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du Canada**

STUDY OF WELL LOGS IN THE
MACHENZIE DELTA-BEAUFORT SEA
AREA TO OUTLINE PERMAFROST
THICKNESS AND/OR GAS HYDRATE OCCURRENCE

The D&S Group
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Abstract

The available downhole logs for 161 wells drilled in the Mackenzie Delta - Beaufort Sea area of northern Canada were examined for indications of the presence of ground-ice and clathrate hydrates. In the report the justification for each of the picks of permafrost thickness are presented together with a map showing the distribution of permafrost. Results are compared with the downhole temperature observations of the Geothermal Service of Canada.

Résumé

On a examiné les rapports de sondage en profondeur de 161 points dans la région du delta du Mackenzie et de la mer de Beaufort pour des indications de présence de glace et d'hydrate de clathrate dans le sol on justifie et presente les choix pour les épaisseurs de pergélisol ainsi qu'une carte de distribution du pergélisol. Les résultats de l'étude sont comparés aux profils de température obtenus par le service géothermique du Canada.

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PREPARED FOR:

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OTTAWA

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I.P. Norquay, P. Eng.
May, 1983

The D & S Group

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ABSTRACT

This is a study of the phenomena permafrost and gas hydrate and how they manifest themselves in the earth's measurable physical properties; Resistivity, Spontaneous Potential, Acoustic Velocity, Density, Neutron absorption, Gamma Ray Radiation, Temperature, bore hole competence and the presence of gas in the mud.

This understanding was used to develop a criteria for identity of 'permafrost' and gas hydrates that was systematically applied to all (161) wells available in the Beaufort Sea, MacKenzie Delta area of Northern Canada.

In theory and practice the critical data was resistivity analyzed in concert with Gamma Ray and supported by spontaneous potential and acoustic velocity. A numerical solution is made to illustrate the process, also a Log/Mate computer analysis is presented to show a continuous plot of the variation of ice present in the vicinity of 0°C.

Comparison with Geothermal Service of Canada GSC data shows generally good agreement.

The possibility of Gas Hydrates are present in 23 of the wells, this by design is optimistic so as to not condemn too easily this potential reserve.

This study, that followed a universal criteria, was compared with the results of other published work. While others used a variety of approaches there was also generally good agreement.

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STUDY OF WELL LOGS IN THE
MACKENZIE DELTA-BEAUFORT SEA
AREA TO OUTLINE PERMAFROST
THICKNESS AND/OR GAS HYDRATE OCCURRENCE

A. DEFINITIONS AND CONCEPTS - PERMAFROST & ICE BEARING PERMAFROST

1) Permafrost and Ice Bearing Permafrost (IBPF)

Permafrost has been blessed with two distinctly separate definitions. (Appendix 1). They are:

- a) ground that is frozen
- b) ground that remains below 0°C for more than two years.

In this study we shall follow the clarification given by Taylor and Judge (1981¹) where condition a) above, shall be referred to as ice-bearing permafrost IBPF, and b) as Permafrost.

Only properly acquired temperature data can define the presence of permafrost, Taylor & Judge (1974²), while IBPF manifests itself as changes in measurable qualities (primarily Resistivity and Acoustic Velocity). Osterkamp & Payne (1981³).

Following the convention used in other comparisons the thickness shall be referred to as the base of the IBPF (or permafrost), Judge & Taylor (1981¹). As this study is well log based, Kelly Bushing KB depths shall be the datum. GSC² temperature data will be converted from ground level GL to KB for comparison purposes.

IBPF will coincide with permafrost only for pure water, in a large container under the pressure of one atmos. As this study of well logs will indicate the base of the IBPF, the following will give some appreciation of how much it will differ from temperature based permafrost determination.

2) Freezing Point Depression (FPD)

The temperature at which ground becomes ice bearing is lower than 0°C by the factor, freezing point depression (FPD). As summarized by Osterkamp & Payne³, the FPD is caused by pressure, chemical (salts) and soil particle effects, all of which are additive.

$$T_o = -T_p - T_c - T_s \text{ } ^\circ\text{C}$$

where: T_o = freezing point

T_p = pressure correction

T_c = salt concentration correction

T_s = grain size correction

The theoretical magnitude and hence significance of these factors are:

a) Pressure Correction

$$T_p = B P \text{ } ^\circ\text{C}$$

where: B is the clausius - clapyron slope (0.00751°C atmos. ⁻¹).

P is the pressure on the ice and water in the pore space.

At 600m, a representative depth of permafrost in this study area, T_p is .44°C.

b) Salt Concentration Correction

$$T_c = 0.0137 + 0.051990S + 0.00007225S^2 \cdot \text{C}$$

where: S is the salinity of the pore water in parts per thousand (PPT).

This factor would range from negligible in shallow fresh water sands to approximately 1.64°C for waters at 30 PPT. In this area 15 PPT is representative of expected total solids giving $T_c = .8^\circ\text{C}$.

c) Grain Size Correction

$$T_s = \left(\frac{W}{a}\right) b$$

where: W is the fractional unfrozen water content

a and b are constants related to the specific area of the soil

The FPD due to grain size ranges from near zero in coarse sands and gravels to several degrees in very fine clays.

Considering the above it is expected that, in this area the FPD would range from;

$$\begin{aligned} T_o &= -T_p - T_c \\ &= - .44 - .8 = 1.28 \text{ }^\circ\text{C in the gravel and coarse sands to} \\ T_o &= -T_p - T_c - T_s \\ &= -.44 - .8 - 7^* \text{ }^\circ\text{C} \\ &= 8.24^\circ\text{C} \end{aligned}$$

* from Timur as illustrated by Pollard & Nash (1971)⁴

in the fine grain shale. The change from freezing start to finish also covers several degrees.

In coarse material the salt concentration is dominant, and considering an average geothermal gradient of .022 °C/m Bily and Dick (1974)⁵ the expected IBPF base would be $\frac{\text{FPD}}{\text{gradient}} = \frac{1.28}{.022} = 58\text{m}$ above the 0°C isotherm.

In fine material the dominant factor is Ts which is large, vague, and gradational. Thus the change from not frozen shale to frozen shale can be some hundreds of meters above the 0° isotherm, e.g., for the FPD as calculated above the IBPF base would begin:

$$\frac{\text{FPD}}{\text{gradient}} = \frac{9.28}{.022} = 422\text{m}$$

above the 0°C isotherm, with a further displacement of the same order (400± M) to arrive at the depth where fine material is frozen to its maximum state.

Hence a sharp break in log response is not expected in fine material. This is due to the effect of fine grain material that leaves a fraction of unfrozen water. In addition to the soil particle effect, other water may fail

to freeze because of the increase in salinity due to salt rejection from the ice. Thus in a static temperature regime some transition is expected in all formations, ranging from very little in coarse material to very large in fine material.

In mixed lithology e.g., shaly sand, all factors will combine to leave some vertical range of co-existence of ice and water.

3. Effects of Being Frozen

The state of being frozen affects the measurable qualities of material as follows:

a) Resistivity

Resistivity increases gradually as temperature decreases to 0°C less FPD, at which point it either increases dramatically as in the case of coarse sands, or subtly when the material is fine granual (shale).

Data acquired under laboratory condition illustrates this. King (1974)⁶. Table A describes the material, with Figure 1 displaying its resistivity response to temperature changes.

TABLE A: Physical Properties of Specimens

<u>Specimen Number</u>	<u>SH2</u>	<u>SS1</u>	<u>SS4</u>	<u>SS5</u>
Bulk density, frozen, gm/cm ³	2.332	2.453	2.374	2.327
Bulk density, dry, gm/cm ³	2.205	2.329	2.237	2.167
Porosity, fraction	0.13	0.14	0.15	0.17
Shale content, fraction	1.00	0.00	0.38	0.27

Note the FPD is near zero for SS1 the shale free sample, and increases as shale content increases. This allows us to create a theoretical resistivity profile for each material, (Figure 2). This illustrates the ease that IBPF can be determined in clean coarse sands, and the difficulty that shale introduces.

b) Acoustic Properties

Compressional wave behavior is what is monitored by both well bore logging and crystal cable recording.

The response of compressional wave velocity behaves in a similar fashion to Resistivity, i.e., clean sand velocity increases dramatically at 0°C - FPD, and FPD is small. The effect is less sharp as shale increases (also of course the FPD increases as well).

Figure 3 displays compressional wave velocity response to temperature change. Results are compatible to resistivity response, note that shale is almost oblivious to temperature change, both with practically no change in velocity down to 0°C - FPD, then only a gradual and minor increase.

Shear response is similar as illustrated in Figure 5. A theoretical acoustic profile would be as in Figure 4.

c) Hysteresis

Kings⁶ data indicates a reduction in FPD on ascending temperature for both Resistivity and Acoustic Velocity measurements, Figures 1, 3, & 5 This is diametrically opposite to Timur's (1968)⁷ results as reported by Pollard & Nash⁴, where the FPD is shown to increase on ascending temperature (acoustic velocity) Figure 6. We make no attempt to resolve this conflict, however, King's⁶ data best follows the principle of hysteresis. If so, the FPD would be decreased on ascending temperature (regressing permafrost) placing the IBPF closer to the 0°C isotherm in this condition.

d) Spontaneous Potential

Where ice and water co-exists, the water increases in salinity as the salts are rejected by the ice. An increasing ice portion in the pore space effectively reduces the porosity, this reduced porosity contains water of increased salinity. As such a semi-frozen sand will generate increasing negative SP as the salinity increases following the general formulae.

$$E_c = -K \log \frac{a_w}{a_{mf}}$$

where: E_c is the total electrochemical emf.

a_w - chemical activity¹ of the pore water

a_{mf} - chemical activity of the mud filtrate

1 - chemical activity is proportional to salt content

When all the water is frozen the SP will become characterless, as it does in front of zero porosity media. Theoretically the SP profile will be as shown in Figure 7.

e) Temperature

There is some difference in geothermal gradient within the IBPF relative to the non-frozen material below. Geothermal data from study area well No. 68, (YA YA P-53 69° 12.8"N 134° 42.7'W) illustrates this. Figure 8. Note geothermal gradient .0175°C/m above the 0°C isotherm and .0143 below. These gradients are comparable to those used in other studies.

Note the relatively smooth shape of the most recent temperature profile (5 years undisturbed) and contrast it with the sharp break to a plateau that is characteristic of profiles made shortly after the circulation of warm drilling fluid ceased.

The behavior of temperature with time is a function of the specific heat of adjacent material plus the latent heat of fusion. In ice bearing permafrost the later is dominant and indicates the base of IBPF at 402 ± 15m. GL. The equilibrium temperature at the base of the IBPF depth

(≈ 433m GL) is -0.754. This difference represents the FPD for this material.

Theoretical temperature profiles would be as in Figure 9.

f) Other Commonly Measured Properties

Natural Gamma Ray radition - no known change

Neutron absorption rate - no known change

Electron density - the change from 1000 kg/m³ water to 900 kg/m³ ice is masked by other factors (shale content, hole size and vugosity).

4. Alteration Caused By Thawing

Circulation of drilling fluid past any material will create a zone of thermal invasion whose well bore face will be at drilling fluid temperature TDF and its influence will extend some depth into the material. The depth invaded will be a function of both time exposed and the difference in drilling fluid to formation temperature.

