70	20	2	19	62	5	40	-					
9810-20	20	2	18	67	9	50	-					





LOGGING REPORT

WELL NAME SEABEE #1

Date 7-6-79 Driller Depth 1623'

Elevation 322' KB Logger Depth 1621'

Logs Ran and Intervals

DIL/GR	125-1615'
FDC/CNL	125-1615'
BHCS	125-1603'
HOT	125-1618'

Additional Logs to Run

NONE

Zones of Interest

Depth	Gross Thickness	Net Feet of Porosity	Lith	Porosity	Probable Fluid Content
284-300'	16	10	Ss	24% avg.	Pos Gas, Oil & Water
697-704'	7	7	Ss	40% ?	Gas ?
1104-1142'	38	38	Ss	19-24%	Water

Discussion:

NOTE: All zones above approximately 1000' are considered to be within the permafrost or influenced by permafrost effect.

Log Tops & Correlations:

All in Nanushuk Formation

Additional Evaluation Plans:

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RON BROCKWAY

Wellsite Geologist

Log Analyst



LOGGING REPORT

WELL NAME SEABEE #1  
 Date July 25, 26, 1979 Driller Depth 4009'  
 Elevation 322' KB Logger Depth 4010'

Logs Ran and intervals

GR/SP/DIL 1618-4004'  
 GR/CAL/FDC/CNL 1618-4009'  
 GR/BEC 1618-4005'  
 HRD 1618-4008'  
 Velocity Survey Top shot 250 - Bottom shot 4000

Additional Logs to Run

Zones of Interest

Depth	Gross Thickness	Net Feet of Porosity	Lith	Porosity	Probable Fluid Content	
					Sw	
2122-2126'	4	4	Ss	11	55%	Oil & Water
2588-2594'	6	6	Ss	9.5	45%	Oil & Water
2656-2660'	4	4	Ss	16	32%	Oil & Water

Discussion:

Above Sw values based on porosity density  $R_{wa} = 0.12$  which may or may not be accurate, but no other  $R_w$  calculations possible. Other zones varied in porosity from 6% to 10-5% and Sw from 63% to 100%. Sands appear very shaly.

Log Tops & Correlations:

Possible top Torok 3655' or higher.

Additional Evaluation Plans:

RON BROCKWAY

Wellsite Geologist  
 ARMOUR KANE  
 Log Analyst





LOGGING REPORT

WELL NAME SEABEE #1

Date November 21-22, 1979 Driller Depth 10,004'

Elevation 322' KB Logger Depth 9990'

Logs Ran and Intervals

GR/SP/DIL 3973-9974' (log recorded 10' shallow)

GR/CAL/CNL/FDC 3983-9977'

GR/BHC 3983-9973'

HRD-Dipmeter 3987-9987 CST-Sidewall Cores - Top: 4821'; Btm: 9879'

Birdwall Velocity Survey - Top shot: 3980'; Btm: 9880'

Additional Logs to Run

NONE

Zones of Interest

Depth	Gross Thickness	Net Feet of Porosity	Lith	Avg Porosity	Probable Fluid Content
* 7658-7665'				8.5	
8890-8900'				7	
9020-9060'				9	

Discussion:

\* The above 3 zones appear of interest from the DIL but prove to be of low porosity. Porosity agrees well from CNL/FDC cross-plot and sonic interval transit time using an interval transit time of the matrix of 19,500 FDC Caliper shows hole diameter more than or equal to 18" from casing to 7550' with the exception of a few feet.

Log Tops & Correlations:

Fortress Mtn. 7644' DIL +10' = 7654'

Additional Evaluation Plans:

ARLEN EHM  
Wellsite Geologist  
ARMOUR KANE  
Log Analyst



LOGGING REPORT

WELL NAME SEABEE #1

Date January 18 and 19, 1980 Driller Depth 12,814'

Elevation 322' KB Logger Depth 12,796'

Logs Ran and Intervals

DIL/GR/SP	-	9967-12,790' (GR to 9800')
BHCS/GR/TTI	-	9967-12,772' (GR to 9600')

Additional Logs to Run

NONE

Zones of Interest

Depth	Gross Thickness	Net Feet of Porosity	Lith	Porosity	Probable Fluid Content
NONE					

Discussion:

The normal logging suite (FDC/CNL, HDT Dipmeter and CST), were not run due to extremely tight hole conditions and apparent lack of hydrocarbon-bearing zones on DIL and BHCS.

Log Tops & Correlations:

"Lower" Fortress Mtn. Ss interval top at 10,353'

Additional Evaluation Plans:

Recommend running CNL/FDC log through pipe back across entire interval on next open hole logging run.

RON BROCKWAY/HARRY HAYWOOD

Wellsite Geologist

Log Analyst



LOGGING REPORT

WELL NAME SEABEE #1  
 Date March 30-31, April 1-4, 1980 Driller Depth 15,611'  
 Elevation 322' KB Logger Depth 15,490' - Never reached TD

Logs Ran and Intervals

Temperature Log 100 - 12,750'  
GR/CAL/CNL/EDC (thru 9 5/8" csg) 9965 - 12,785'  
Birdwell Velocity Survey Top - 5655', Bottom - 12,800'  
GR. (thru drill pipe) 12,700 - 15,490' (GR only - IDT failed)  
GR/SP/DIL 12,938 - 13,172'

Additional Logs to Run

None

Zones of Interest

Depth	Gross Thickness	Net Feet of Porosity	Lith	Porosity	Probable Fluid Content
NO ZONES OF INTEREST					

Discussion:

Hole in very bad condition. Made 4 attempts with DIL/BHC. Stopped at 12,830', 13,173', 13,044' and 14,305' and stuck tools on every attempt, but managed to pull loose. Clean out between each attempt. CNL in casing correlates very well with open hole BHC, but can't be used quantitatively.  $\phi$  values higher than BHC by 3-10 p.u.

Log Tops & Correlations:

Pebble shale 13,068'

Additional Evaluation Plans:

Went in hole with 5th DIL/BHC attempt. Tool stopped at 12,900'. Took 8000 lbs. to pull loose. Came out of hole and rigged down.

ARLEN EHM

Wellsite Geologist

ARMOUR KANE

Log Analyst

WELL NAME \_\_\_\_\_ SEABEE #1 \_\_\_\_\_ DST. NO. 1 DATE 8/6 & 7/79

Formation Tested TOROK Hole Size 12 1/4"  
 Test Interval 5340-5388' Drill Collar Length \_\_\_\_\_ I.D. \_\_\_\_\_  
 Total Depth 5388' Drill Pipe Length \_\_\_\_\_ I.D. \_\_\_\_\_  
 Choke Size: \_\_\_\_\_ Packer Depth(s) 5326', 5340' Ft.  
 Surface \_\_\_\_\_ Bottom Hole \_\_\_\_\_  
 Depth Tester Valve \_\_\_\_\_ Ft.

Cushion Type Fresh Water Amount Drill pipe fullTEST DATARESISTIVITY/CHLORIDE DATA

Tool open at Packer failed hrs.  
 Initial flow period \_\_\_\_\_ min.  
 Initial shut-in period \_\_\_\_\_ min.  
 Final flow period \_\_\_\_\_ min.  
 Final shut-in period \_\_\_\_\_ min.  
 Unseated packer at \_\_\_\_\_ hrs.

Recovery Water \_\_\_\_\_ @ \_\_\_\_\_ OF. \_\_\_\_\_ ppm  
 Recovery Mud \_\_\_\_\_ @ \_\_\_\_\_ OF. \_\_\_\_\_ ppm  
 Recovery Mud Filtrate \_\_\_\_\_ @ \_\_\_\_\_ OF. \_\_\_\_\_ ppm  
 Mud Pit Sample \_\_\_\_\_ @ \_\_\_\_\_ OF. \_\_\_\_\_ ppm  
 Mud Pit Sample Filtrate \_\_\_\_\_ @ \_\_\_\_\_ OF. \_\_\_\_\_ ppm  
 Mud Weight \_\_\_\_\_ vis \_\_\_\_\_ cp

Description of initial flow period Packers failed immediately upon initial open.

Description of final flow period \_\_\_\_\_

PRESSURE DATA

TEMPERATURE	Gauge No. Depth:	ft.	Gauge No. Depth:	ft.	Gauge No. Depth:	ft.	TIME	
							Hour Clock	Hour Clock
Est.	OF.	Blanked Off	Blanked Off	Blanked Off	Blanked Off	Blanked Off	Tool	A.M.
							Opened	P.M.
Actual	OF.	Pressures		Pressures		Pressures		Tool
		Field	Office	Field	Office	Field	Office	Opened
								Bypass
								A.M.
Initial Hydrostatic							Reported	Computed
							Minutes	Minutes
First Period	FLOW	Initial						
		Final						
		Closed In						
Second Period	FLOW	Initial						
		Final						
		Closed In						
Third Period	FLOW	Initial						
		Final						
		Closed In						
Final Hydrostatic								

RECOVERY DATA

Cushion	Type	Amount	Depth Back Pres. Valve	Surface Choke	Bottom Choke	Misc. Items Tester Valve
Recovered		Feet bbl of				
Recovered		Feet bbl of				
Recovered		Feet bbl of				
Recovered		Feet bbl of				

Remarks \_\_\_\_\_

HARRY HAYWOOD

E-1

Prepared by \_\_\_\_\_

DRILL STEM TEST REPORT FORM

WELL NAME SEABEE #1 DST. NO. 2 DATE Aug 8 and 9 1979

Formation Tested TOROK Hole Size 12 1/2"  
 Test Interval 5310-5402' HW drillpipe Length 914' I.D. 3"  
 Total Depth 5402' Drill Pipe Length 4348' I.D. 4 1/2"  
 Choke Size: 1/2" & 1/4" Surface Bottom Hole 3/4"  
 Packer Depth(s) 5299' and 5310' Ft.  
 Depth Tester Valve 5262' Ft.  
 Cushion Type Fresh wtr Amount 5262'