When the drilling fluid is kept below 0°C during penetration of the permafrost zone then logged as in Figure 10, the logging devices (for resistivity, acoustic velocity, and spontaneous potential) obtain measurements that respond to the theoretical models. More common is the condition where the drilling fluid is allowed to be above 0°C during penetration and logging. Figure 11.

As complete freezing is approached, the porosity (and hence the permeability) can be reduced to the point that mud filtrate cannot be accommodated and no mud cake forms to protect the sand face from erosion. This plus thaw induced alteration (discussed below in regards to acoustic alteration) can cause large hole size, particularly in front of unconsolidated sands. Figure 12 represents the profile from borehole to unaltered material (competent and unconsolidated). (Pollard & Nash)⁴.

Following is the effect of changing from being frozen to being thawed.

<u>Device</u>	<u>Effect</u>
a) <u>Resistivity</u>	- will return to its pre-frozen lower value
b) <u>Acoustic Velocity</u> (Regular Tools 2' Spacing 2' Span)	- will return to its original lower pre-frozen value. Even lower velocity will be read if expansion (increase pore space) occurs, as described below.
c) <u>Acoustic Velocity</u> (Long Spaced Tools 11' spacing 2' span)	- this special device has the potential to read deeper than the regular device. Faster velocity indication from this tool compared to the shorter spaced tool is interpreted as deeper frozen material behind a thawed zone. The longer span increases the likelihood of cycle skips due to the condition referred to below. Fig. 13. compares the refraction paths for long and regular tools in thawed and frozen material, Crain & Curwen (1982) ⁸ .
d) <u>Acoustic Amplitude</u>	The presence of the bore hole allows space for the material to expand into to release the stress of freezing and thawing. The uncontained material immediate to the bore hole can fracture, causing a reduction in amplitude. This often manifests itself as cycle skip giving a log that reflects neither the velocity of the thawed zone, nor the invaded zone. Further reduction in amplitude will be caused by the interference of incoming waves from the thawed (slower) phase with compressional arrivals coming from the frozen (faster) material.
e) <u>Spontaneous Potential</u>	Increasing thaw diameter will result in reducing the SP increase (due to pore salinity increase).

<u>Device</u>	<u>Effect</u>
f) <u>Depth_of_Thaw</u>	- The actual depth of thaw is predictable in advance, PUI and Kljuec (1978) ⁹ , and can be determined after from log data, Bateman (1972) ¹⁰ . Pui and Kljuec ⁹ predicted a thaw depth of .5m at 600m for a well drilled to 1000m with the temperature of drilling fluid TDF at 4.5°C. As thaw diameter is sensitive to TDF and exposure time, a record of log total depth and bottom hole temperature (BHT) is included in Table 2. BHT is the reading of a maximum reading thermometer attached to the logging tool; it will err to the high side due to either warm ambient temperature or being washed with warm water.

5. Logging Device Depth of Investigation

Logging tool depths of investigation compare as follows:

a) Resistivity

1) DISFL Dual Induction Spherically Focused Log

<u>Measurement</u>	<u>Depth of Investigation</u>	<u>Definition</u>
SFL	.5m	Spherically Focused Log receives ½ its signal from beyond .5m. The SFL operates as a series measurement i.e., at .5m $R_{log} = .5 R_{near}$ and $.5 R_{far}$
ILD	1.5m	Induction Log Deep received ½ its signal from beyond 2m, ILM operates as a parallel measurement. $\frac{1}{R_{log}} = \frac{.5}{R_{near}} + \frac{.5}{R_{far}}$
ILM	1m	Induction Log Medium, as above at 1m $\frac{1}{R_{log}} = \frac{.5}{R_{near}} + \frac{.5}{R_{far}}$

2) DLL - Dual Laterolog

DLL 2m Deep laterolog, operates as a series measurement, at 2m $R_{log} = .5 R_{near} + .5 R_{far}$

LLM 1.5m Medium laterolog, as above 1.5m $R_{log} = .5 R_{near} + .5 R_{far}$

3) Special Long Spaced Electric Survey

20' normal is influenced by material 3m from the borehole.

b) Acoustic

1) Common Acoustic Log 13HC (3' spacing, 2' span)

Measurement Depth Borehole Compensated Sonic receives all its signal from as near as .05m from the face of the material.

2) Long Spaced Sonic LSS (up to 11 ft. spacing, 2' span or the more recent 8 and 10' spacing, 2' span BHC simultaneous tool).

These devices receive information from deeper in the formation.

3) Crystal Cable

Most of the data relates to deep unthawed materials.

4) Well Phone, Velocity Survey

Same as Crystal Cable.

c) Spontaneous Potential

1) SP

The spontaneous potential is mostly influenced by material .3m from borehole.

6. Relative Significance of Thawing on Measurement

Considering the relative depth of investigation of logging devices and the finite depth of thawing, the actual recorded data will differ from the theoretical as:

a) Crystal Cable

Crystal Cable data will be least affected and can be expected to provide a consistent IBPF indication. It is though, dependent on a significant volume of the frozen material being present.

b) Well Geophone, Velocity Survey

This type of data, while little affected by thawing, lacks detail due to the gross ($\approx 150\text{m}$) intervals between stations.

c) DISFL

Unless frustrated by greatly enlarged hole, the common DISFL (or earlier DILL8) will provide reasonably consistent indications. The possession of resistivity measurements at 3 depths of investigation will help to identify the presence of a thawed zone - thus giving more support to the IBPF pick.

d) DLL

This device, by being a series type measurement, acquires better data when there is large hole, salt mud (kcl), or high values of resistivity (as is frozen coarse sand). The two depths of measurement can identify the presence of a thawed zone. It is further enhanced if the shallow MSFL micro spherically focused log is included.

e) ES

Long spaced ES data when combined with regular DISFL is quite diagnostic. Cox (1973)¹¹, Crain (1977)¹².

f) BHCS

Regular acoustic values of velocity can vary from the low velocity of the thawed zone to the high velocity of the frozen zone depending upon the depth of thaw and the relative strength of the received thaw versus frozen signal. The BHCS logs in this area were run when significant improvement was being made in instrumentation and technique. The same condition could show as; much cycle skips and worthless trash on a poorly run log, or steady interpretable data when correctly run.

The regular sonic is the least consistent of the common devices.

A comparison of LSS to BHC data has the potential of defining the presence of deeper frozen material. In practice its use is often frustrated by loss of signal (cycle skips) due to the longer path of the LSS.

g) SP

The IBPF effects on the SP will be less as thaw depth increases (and also as hole size increases). This data is secondary to resistivity, Crystal Cable and Acoustic Velocity, so SP quality reduction is not fatal.

h) Hole Diameter

When regular tools (BHCS caliper maximum diameter 400mm) are used in the common 311mm hole, often the hole is caved beyond the tools size and its unknown if the hole is 401mm or 1000+mm. This will cause ambiguity in decyphering all other data. Bore hole geometry tool BGT reads to a maximum diameter of 1800+mm and has been run on some area wells (this data is not generally available).

B. DEFINITIONS AND CONCEPTS - GAS HYDRATES

1) Gas Hydrates

Natural gas hydrates (Clathrates) are a specific inclusions compound where spherical chambers within the host (water) molecule hold the guest (gas) molecules. Hitchon¹³. This entrance of gaseous molecules into the vacant lattice positions of liquid water causes the water to solidify at temperatures above the freezing point of water. (Katz) 1971⁴.

2) Characteristics & Expected Log Response

This condition has essentially the same qualities as ice, it is resistive, will develop less SP if completely hydrated and will allow caving due to both lack of filter cake protection, and hydrate pressure generation.

Figure 14 displays a linear increase in resistivity as connate water is converted to hydrate, Makogan and Trebin (1971)¹⁵. The hydrated gas zone is hence more resistive than an equivalent free gas zone.

As the presence of gas causes solidification at temperatures above the freezing point of water we expect for a given depth (temperature), the resistivity of a hydrate zone to be greater than an IBPF zone. Recent laboratory measurements of ICPF and hydrate support this. Pearson (1982)¹⁶.

The hydrated zone will develop less SP if hydration is complete.

Caving will exist due to lack of protective filter cake, and the spalling (to relieve stress) of material away from the face of the reservoir.

The density of hydrate is similar to that of ice 900 kg/m³. It's neutron gamma response, due to high hydrogen content, will display low secondary gamma response (equals high porosity on a neutron porosity log). Sheshukov (1973)¹⁷.

Acoustic velocity will be high, as in ice. This may be seen on crystal cable data, but the decomposition of hydrate near the bore hole will attenuate and cause much cycle skipping on the regular bore hole acoustic log, unless the log is obtained shortly after penetration or the TDF kept low. (Bily & Dick)⁵.

The similarity of IBPF and hydrate makes identification of hydrate difficult if it is present immediately below or within the IBPF. If the hydrate is considerably below the IBPF, the difficulty is diminished.

As hydrated media contains such a disproportionate amount of gas relative to a free gas zone there will be anomalously high gas readings on mud logs. Bily & Dick⁵ assess this as the most pronounced characteristic of hydrate bearing zones.

3) Hydrate Possible Depth Intervals

Conditions of pressure and temperature critical for the formation of hydrates above been combined into a convenient chart, Figure 15. It shows an envelope of possible hydrate occurrence relative to permafrost depth (Bily & Dick)⁵. The hydrate prone interval is indicated to be from surface to permafrost depth plus 750m.

C. INTERPRETATION FOR IBPF AND HYDRATES

1) Criteria

With the preceding understanding of the qualities of IBPF, gas hydrate, logging tool response and measurement environment, we set up the following criteria for analyzing the 161 wells that were in the study area. The criteria was to be universal, that is:

- to be not sensitive to the individual doing the pick
- to accommodate the expected range of geological (age and lithology) and geochemical (formation water salinity) conditions
- to overcome the variations in measurement environment (hole size, drilling mud salinity, temperature of drilling fluid & time exposed).

2) Procedure

The procedure to satisfy this criteria consisted of:

- a) Note the resistivity in 1) shales and 2) the wet not frozen sands below the expected base of IBPF and calibrate the resistivity response to changes in shaliness.
- b) Work upward looking for increases in resistivity that are not caused by changes in shaliness.
- c) Such picks are supported by:
 - 1) Acoustic velocity increasing if the IBPF is not thawed, acoustic velocity decrease or skipping if thaw is present.
 - 2) SP having either co-existence (increased negative values) effect or complete freezing effect (loss of character, i.e., no longer conforms to the GR indication of shale).
 - 3) Caliper showing the sands to be caved rather than being undergauge due to protective filter cake.
- d) After the above 'pick' was recorded on the analysis detail sheet Table 1, it was compared to the IBPF and 0°C isotherm depths retrieved from temperature data of the Geothermal Service of Canada. Taylor, Burgess, Judge, Allen (1982)¹⁷. This resulted in agreement or;
 - 1) If the IBPF was above the 0°C isotherm the resultant FPD was reviewed as to reasonableness for the type of media present.
 - 2) If the indicated IBPF was below the 0°C isotherm the well was flagged as a gas hydrate candidate.
- e) All remaining wells were then analyzed in the same manner.
- f) Crystal Cable Data as it became available was then interpreted, compared then entered on this analysis detail sheet.