TEST DATA

RESISTIVITY/CHLORIDE DATA

Tool open at: 2345 hrs., 8-8-79 hrs.  
 Initial flow period Packer failed in 3.5 min.  
 Initial shut-in period \_\_\_\_\_ min.  
 Final flow period \_\_\_\_\_ min.  
 Final shut-in period \_\_\_\_\_ min.  
 Unseated packer at: 2358 min.  
 Recovery Water \_\_\_\_\_ @ \_\_\_\_\_ OF. \_\_\_\_\_ ppm  
 Recovery Mud \_\_\_\_\_ @ \_\_\_\_\_ OF. 5000 ppm  
 Recovery Mud Filtrate \_\_\_\_\_ @ \_\_\_\_\_ OF. \_\_\_\_\_ ppm  
 Mud Pit Sample \_\_\_\_\_ @ \_\_\_\_\_ OF. 5000 ppm  
 Mud Pit Sample Filtrate \_\_\_\_\_ @ \_\_\_\_\_ OF. \_\_\_\_\_ ppm  
 Mud Weight 14.5 vit 54 cp

Description of initial flow period completely Packer not/seated on initial open w/surface choke closed, and w/well shut in @ surface w/1525 psi. Packer then seated w/minimum 325 psi thru 1/2" choke. Packer failed in 3.5 min.

Description of final flow period \_\_\_\_\_

PRESSURE DATA

TEMPERATURE	Gauge No. Btm		Gauge No.		Gauge No.		TIME		
	Depth:	ft.	ft.	Depth:	ft.	Depth:	ft.		
Est.	OF	Blanked Off	Hour Clock	Blanked Off	Hour Clock	Blanked Off	Hour Clock	Tool Opened	A.M.
Actual	92	OF	Pressures	Pressures	Pressures	Pressures	Pressures	Tool Opened	A.M.
			Field	Office	Field	Office	Field	Bypass	P.M.
Initial Hydrostatic	4082							Reported	Computed
			Minutes	Minutes					
First Period	FLOW	Initial	No other pressures recorded.						
		Final							
		Closed In							
Second Period	FLOW	Initial							
		Final							
		Closed In							
Third Period	FLOW	Initial							
		Final							
		Closed In							
		Final Hydrostatic							

RECOVERY DATA

Cushion	Type	Amount	Depth Back Pres. Valve	Surface Choke	Bottom Choke	Abn. From Tester Valve
Recovered		Feet bbl of				
Recovered		Feet bbl of				
Recovered		Feet bbl of				
Recovered		Feet bbl of				

Remarks 2 samples of gas and gas cut mud were collected while reversing out from top of DST tool.

SUMMARY OF GAS PEAKS WHILE REVERSING OUT

Peak Ditch Gas Units	Chromatograph (PPM)				
	C1	C2	C3	C4	C5
1965	60,000+	5420	1975	825	0
4745	60,000+	11500	4433	1260	350
2060	60,000+	5600	2050	820	120



**HUSKY**

## U.S. GEOLOGICAL SURVEY/ONPRA

## DRILL STEM TEST REPORT FORM

WELL NAME SEABEE #1 DST. NO. 3 DATE 4-8-80, 4-9-80, 4-10-8

Formation Tested TOROK (Ref log CNL/FDC) Hole Size 9 5/8" csg.  
 Test Interval 5366-5394' (Aug. 19, 1979) Drill Collar Length 188.14' I.D. 2 7/8"  
 PB Total Depth 8243' Drill Pipe Length 5112' I.D. 4.276"  
 \* Choke Size: Variable: Packer Depth(s) 5341.13 Ft.  
 Surface 6/64"-17/64" Bottom Hole 3/4" Depth Tester Valve 5307.37 Ft.  
 Cushion Type Fresh water Amount 500 Ft.

TEST DATA

Tool open at \_\_\_\_\_ hrs.  
 Initial flow period \_\_\_\_\_ min.  
 Initial shut-in period \_\_\_\_\_ min.  
 Final flow period \_\_\_\_\_ min.  
 Final shut-in period \_\_\_\_\_ min.  
 Unseated packer at \_\_\_\_\_ hrs.

RESISTIVITY/CHLORIDE DATA

	Resistivity	Chloride Content
Recovery Water	@ _____	_____ ppm
Recovery Mud	@ _____	_____ ppm
Recovery Mud Filtrate	@ _____	_____ ppm
Mud Pit Sample	@ _____	_____ ppm
Mud Pit Sample Filtrate	@ _____	_____ ppm
Mud Weight	<u>14.5</u> vis	<u>41</u> cp

DESCRIPTION OF FLOW PERIODS4-8-80

1st Flow Period: (Cleanup flow period). Opened tool at 0420 hrs, 4-8-80, immediate strong blow, GTS in 4 min, shut in after 5 min to repair leaks in surface equipment, reopened for 120 min. with gas at surface through 12/64" choke at 2.1 MMCFPD and 2600 psi surface flow pressure, changed to 16/64" choke w/3.2 MMCFPD, 2200 psi SFP, shut in at 0620 hrs for 5 hrs. (320 min).

2nd Flow Period: (180 min.) (1st flow of four point test). Opened tool at 1120 hrs through 12/64" choke, changed to 6/64" choke after 5 min. w/2800-2900 psi SFP and calculated rate 0.5 MMCFPD. Shut in for 6 hrs at 1420 hrs.

GAS ANALYSIS - CHROMATOGRAPH - PERCENT (%)

<u>C<sub>1</sub></u>	<u>C<sub>2</sub></u>	<u>C<sub>3</sub></u>	<u>IC<sub>4</sub></u>	<u>NC<sub>4</sub></u>	<u>C<sub>5</sub></u>
92.6%	6.7%	0.3%	0.1%	0.1%	0.2%

3rd Flow Period: (180 Min.) Opened at 2023 hrs. 4-8-80, on 8/64" choke w/calculated rate of 0.95 MMCFPD and 2600-2700 psi SFP. Shut in well for 6 hrs. at 2323 hrs. 4-8-80

4-9-80

\*4th Flow Period: (180 min.) Opened tool at 0525 hrs. (4-9-80). Choke washed out (greater than 12/64"). Measured rate 4.0 MMCFPD and SFP of 2500 psi increasing to approx. 4.5 MMCFPD and SFP 2600 psi at end of flow period. Shut in well for 6 hrs. at 0825 hrs. 4-9-80.

GAS ANALYSIS - CHROMATOGRAPH - PERCENT (%)

<u>C<sub>1</sub></u>	<u>C<sub>2</sub></u>	<u>C<sub>3</sub></u>	<u>IC<sub>4</sub></u>	<u>NC<sub>4</sub></u>	<u>C<sub>5</sub></u>
95.1%	3.9%	0.7%	0.1%	0.1%	0.1%

\*5th Flow Period: (480 min.) Opened tool at 1425 hrs. 4-9-80. Choke washed out (greater than 17/64"). Measured rate 6.7 MMCFPD and SFP of 2250 psi. After 5 hrs. (300 min.) SFP started to decline to 2100 psi in 8 hrs. (480 min.) giving a measured rate of 6.2 MMCFPD. Shut in well at 2225 hrs. for FSI (16 hrs).

GAS ANALYSIS - CHROMATOGRAPH - PERCENT (%)

<u>C<sub>1</sub></u>	<u>C<sub>2</sub></u>	<u>C<sub>3</sub></u>	<u>IC<sub>4</sub></u>	<u>NC<sub>4</sub></u>	<u>C<sub>5</sub></u>
93.9%	4.7%	0.7%	0.1%	0.2%	0.4%

\*Revised from previous report of 4-10-80.



HUSKY OIL NPR OPERATIONS, INC.  
U.S. GEOLOGICAL SURVEY/ONPRA

DRILL STEM TEST REPORT FORM

WELL NAME \_\_\_\_\_

SEABEE #1

DST. NO. 3

DATE 4-11-80

PRESSURE DATA

TEMPERATURE	Gauge No. 1489		Gauge No. 1460		Gauge No. 6104		Gauge No. 6103	
	Depth: 5323.64 ft.		Depth: 5327.72 ft.		Depth: 5375.6 ft.		Depth: 5379.65 ft.	
Est.	72 Hour Clock		72 Hour Clock		72 Hour Clock		72 Hour Clock	
OF.	Blanked Off No		Blanked Off No		Blanked Off Yes		Blanked Off Yes	
Actual 120 OF.	Pressures		Pressures		Pressures		Pressures	
	Field	Office	Field	Office	Field	Office	Field	Office
Initial Hydrostatic	4065.6		4067.5		4077.6		4098.8	
First Period FLOW	Initial	1581.5	1583.1		1656.2		1640.6	
	Final	2614.5	2618.5		2604.5		2645.4	
	Closed In	3629.4	3642.3		3633.4		3635.8	
Second Period FLOW	Initial	2139.4	2137.1		2196.3		2183.2	
	Final	3586.8	3598.3		3585.8		3603.9	
	Closed In	3629.4	3613.0		3617.5		3685.8	
Third Period FLOW	Initial	1824.3	1831.0		1908.6		1912.2	
	Final	3513.1	3539.6		3538.1		3524.0	
	Closed In	3629.4	3642.3		3617.5		3635.8	
Fourth Period FLOW	Initial	1895.8	1874.7		1940.1		1960.1	
	Final	3252.2	3261.7		3269.0		3268.4	
	Closed In	3600.0	3627.6		3617.5		3619.9	
Fifth Period FLOW	Initial	1924.3	1933.0		1971.7		1992.1	
	Final	2774.0	2764.7		2762.7		2789.2	
	Closed In	3556.7	3569.0		3550.8		3587.9	
Final Hydrostatic	4051.2		4155.5		3919.1		3939.3	

RECOVERY DATA

Cushion	H <sub>2</sub> O	Type	500' Amount	Depth Back Pres. Valve	*variable		Nuc. from Test. Valve
					Surface Choke	Bottom Choke	
Recovered	0		Feet/bbl of			17/64	
Recovered			Feet/bbl of				
Recovered			Feet/bbl of				
Recovered			Feet/bbl of				

Remarks Norelco variable choke exhibited positive signs of erosion, therefore requiring recalibration before actual choke sizes used can be determined.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