- g) Procedure Steps 2 & 3 were applied throughout each well from surface to 2000m, with particular interest in the hydrate prone envelope, top of logged interval to base of permafrost plus 750m depth.
- h) Such located hydrate zones were noted on the analysis detail sheet, then compared to mud gas data for support. If supported the interval was designated as 'hydrate likely'.
- i) The log picks, with preferred pick identified, GSC data and hydrate identification are recorded in Table 2 Analysis Summary.

3) Results

The preferred log derived pick for the base of IBPF, transition zone and possible gas hydrate are listed in Table 3. Included in this list is the GSC temperature based picked for IBPF and the 0°C isotherm.

A map displaying IBPF by location is in Appendix 2.

An annotated montage of reduced scale logs, including GSC 18 temperature converted to compatible scale by the Log/Mate system, Crain (1979)¹⁹ is in Appendix 3 and 4.

Previously published interpretations of IBPF and hydrate were reviewed and compared to this work. Detailed comparison is included in Section D.

NOTE: The number used to identify each well reflects the sequence that these wells follow in the publication 'Schedule of Wells NorthWest Territories and Yukon Territory', Indian & Northern Affairs, Canada. Publication QS-8233-000 BB-A2.

D. COMPARISON

After following the criteria that was applied uniformly to all wells, our results were compared to the results of other published studies. All results are listed in the tables on the following pages.

REFERENCE: 4 Observation on Permafrost Logging in the Canadian Arctic

Author: Pollard, D.E. and Nash, R.G.

WELL			TRANS	REASON
NO.	NAME	IBPF		
132	Atkinson Point H-25			
	Their Pick	460		Big hole to 460, SP drifting above 466, RES increase at 466
	Our Pick	466	478	Not given
	Crystal Cable		478	RES higher than for equivalent sands below, SP & Cal are supportive, velocity consistent for IBPF
	GSC Temperature			RES increase
	COMMENT:			Not available
				Not available
				Close agreement
143	Nuvorak 0-09			
	Their Pick	357	418	Appears to be based on depth of deepest cave
	Our Pick	360	-	Not given
	Crystal Cable			RES higher than expected.
	GSC Temperature			Pick not made
	COMMENT:			Not available
				Not available
				Close agreement
129	Natagnak K-23			
	Their Pick	518		Approximate pick
	Our Pick	535		Abrupt increase in resistivity (base of a frozen sand)
	Crystal Cable			Not available
	GSC Temperature			Not available
	COMMENT:			Good agreement.

REFERENCE: 1 Canada, Indian and Northern Affairs, quoted in 'Measurement and Prediction of Permafrost Thickness, Arctic Canada'

WELL			TRANS	REASON
NO.	NAME	IBPF		
90	Kilagmiotak M-16			
	Their Pick	725		Not given
	Our Pick	740		Abrupt RES increase
	Crystal Cable	707	790	Base of Gradient 9500 - 6500 @ 707m
	GSC Temp.			
	COMMENT:			Generally good agreement
66	YaYa A-28			
	Their Pick	600		Not given
	Our Pick	673		Base of frozen sand
	Crystal Cable	573	728	RES gradient change 10,200 - 6800 @ 573m
	GSC Temp.		Ex674	
	COMMENT:			Case of RES having greater ability to detect thinner frozen sands - Crystal Cable requires some mass of frozen material to respond.
65	YaYa I-17			
	Their Pick	595		Not given
	Our Pick	685		RES indicates base of frozen sand
	Crystal Cable	573	721	Base of RES gradient 9500 - 7000 @ 573m
	COMMENT:			Case of RES having greater ability to detect thinner frozen sands - Crystal Cable requires some mass of frozen material to respond.

REFERENCE: 1

WELL			TRANS	REASON
NO.	NAME	IBPF		
64	Red Fox P-21			
	Their Pick	615		Not given
	Our Pick	610		RES indicates the base of deepest frozen silt.
	GSC Temp.		640	RES gradient change
	COMMENT:		583	Good agreement
74	Kumak E-58			
	Their Pick	204		Not given
	Our Pick	217		Abrupt RES change
	GSC Temp.		286	Base of RES gradient change
	COMMENT:		E283	Good agreement
101	Taglu H-54			
	Their Pick	420		Not given
	Our Pick	515±		RES indicates base of frozen sand
	Crystal	445		
	GSC Temp.	513±15	542	
	COMMENT:			As YaYa A-28, crystal data picks base of IBPF, RES has ability to detect small changes and can be tuned to approach GSC temperature picks.
54	Titalik 0-15			
	Their Pick	107		Not given
	Our Pick	97		Point of inflection on RES rise
	COMMENT:		107	Base of RES gradient
				Good agreement

REFERENCE: 20 Permafrost Investigation by Crystal Cable

AUTHOR: Walker, T.H.D., Stuart, A.J.

WELL			TRANS	REASON
NO.	NAME	IBPF		
122	IVIK C-52 Their Pick to Our Pick Crystal Cable COMMENT:	629 649 649 649		Based on all data Abrupt RES increase 10,200 - 6700 @ 649m RES and Crystal Cable data agrees as this is a definite base of a massive frozen section.
116	MAGAK A-32 Their Pick to Our Pick Crystal Cable COMMENT:	230 285 236 240		Based on all data ES indicates abrupt RES increase 9000 - 6400 @ 240m Good agreement, as IVIK C-52
100	TAGLU F-43 Their Pick to Our Pick GSC Temp Crystal COMMENT:	527 549 548 518	618 x633	Based on all data At abrupt RES increase Base of resistivity gradient 7800 - 6500 @ 518m Good illustration of RES & Crystal Data picking base of massive IBPF section - but Resistivity alone being most able to estimate base of transition (close to 2°C)

REFERENCE: 20

WELL			TRANS	REASON	
NO.	NAME	IBPF			
125	IMERK B-48				
	Their Pick	393		Based on all data. Section is well defined.	
	to	549			
	Our Pick	542		Abrupt RES increase at base of sand - note presence of unfrozen section above.	
	Crystal Cable	384		9500 - 6500 @ 384m	
	COMMENT:			Good agreement. RES is sensitive to both the massive section of IBPF and the thin relic lenses below	
104	UPLUK C-21				
	Their Pick	237		Based on all data	
	to	255			
		Our Pick	233		Deepest that resistivity is in the IBPF range.
	Crystal	247		7800 - 5650 @ 247m	
	COMMENT:			Good agreement. Note that crystal cable data has approximately + -15m range of depth accuracy.	
78	NIGLINTGAK H-30				
	Their Pick	61		Based on all data	
	to	92			
		Our Pick	89		Based on resistivity being higher than expected.
				189	Based on base of resistivity gradient.
	Crystal GSC Temp.	61 77	E 152	From SRS Velocity 30m stations	
	COMMENT:			Good agreement. Very large difference between IBPF and 0°C and also between log picks of IBPF and base of transition. This would be consistent for shale, log appearance indicates sand/shale. Suspect long section of co-existence.	

REFERENCE: 21 Determination of Permafrost Thickness in Wells in Northern Canada

AUTHOR: Hnatiuk J., and Randall, A.G.

WELL			TRANS	REASON
NO.	NAME	IBPF		
51	REINDEER F-36			<p>All three curves show an increase in resistivity at a depth of 1110' (338m)</p> <p>Sands above 340m have higher resistivity than equivalent sands below.</p> <p>There is excellent agreement in the pick for IBPF. Us and the other workers have chosen IBPF base within the range of depth accuracy of confirmation by GSC temperature and crystal cable - two major standards.</p>
	Their Pick	338		
	Our Pick	342		
	Crystal	347		
	GSC Temp.	349 + 8	E363	
	COMMENT:			

The "increase in resistivity" referred to in the previous paper can not mean an increase in absolute resistivity at that point (338m) as there are many resistivity values higher in sands below. We interpret their reason as a shale base line gradient change that does occur in the vicinity of 338m.

By the second condition of our criteria our pick had to be independent of the existence of shale sections necessary to set up the gradient comparison as explained above.

Our approach on all wells was to calibrate the resistivity response in the not frozen sands and work upwards looking for resistivity increases that are not due to changes in shaliness. Our first pass gives 303m as the base of a frozen sand and 354m as the top of a non-frozen sand (of comparable shaliness). SP performance, being more negative above 303m supports this. The simple overlay of Resistivity on GR (inverted as $R_{SH} < R_{SD}$) shows depth 340m where the Resistivity becomes relatively higher than below and is hence our pick for base of IBPF.

Numerically this can be performed by calculating the expected resistivity and comparing it to the measured value, if the later is higher IBPF is indicated. In the simple but common case where porosity and formation water resistivity are constant:

$$RES_{calc} = R_{SH} + (1-V_{sh}) (RES_{SD} - RES_{SH})$$

Volume shale V_{sh} can be determined from the GR:

$$V_{sh} = \frac{GR - GR_0}{GR_{100} - GR_0}$$

For this well using:

$$\begin{array}{ll} RES_{SD} = 35 \text{ ohm-m} & GR_0 = 3 \text{ divisions} \\ RES_{SH} = 7 \text{ ohm-m} & GR_{100} = 7 \text{ divisions} \end{array}$$

Results in the following numerical solution:

DEPTH feet	GR divisions	VSH	RESC ohm-m	RESM ohm-m	RESM-RESC ohm-m
1700	3	00	35	35	0
1700	6.5	.87	11	15	4
1360	5.0	.50	24	20	-1
1315	4	.25	28	25	-3
1210	3.5	.13	31	35	4
1190	6.2	.75	15	15	0
1170	4.2	.30	27	30	3
1135-60	6.0	.75	14	10	-4
1122-28	6.0	.75	14	11	-3
1115-22	6.0	.75	14	15	1
1108-15	5.7	.68	16	25	9
1095-1103	5.5	.63	17	22	5
1075	6.0	.75	14	25	11
1040	4.7	.43	23	40	17
1010	6.5	.87	10	10	-0
980	3.5	.13	31	200	169

The IBPF is identified where RESM is greater than RESD, 1115' or 340m.

To illustrate the use of standard industry computer practice, we performed a regular Log/Mate Shaly Sand Analysis¹⁹, Figure 16. The black infilling represents ice, Sw water saturation represents co-existing water. It shows, by continuous plot, the gradual decrease in co-existing water at depths above 340m.

E. CONCLUSIONS

1) Permafrost

Resistivity results supported its theoretical choice. It displayed the qualities of a good employee by:

- a) being available for work - essentially every well had a resistivity log available.
- b) doing the job required of it - 126 picks for 161 wells were resistivity based. The ubiquitous resistivity log was present over the zones of interest on more wells than any other type log. Crystal cable data was chosen for 20 wells - not because of being superior data, but because the IBPF was above the top resistivity reading. In contrast, acoustic 'picks' were preferred on only 5 wells and mostly because no resistivity was available over the IBPF depth interval.
- c) having the ability to 'wear two hats'. Temperature data properly run, i.e., early data plus subsequent runs, gives the base of IBPF and the 0° C isotherm depth. Only resistivity can approach this with reasonable reliability, it can by abrupt change display the base of IBPF and by subtle gradient change show the base of transition which will approximate the 0°C isotherm.
- d) attending to detail, the vertical resolution allows analysis with confidence of 2m thick zones. In contrast crystal cable data requires IBPF to be massive to be recognized.