H. HAYWOOD

Prepared by

11/78



DRILL STEM TEST REPORT FORM

WELL NAME SEABEE #1 DST. NO. 4 DATE 4-13-80
Formation Tested NANUSHUK GP Hole Size 9 5/8" csg.
Test Interval 2652-2664' Drill Collar Length 184.14 ft. I.D. 2.88"
Total Depth 5292' PBTD Drill Pipe Length 2411.14 ft. I.D. 4.276"
Choke Size: Surface 1/4" Bottom Hole 3/4"
Packer Depth(s) 2638.34 Ft.
Depth Tester Valve 2615.91 Ft.
Cushion Type None Amount

TEST DATA

RESISTIVITY/CHLORIDE DATA

Tool open at 0058 hrs. 4-13-80 hrs.
Initial flow period 60 min.
Initial shut-in period 120 min.
Final flow period 180 min.
Final shut-in period 360 min.
Unseated packer at 1312 hrs. 4-13-80 hrs.

Resistivity Chloride Content
Recovery Water @ OF. ppm
Recovery Mud @ OF. ppm
Recovery Mud Filtrate @ OF. ppm
Mud Pit Sample @ OF. ppm
Mud Pit Sample Filtrate @ OF. ppm
Mud Weight 9.7 - 10.8 vis 39 cp

Description of initial flow period Immediate strong blow, continued throughout; gas to surface
TSTM in 9 min; max 50 psi at Haliburton manifold on rig floor.

Description of final flow period Tool opened w/100 psi, decrease gradually to 3 psi at 105 min;
increased to 12 psi, and then decreased to 5 psi for remainder of test at 180 min;
no fluid to surface.

PRESSURE DATA

Table with columns for TEMPERATURE, Gauge No., Depth, Est. OF., Pressures (Field, Office), and various flow periods (Initial Hydrostatic, FLOW, Closed In, Final Hydrostatic).

RECOVERY DATA

Table with columns: Cushion, Type, Amount, Depth Back Pres. Valve, Surface Choke, Bottom Choke.

Remarks No recovery; reversed out minor sl oil and gas cut mud (slight sheen on top flare pit after reverse out, w/occ to rr min globules of oil in mud); recovered approx. 250 ml gas cut mud w/oil globules a/a from spl chamber; (NOTE: increase in final hydrostatic due to increase in mud wt from 9.7 to 10.4 lbs per gal during final shut in.)

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**GAS ANALYSIS REPORT**

Company Husky Oil Company Date April 11, 1980 Lab No. 3438-1  
 Well No. Seabee No. 1 Location \_\_\_\_\_  
 Field NPRA Formation Torok  
 County \_\_\_\_\_ Depth 5366-94 (DST #3)  
 State Alaska Sampling Point Test Tool  
 Line pressure \_\_\_\_\_ psig; Sample pressure 1125 psig; Temperature \_\_\_\_\_ °F; Container number \_\_\_\_\_  
 Remarks \_\_\_\_\_

Component	Mole % or Volume %	
Oxygen .....	0	
Nitrogen .....	1.41	
Carbon dioxide .....	0.32	
Hydrogen sulfide .....	---	
Methane .....	94.43	
Ethane .....	2.64	Gallons per MCF
Propane .....	0.67	0.184
Iso-butane .....	0.09	0.029
N-butane .....	0.14	0.044
Iso-pentane .....	0.05	0.018
N-pentane .....	0.04	0.014
Hexanes .....	0.07	0.029
Heptanes & Higher .....	0.14	0.064
Total .....	100.00	0.382
GPM of pentanes & higher fraction .....		0.126
Gross btu cu. ft. @ 60° F. & 14.7 psia (dry basis) .....		1039
Specific gravity (calculated from analysis) .....		0.589
Specific gravity (measured) .....		0.590

Remarks: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



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## ANALYTICAL REPORT

From Husky Oil Company Product Condensate Sample  
Address Anchorage, Alaska Date April 11, 1980  
Other Pertinent Data \_\_\_\_\_  
Analyzed by TH Date April 21, 1980 Lab No. 3438-2

REPORT OF ANALYSIS  
CONDENSATE SAMPLE  
SEABEE NO. 1  
NPRA, ALASKA

### DISTILLATION ANALYSIS

<u>T, F</u>	<u>% RECOVERED</u>	<u>CARBON NUMBER</u>
-43.7	0.52	C <sub>3</sub>
+10.9	0.99	IC <sub>4</sub>
+31.1	2.30	NC <sub>4</sub>
49.10	2.62	Necpentane
82.1	4.44	IC <sub>5</sub>
96.9	6.70	NC <sub>5</sub>
140.0	18.08	C <sub>6</sub>
189.6	36.13	C <sub>7</sub>
234.4	69.17	C <sub>8</sub>
303.4	85.19	C <sub>9</sub>
345.4	91.28	C <sub>10</sub>
384.6	96.00	C <sub>11</sub>
421.3	97.25	C <sub>12</sub>
455.7	98.77	C <sub>13</sub>
488.7	99.20	C <sub>14</sub>
519.0	100.00	C <sub>15</sub>



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## ANALYTICAL REPORT

From Rusky Oil Company Product Mud  
Address Anchorage, Alaska Date April 18, 1980  
Other Pertinent Data \_\_\_\_\_  
Analyzed by TH/LMG Date May 1, 1980 Lab No. 3492

REPORT OF ANALYSIS  
MUD SAMPLES  
DST NO. 4 (2652-64)  
SEABEE NO. 1, NPRA, ALASKA

Samples received April 18, 1980

<u>SAMPLE</u>	<u>CHLORIDE</u> <u>Milligrams/liter</u>	<u>HYDROCARBONS</u> <u>Milligrams/gram</u>	<u>G.C.</u> <u>IDENTIFICATION</u>
Mud after reverse circ	40	4.4	Condensate
Mud from CIP Valve	350	6.7	Condensate
Mud below Hydrospring Tester	300	33	Condensate



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## CRUDE OIL ANALYSIS REPORT

Company Husky Oil Company Date April 22, 1980 Lab. No. 3438-2  
Well No. Seabee No. 1 Location \_\_\_\_\_  
Field NPRA Formation Torok  
State Alaska Depth 5366-94 (DST No. 3)

### GENERAL CHARACTERISTIC

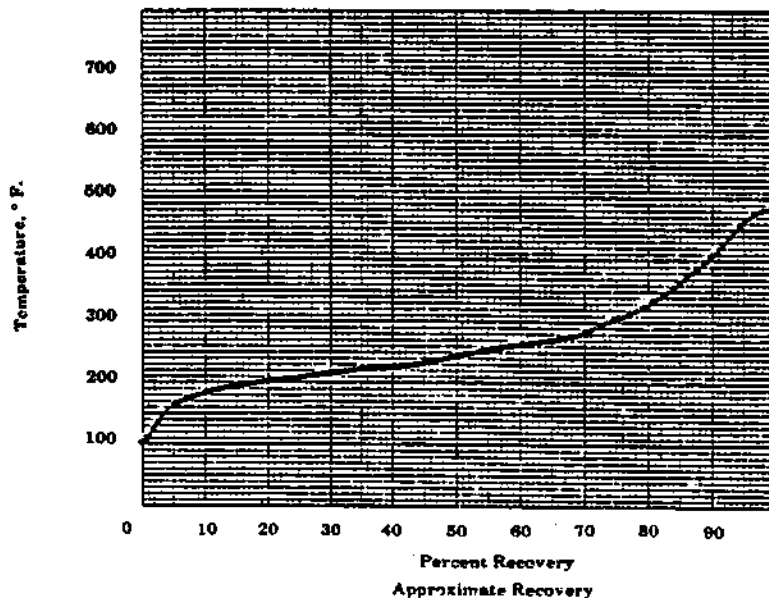
Specific gravity @ 60/60 ° F ..... 0.7568  
A.P.I. gravity @ 60 ° F ..... 55.5  
Saybolt Universal Viscosity @ 70 ° F., seconds ..... 29.0  
Saybolt Universal Viscosity @ 100 ° F., seconds ..... 28.8  
S.s. and water, % by volume ..... <0.01  
Pour point, ° F ..... <-70  
Total sulphur, % by weight ..... 0.01

REMARKS: Condensate sample taken April 9, 1980 @ 2155 Hrs. 265 psi @ 47°F.  
6,216 MMCFPD 17/64 inch choke.

### ENGLER DISTILLATION

Recovery, %	Temperature, ° F.
IBP	106
5	167
10	185
15	196
20	206
25	211
30	218
35	225
40	231
45	238
50	246
55	255
60	266
65	272
70	283
75	311
80	334
85	365
90	408
95	470
E.P.	483
Recovery, %	99.4
Residue, %	0.5

### DISTILLATION GRAPH



30# EP gasoline, % .....  
30# EP gasoline, % .....



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## GAS ANALYSIS REPORT

Company Husky Oil Company Date April 28, 1980 Lab No. 3436-1  
 Well No. Seabee No. 1 Location \_\_\_\_\_  
 Field NPRA Formation Torok  
 County \_\_\_\_\_ Depth 5366-94 (DST No. 3)  
 State Alaska Sampling Point 4th Flow Period  
 Line pressure \_\_\_\_\_ psig; Sample pressure \_\_\_\_\_ psig; Temperature \_\_\_\_\_ °F; Container number \_\_\_\_\_  
 Remarks Sample No. 8, 4-9-80 @ 0800 Hrs

Component	Mole % or Volume %	Gallons per MCF
Oxygen.....	0	
Nitrogen.....	1.37	
Carbon dioxide.....	0.36	
Hydrogen sulfide.....	—	
Methane.....	93.42	
Ethane.....	3.06	
Propane.....	0.62	0.170
Iso-butane.....	0.08	0.026
N-butane.....	0.16	0.050
Iso-pentane.....	0.13	0.047
N-pentane.....	0.12	0.043
Hexanes.....	0.31	0.127
Heptanes & Higher.....	0.37	0.170
Total.....	100.-0	0.633