Crystal cable data strength is in giving the geophysicist the near surface information needed for correct seismic interpretation, where knowing the depth of massive IBPF is much more significant than the identity of a few frozen thin stringers.

2) Gas Hydrates

All published references that was reviewed described the identity of gas hydrates in classic good quality reservoirs, e.g, Bily & Dick⁵, Makogan et al¹⁵, and Seshukov⁷. The study area, times the hydrate possible depth

interval represents an enormous volume of clastic material. Within this volume will be some poor (shaly) reservoirs as well as good reservoirs.

The difficulty in correctly identifying gas bearing shaly zones is recognized. The Milk River formation of Southern Alberta being an example. Hydrate bearing shaly reservoirs are marginally less difficult to identify.

To prevent some such zones from being condemned we have given each the benefit of doubt and have allowed our list to 'likely' gas hydrate wells to be larger than life. More detailed specific log analysis is required to resolve this.

3) Comparisons

Resistivity based 'picks' are generally supported by the GSC temperature data.

Comparison to crystal cable data is as expected it:

- a) agrees well when the IBPF base is within a massive sand, or
- b) resistivity shows IBPF truly to be deeper than crystal data if it extends down through a thin sand/shale sequence, or
- c) crystal cable data does not clearly indicate IBPF where the volume of frozen material is small as in thin sand thick shale sequences

Comparison to other studies also gives generally good agreement which is remarkable in that this study is predominantly resistivity based and considerable variety in methods were used by other workers.

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FIGURE I

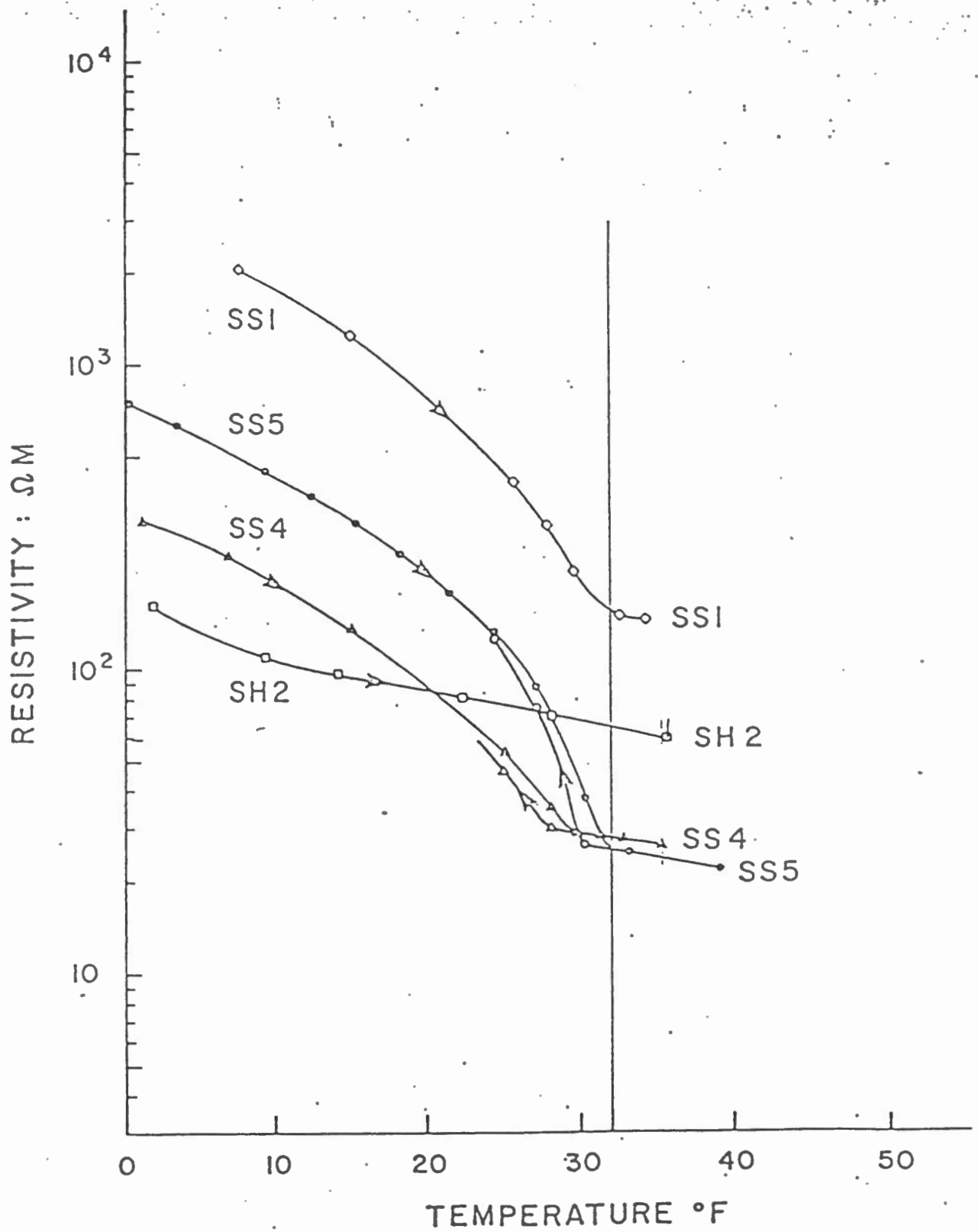


FIGURE I - RESISTIVITY AS A FUNCTION OF TEMPERATURE AT A FREQUENCY OF 1KHZ⁶

FIGURE 2

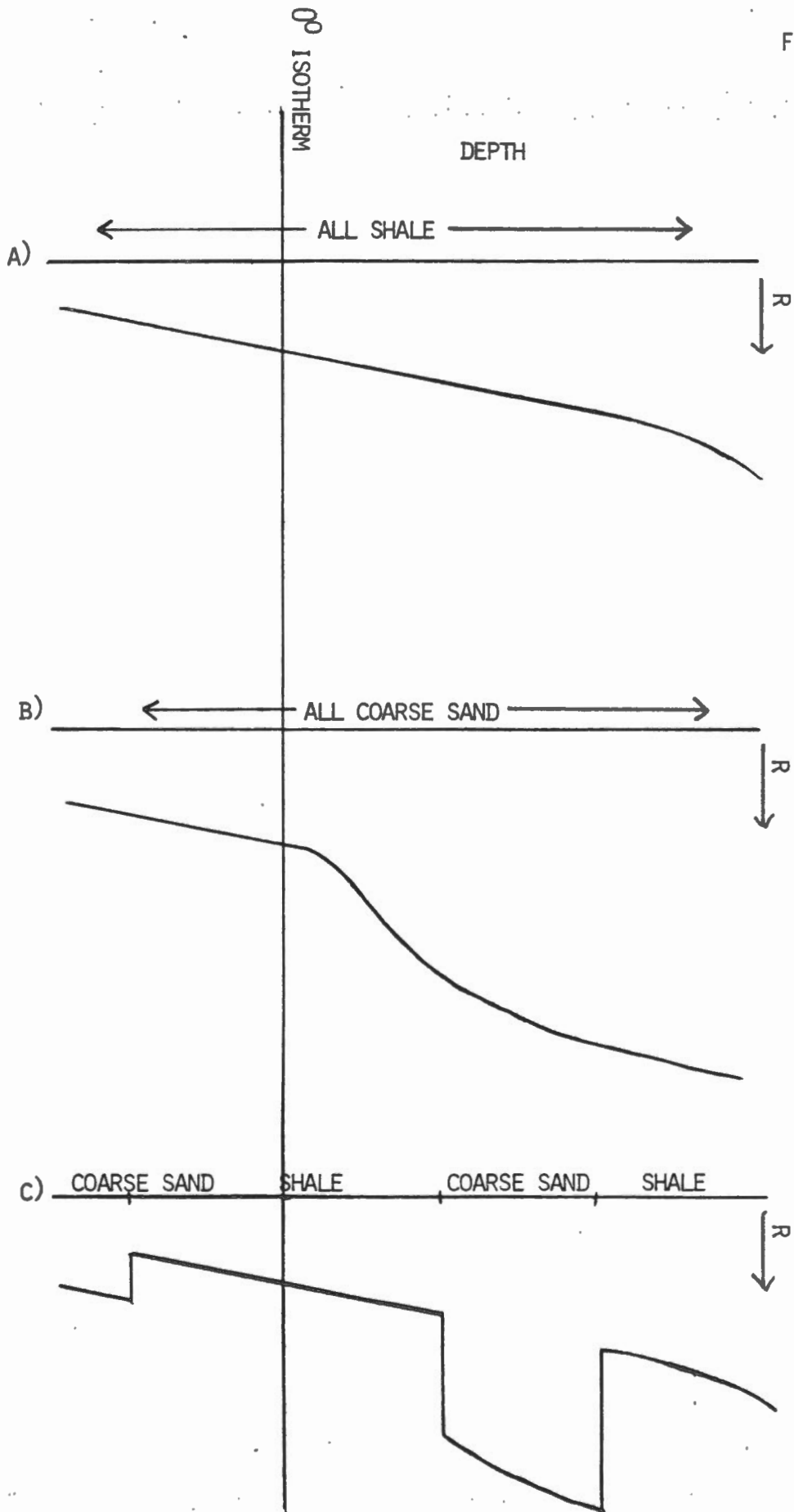


FIGURE 2 - THEORETICAL RESPONSE: RESISTIVITY VERSUS DEPTH IN THE VICINITY OF THE 0°C ISOTHERM

FIGURE 3

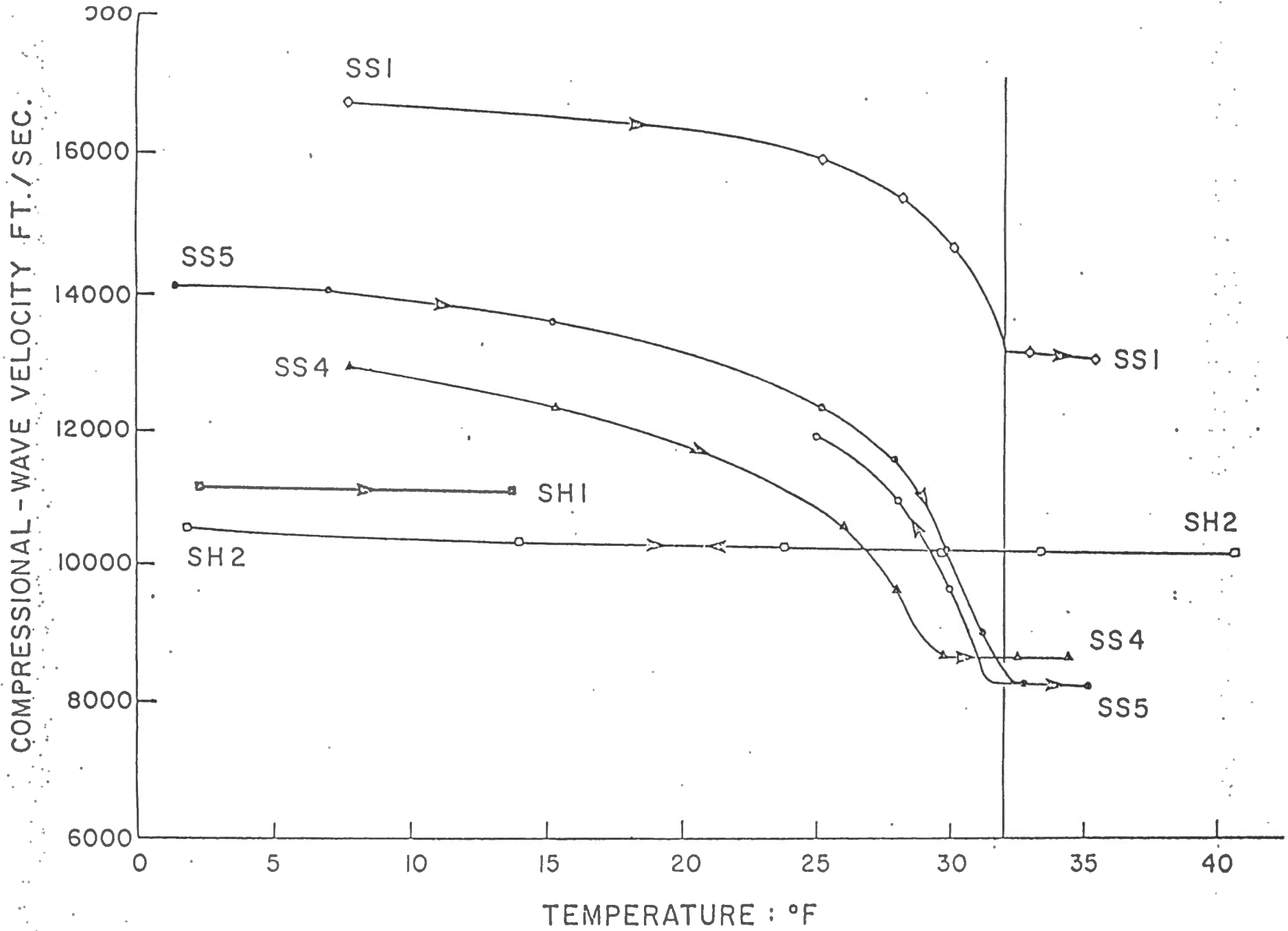


FIGURE 3: COMPRESSIONAL - WAVE VELOCITY AS A FUNCTION OF TEMPERATURE AT AN AXIAL STRESS OF 500 PSI⁶

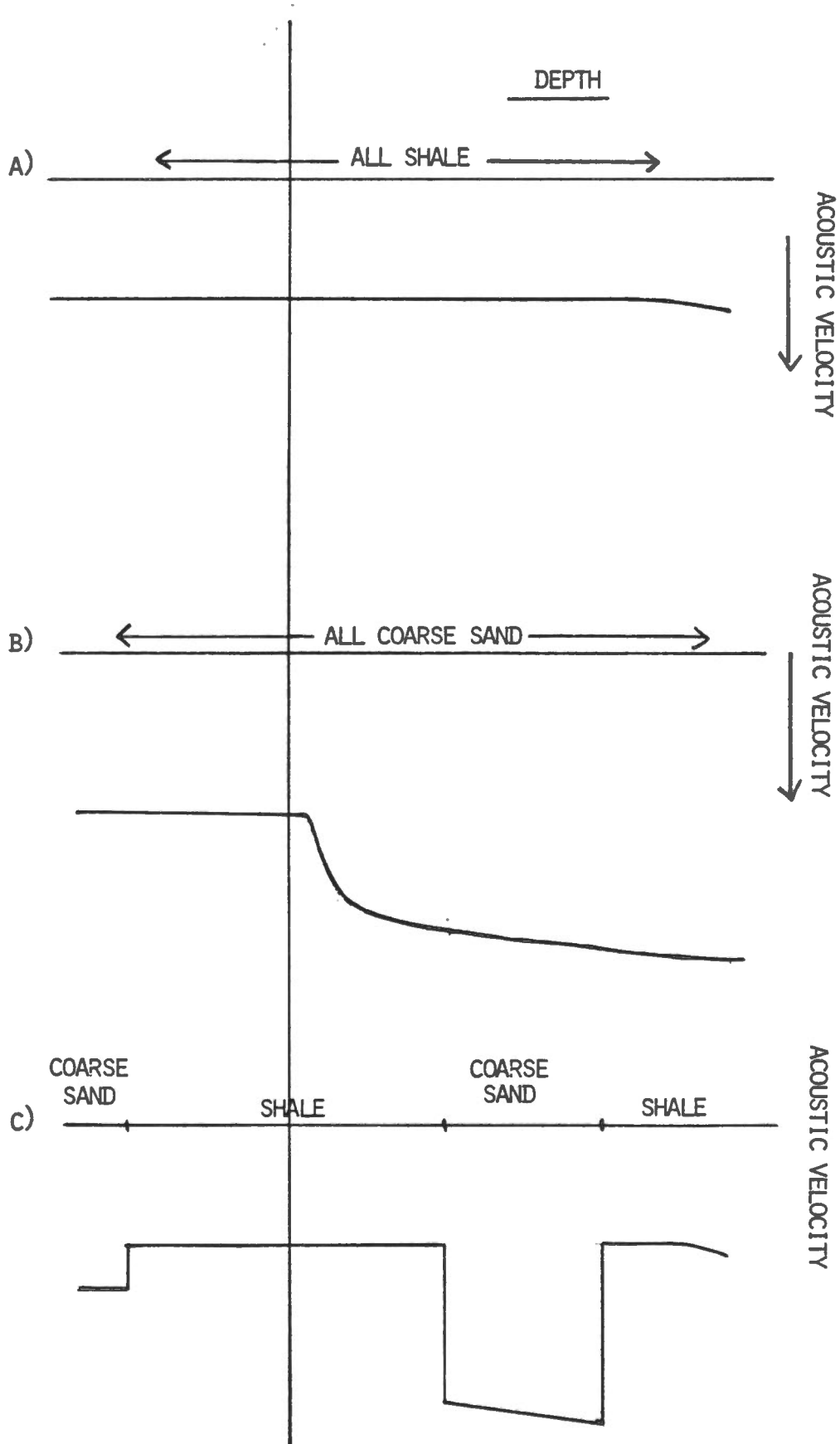


FIGURE 4: THEORETICAL RESPONSE: ACOUSTIC VELOCITY VERSUS DEPTH IN THE VICINITY OF THE 0°C ISTOTHERM

FIGURE 5

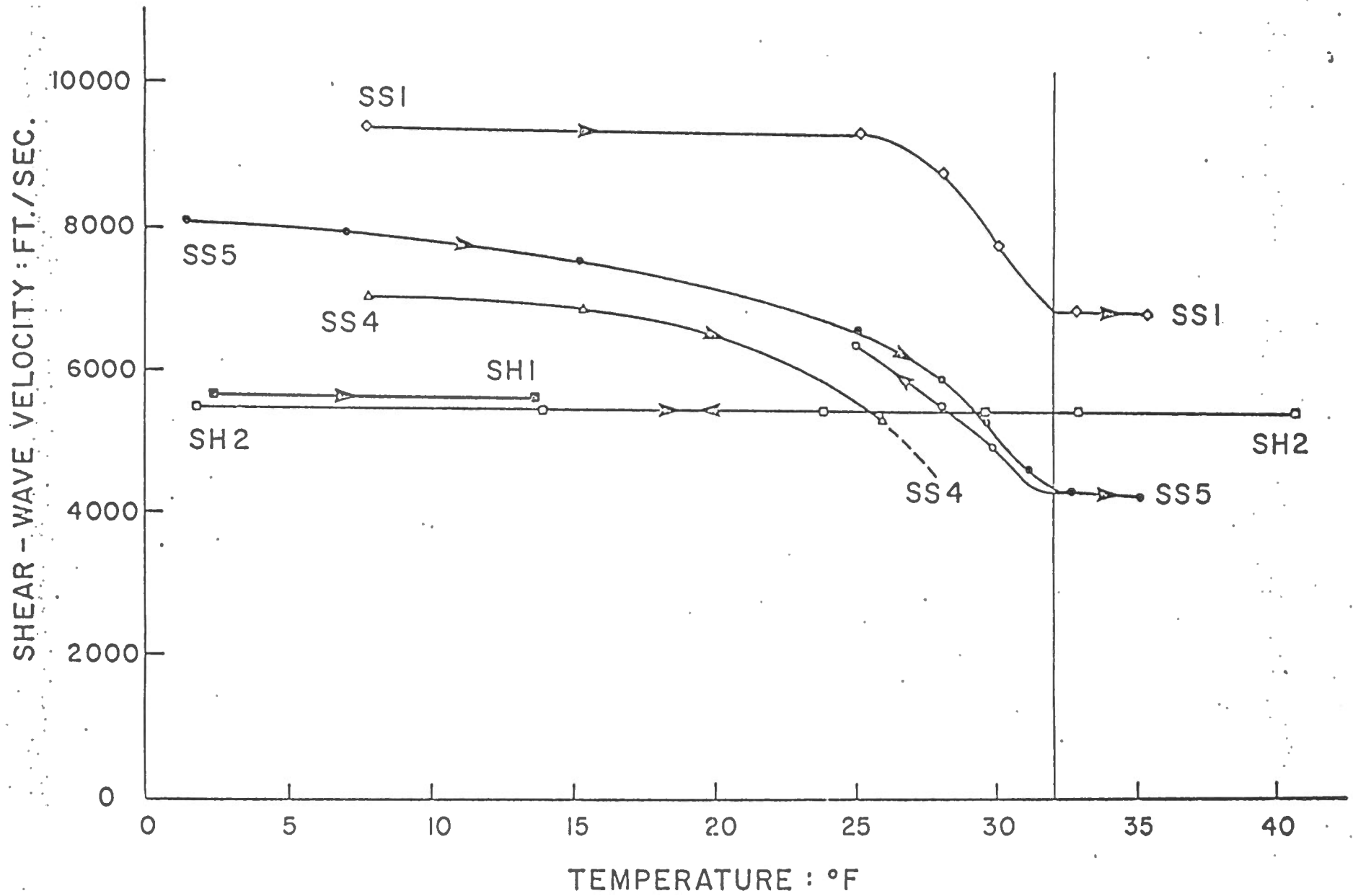