GPM of pentanes & higher fraction ..... 0.387  
 Gross btu cu. ft. @ 60° F. & 14.7 psia (dry basis) ..... 1064  
 Specific gravity (calculated from analysis) ..... 0.611  
 Specific gravity (measured) ..... 0.610

Remarks: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_





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## GAS ANALYSIS REPORT

Company Busky Oil Company Date April 28, 1980 Lab No. 3436-2  
 Well No. Seabee No. 1 Location \_\_\_\_\_  
 Field NPRA Formation Torok  
 County \_\_\_\_\_ Depth 5366-94 (DST No. 3)  
 State Alaska Sampling Point 5th Flow Period  
 Line pressure \_\_\_\_\_ psig; Sample pressure \_\_\_\_\_ psig; Temperature \_\_\_\_\_ °F; Container number \_\_\_\_\_  
 Remarks Sample No. 10, 4-9-80 @ 2025 Hrs.

Component	Mole % or Volume %	
Oxygen	0	
Nitrogen	1.40	
Carbon dioxide	0.26	
Hydrogen sulfide	---	
<hr/>		
Methane	93.55	
Ethane	3.19	Gallons per MCF
Propane	0.60	0.165
Iso-butane	0.10	0.033
N-butane	0.15	0.047
Iso-pentane	0.11	0.040
N-pentane	0.12	0.043
Hexanes	0.24	0.098
Heptanes & Higher	0.28	0.129
<hr/>		
Total	100.00	0.555

GPM of pentanes & higher fraction ..... 0.310  
 Gross btu cu. ft. @ 60° F. & 14.7 psia (dry basis) ..... 1061  
 Specific gravity (calculated from analysis) ..... 0.606  
 Specific gravity (measured) ..... 0.610

Remarks: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



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## GAS ANALYSIS REPORT

Company Husky Oil Company Date April 28, 1980 Lab No. 3436-3  
 Well No. Seabee No. 1 Location \_\_\_\_\_  
 Field NPRA Formation Torok  
 County \_\_\_\_\_ Depth 5366-94 (DST No. 3)  
 State Alaska Sampling Point 3rd Flow Period  
 Line pressure \_\_\_\_\_ psig; Sample pressure \_\_\_\_\_ psig; Temperature \_\_\_\_\_ °F; Container number \_\_\_\_\_  
 Remarks Sample No. 6, 4-8-80 @ 2300 Hrs.

Component	Mole % or Volume %	Gallons per MCF
Oxygen .....	0	
Nitrogen .....	1.32	
Carbon dioxide .....	0.38	
Hydrogen sulfide .....	—	
Methane .....	93.57	
Ethane .....	3.08	
Propane .....	0.57	0.156
Iso-butane .....	0.09	0.029
N-butane .....	0.15	0.047
Iso-pentane .....	0.12	0.044
N-pentane .....	0.12	0.043
Hexanes .....	0.23	0.115
Heptanes & Higher .....	0.32	0.147
Total .....	100.00	0.581
GPM of pentanes & higher fraction .....		0.349
Gross btu cu. ft. @ 60° F. & 14.7 psia (dry basis) .....	1062	
Specific gravity (calculated from analysis) .....	0.609	
Specific gravity (measured) .....	0.610	

Remarks: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

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## GAS ANALYSIS REPORT

Company Husky Oil Company Date April 28, 1980 Lab No. 3436-4  
 Well No. Seabee No. 1 Location \_\_\_\_\_  
 Field NPRA Formation Torok  
 County \_\_\_\_\_ Depth 5366-94 (DST No. 3)  
 State Alaska Sampling Point 2nd Flow Period  
 Line pressure \_\_\_\_\_ psig; Sample pressure \_\_\_\_\_ psig; Temperature \_\_\_\_\_ °F; Container number \_\_\_\_\_  
 Remarks Sample No. 4, 4-8-80 @ 1300 Hrs.

Component	Mole % or Volume %	
Oxygen .....	0	
Nitrogen .....	1.28	
Carbon dioxide .....	0.35	
Hydrogen sulfide .....	—	
Methane .....	93.88	
Ethane .....	2.94	Gallons per MCF
Propane .....	0.60	0.165
Iso-butane .....	0.37	0.023
N-butane .....	0.14	0.044
Iso-pentane .....	0.16	0.058
N-pentane .....	0.14	0.051
Hexanes .....	0.18	0.074
Heptanes & Higher .....	0.26	0.120
Total .....	100.00	0.535
GPM of pentanes & higher fraction .....		0.303
Gross btu cu. ft. @ 60° F. & 14.7 psia (dry basis) .....	1057	
Specific gravity (calculated from analysis) .....	0.615	
Specific gravity (measured) .....	0.612	