FIGURE 5: SHEAR - WAVE VELOCITY AS A FUNCTION OF TEMPERATURE AT AN AXIAL STRESS AT 500 PSI

FIGURE 6

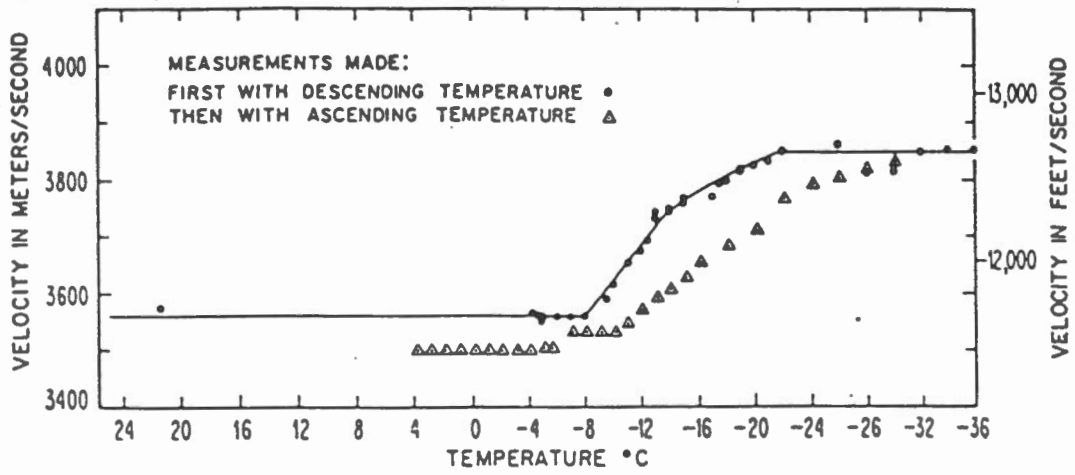


FIGURE 6: MEASUREMENT DATA: ACOUSTIC VELOCITY VERSUS TEMPERATURE⁴

FIGURE 7

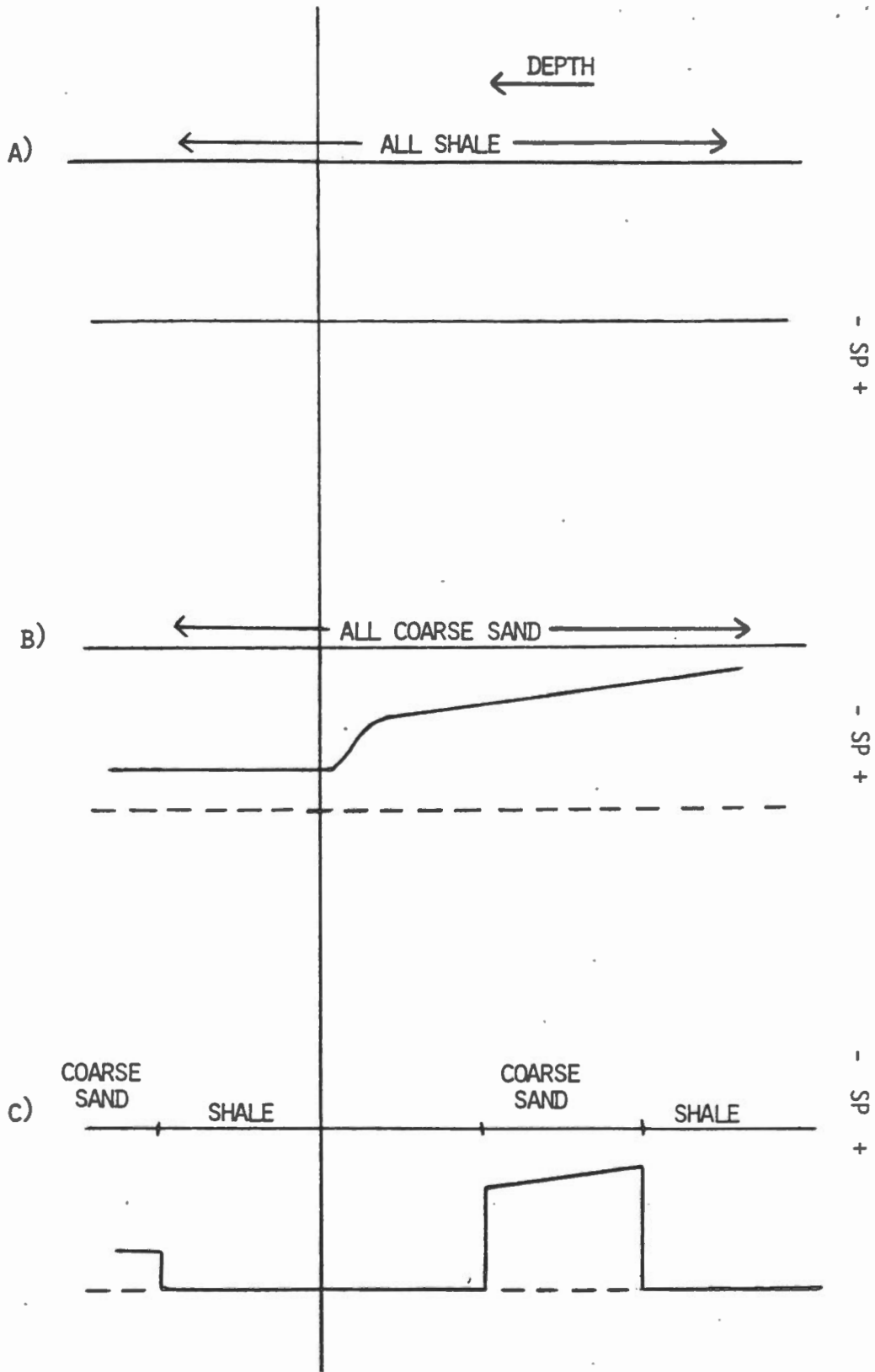


FIGURE 7: THEORETICAL RESPONSE: SPONTANEOUS POTENTIAL VERSUS DEPTH IN THE VICINITY OF 0°C ISOTHERM.

FIGURE 8

176 YA YA P-53 - Well No. 68 (this study)

69° 12.8' N 134° 42.7' W/O

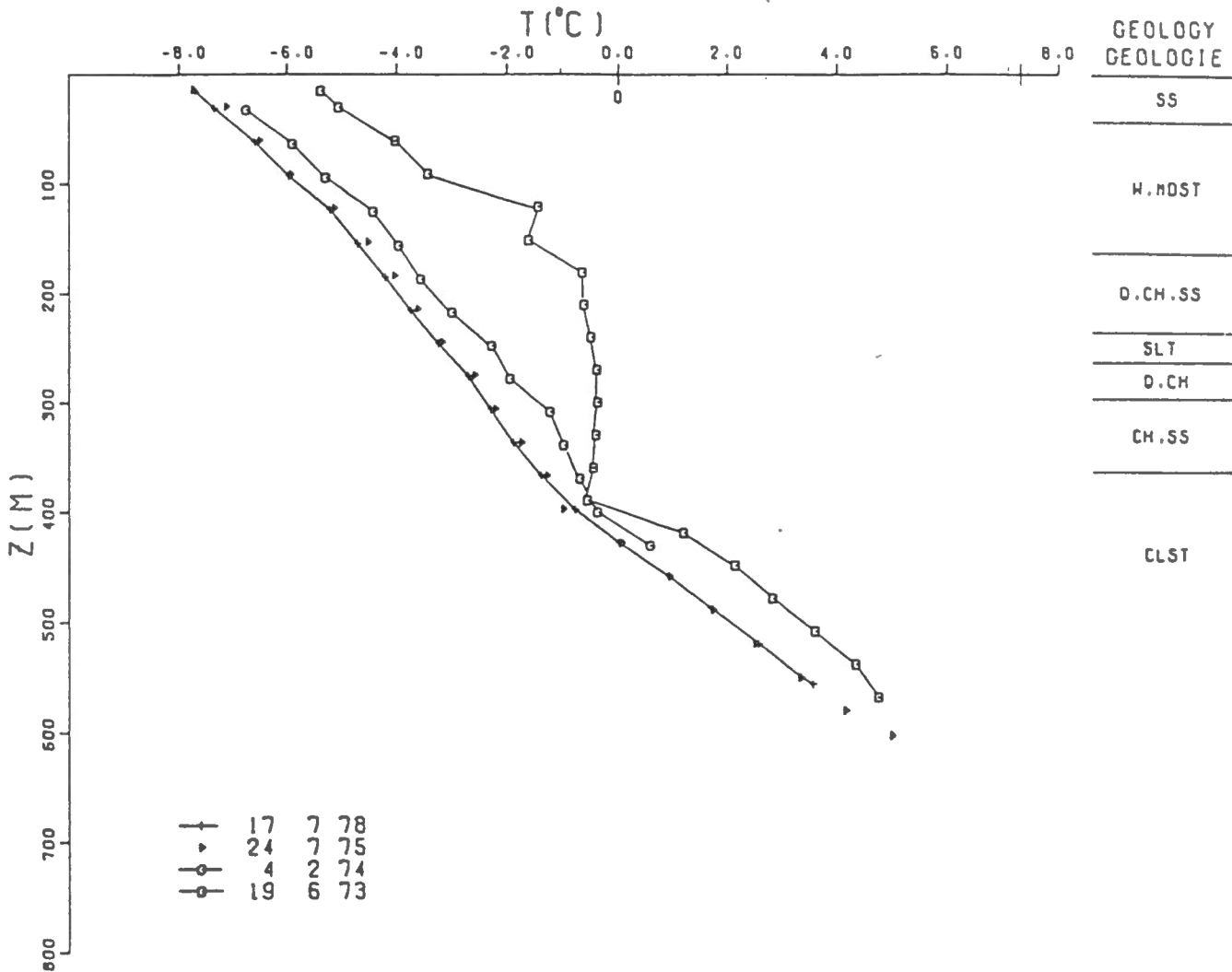


FIGURE 8: MEASUREMENT DATA: TEMPERATURE VERSUS DEPTH
IN THE VICINITY OF THE 0°C ISOTHERM ¹⁸

FIGURE 9

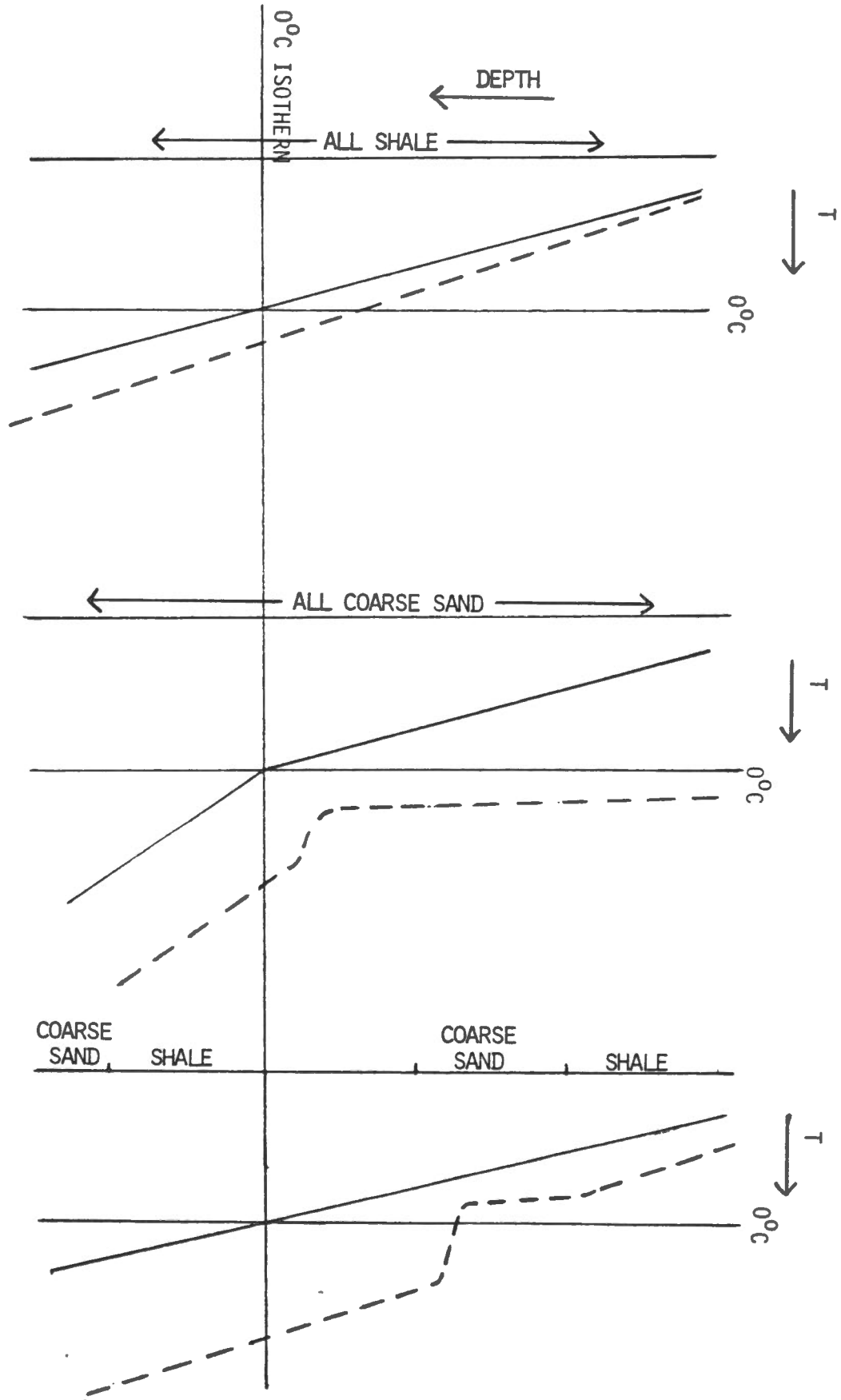


FIGURE 9: Theoretical Response: Temperature Versus Depth in the Vicinity of the 0°C Isotherm

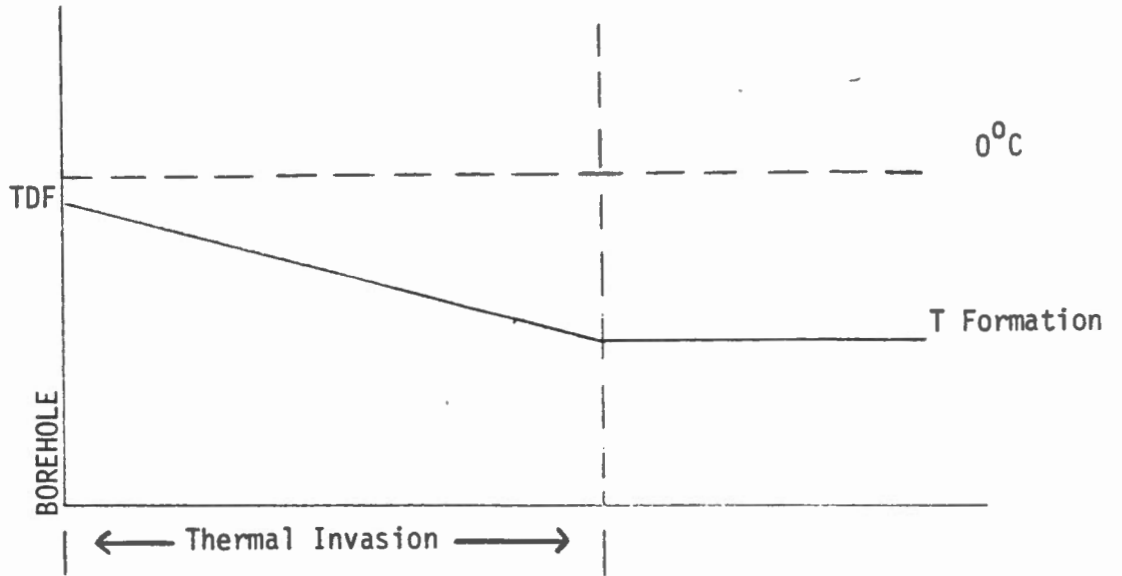


FIGURE 10: LINEAR THERMAL INVASION PROFILE
TEMPERATURE DRILL FLUID $TDF < 0^{\circ}C$

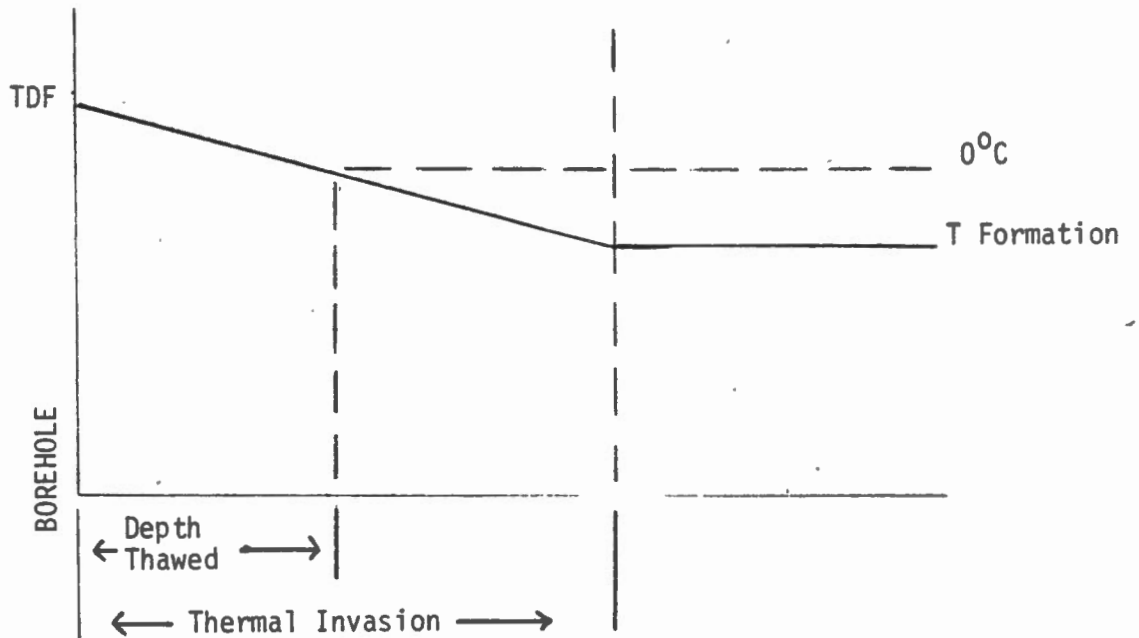
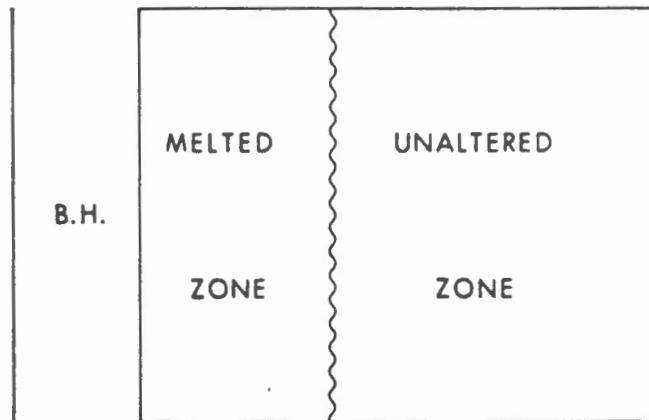


FIGURE 11: LINEAR THERMAL INVASION PROFILE
TEMPERATURE DRILL FLUID $TDF > 0^{\circ}C$

(a) COMPETENT FORMATION



(b) UNCONSOLIDATED SAND

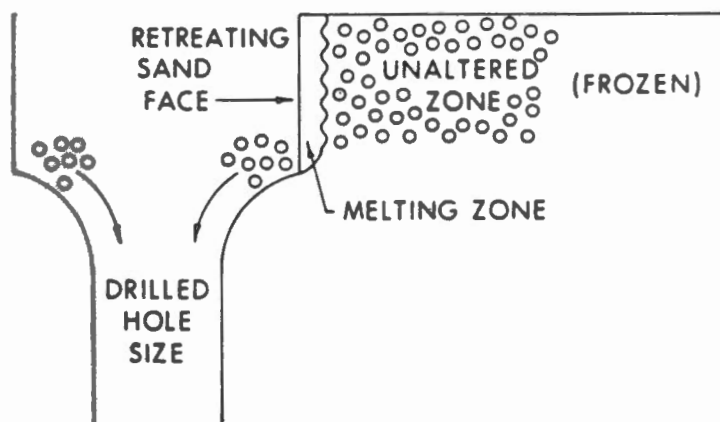
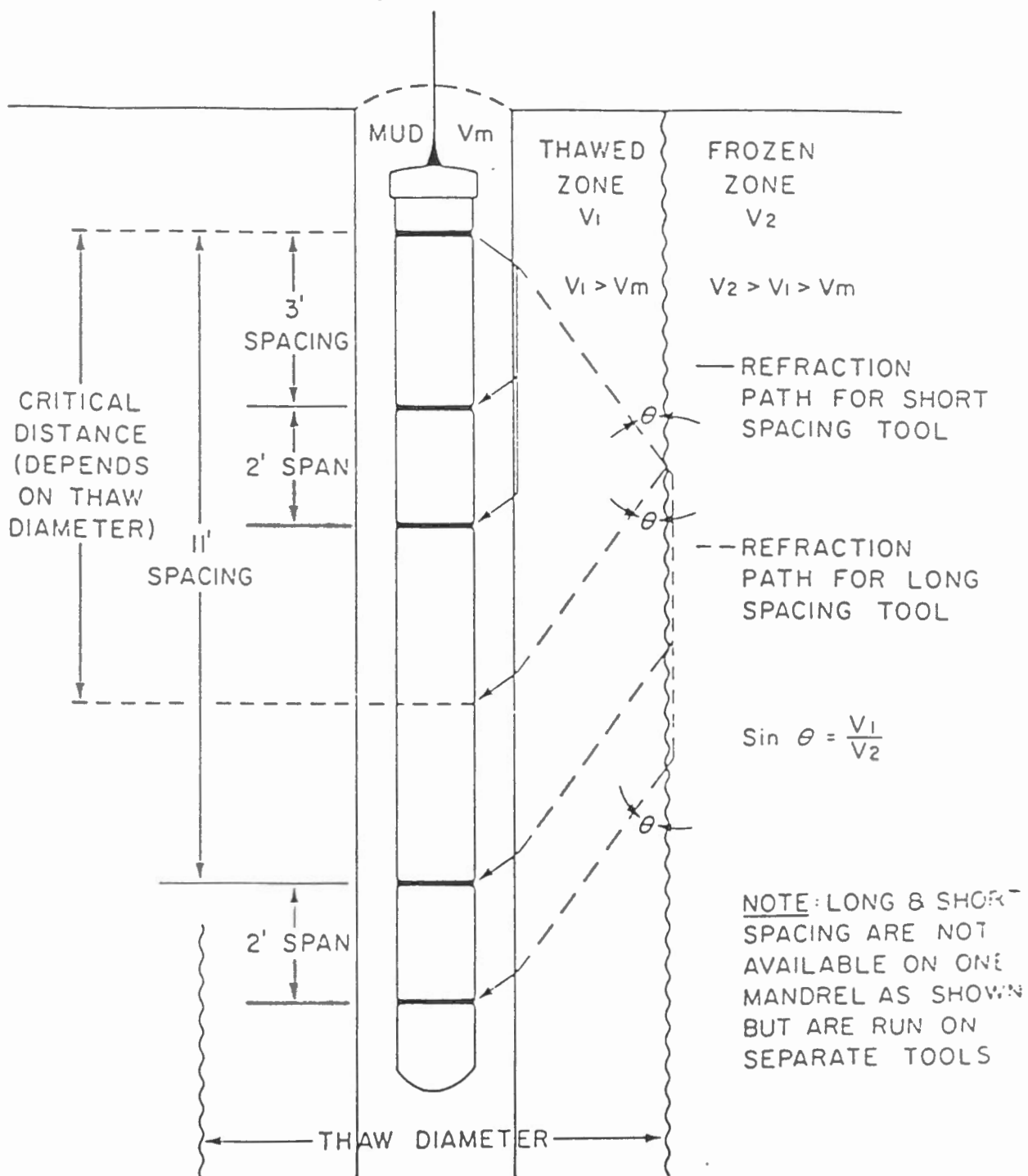
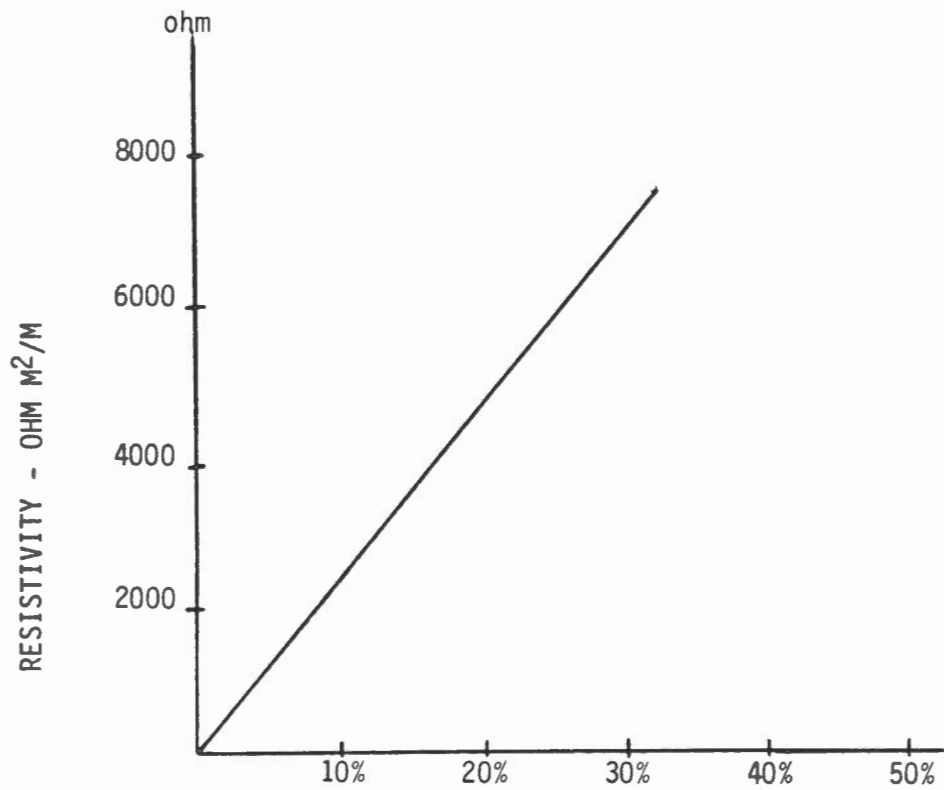