Remarks: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_





# CHEMICAL & GEOLOGICAL LABORATORIES OF ALASKA, INC.

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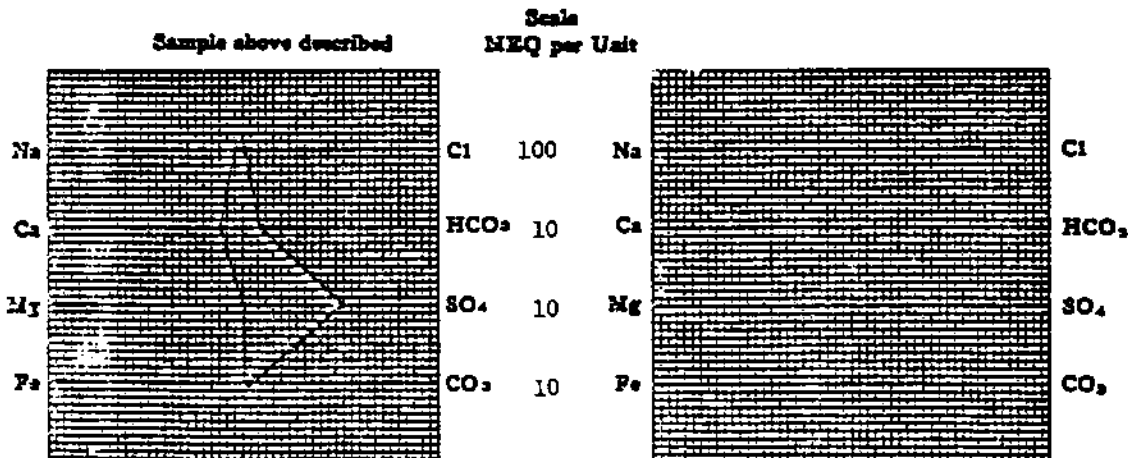
## WATER ANALYSIS REPORT

OPERATOR Husky Oil Company DATE April 28, 1980 LAB NO. 3439  
 WELL NO. Seabee No. 1 LOCATION \_\_\_\_\_  
 FIELD NPRA FORMATION Torok  
 COUNTY \_\_\_\_\_ INTERVAL DST No. 3 (5366-94)  
 STATE Alaska SAMPLE FROM Mod, 1/2 min into reverse out

REMARKS & CONCLUSIONS: Oil & Grease Content = 6 mg/gram  
Chromatographic analysis indicates hydrocarbons present  
to be condensate.

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Sodium	3028	131.72	Sulfate	6000	124.80
Potassium	140	3.58	Chloride	350	9.87
Calcium	565	28.19	Carbonate	240	7.99
Magnesium	10	0.82	Bicarbonate	1320	21.65
Iron	-	-	Hydrosulfide	-	-
<b>Total Cations</b>		<b>164.31</b>	<b>Total Anions</b>		<b>164.31</b>
Total dissolved solids, mg/l	10989		Specific resistance @ 68°F:		
NaCl equivalent, mg/l	7734		Observed	0.85	ohm-centimeters
Observed pH	9.3		Calculated	0.86	ohm-centimeters

## WATER ANALYSIS PATTERN



(No values in above graphs include Na, K, and Li)  
 NOTES: Mg/l = Milligrams per liter Meq/l = Milligram equivalent per liter  
 Sodium chloride equivalent may Differ 2 Percentages calculated from composition

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**GAS ANALYSIS REPORT**

Company Husky Oil Company Date May 2, 1980 Lab No. 3492  
 Well No. Seabee No. 1 Location \_\_\_\_\_  
 Field NPRA Formation \_\_\_\_\_  
 County \_\_\_\_\_ Depth DST No. 4 (2652-64)  
 State Alaska Sampling Point Surface Manifold-Initial Flow Period  
 Line pressure \_\_\_\_\_ psig; Sample pressure 30 psig; Temperature \_\_\_\_\_ °F; Container number \_\_\_\_\_  
 Remarks Sample taken April 13, 1980 @ 0114 Hrs.

Component	Mole % or Volume %	
Oxygen	0	
Nitrogen	1.45	
Carbon dioxide	0.25	
Hydrogen sulfide	—	
Methane	94.82	
Ethane	2.43	Gallons per MCF
Propane	0.31	0.085
Iso-butane	0.05	0.016
N-butane	0.11	0.035
Iso-pentane	0.06	0.022
N-pentane	0.11	0.040
Hexanes	0.18	0.074
Heptanes & Higher	0.22	0.101
Total	100.00	0.373

GPM of pentanes & higher fraction ..... 0.237

Gross btu cu. ft. @ 60° F. & 14.7 psia (dry basis) ..... 1042

Specific gravity (calculated from analysis) ..... 0.602

Specific gravity (measured) ..... 0.600

Remarks: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

#### LISTING OF OTHER AVAILABLE GEOLOGICAL DATA

- A. Final Biostratigraphic Report, Foraminifera, by Anderson, Warren & Associates, dated May 6, 1980.
- B. Final Biostratigraphic Report, Palynology, by Anderson, Warren & Associates, dated May 6, 1980.
- C. Test Wells, Umiat Area, Alaska, USGS Professional Paper, 305-B, 1958.

#### SOURCE OF OTHER GEOLOGICAL AND WELL DATA

Copies and some reproducibles of information referenced in this report, which was generated as part of the USGS/NPRA exploration effort, can be obtained by contacting:

National Oceanic and Atmospheric Administration  
EDIS/NGSDC (D62)  
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Boulder, CO 80303