FIGURE 12: SKETCH SHOWING TWO POSSIBLE CONDITIONS AFTER DRILLING THROUGH PERMAFROST ⁴

FIGURE 13: COMPARISON OF ACOUSTIC REFRACTION PATHS VERSUS SPACING



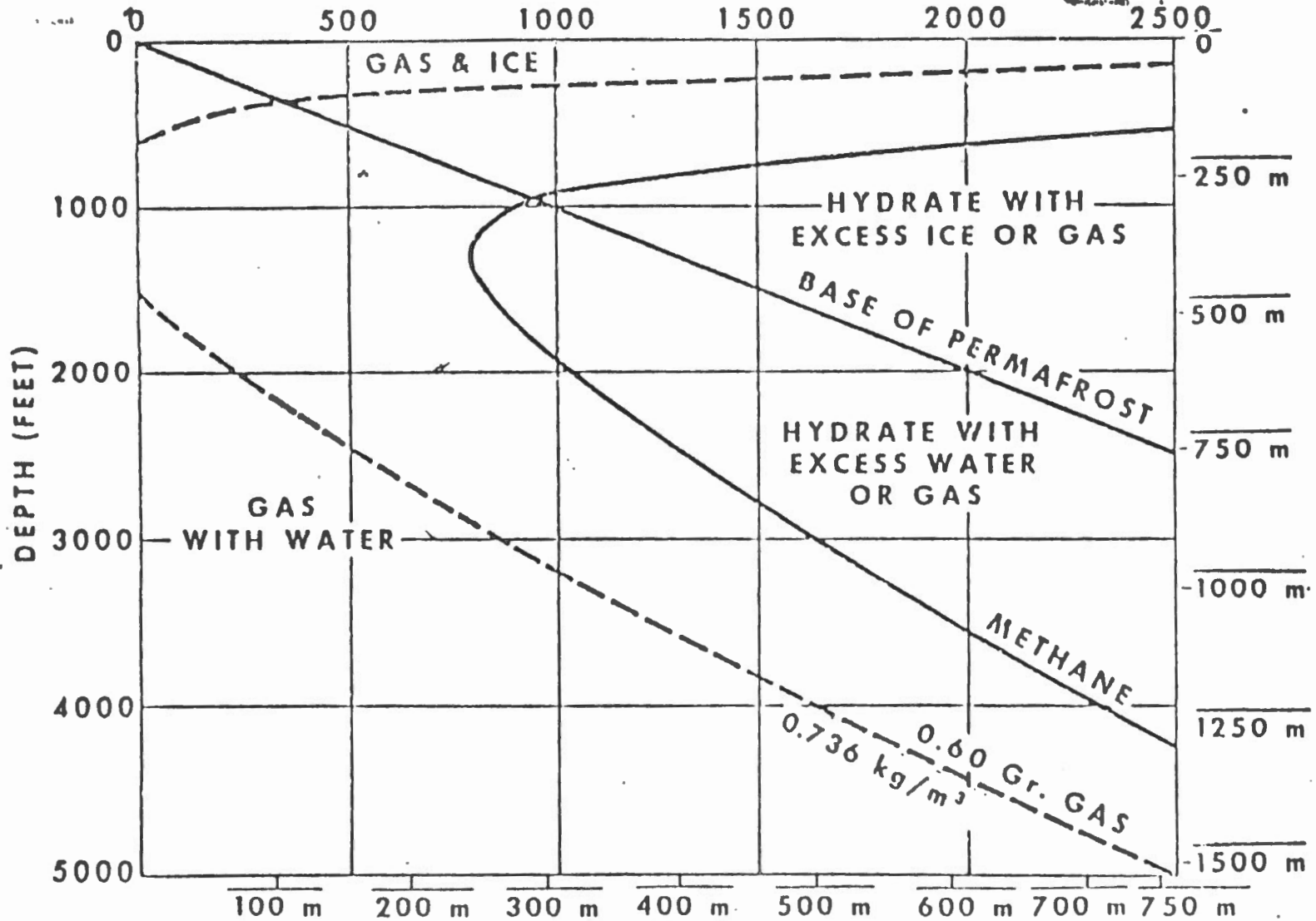


W = Amount of residual water converted to hydrate-percent.

FIGURE 14: Resistivity of specimens versus their Concentration of residual water converted to hydrate (W).¹⁵

RESERVOIR HYDRATE ZONE

DEPTH OF PERMAFROST (FEET)



TEMP. GRAD. = 1.0°F/100FT. 0.018° c/m IN PERMAFROST
 = 1.5°F/100FT. 0.027° c/m BELOW PERMAFROST

PRESSURE GRAD. = 0.435 PSI/FT. (9.84 kPa/m)

LOW SALINITY WATER & SWEET GAS

FIGURE 15: POSSIBILITY OF GAS HYDRATE RELATIVE TO:
 DEPTH OF PERMAFROST AND ZONE DEPTH

FIGURE 15

FIGURE 16

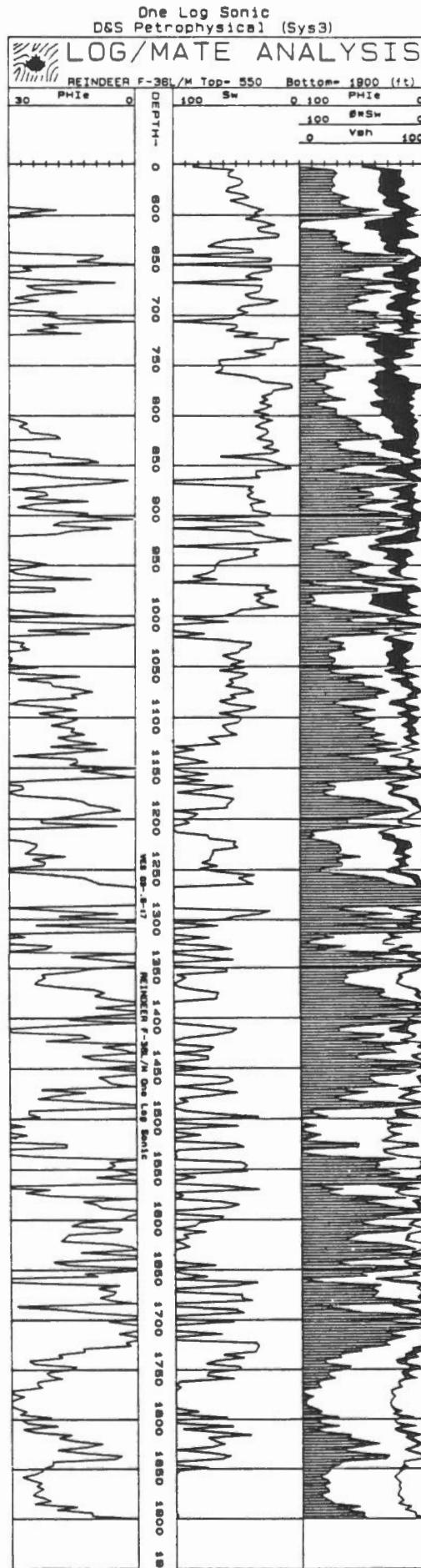


FIGURE 16: Log/Mate
Computed Log Displays
Ice (Black infilling)
and co-existing water
(Sw)

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 1 NAME: UNION AKLAVIK F-17
 K.B.: 8.2 m. G.L.: 2.7 m. CSG: 161.5 m. T.D.: 892.5 m. BHT: 31.1 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<161		✓		IBPF above logged interval	X
Acoustic	BHCS	<161				"	S
Long Acoustic							
SP	✓	<161				"	S
GR	✓					"	S
Caliper							
Neutron							
Density							
Mud Gas							
Sample	✓	244			✓	?	
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred
 S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None Indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

The pick at 244m on the sample log coincides with the top of the cretaceous with gravel and claystones above. RES is low above 244 to csg - no log evidence of IBPF.

ORIGINAL PICK D.L.

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 2 NAME: UNION AKLAVIK F-38
 K.B.: 12.2 m. G.L.: 7.2 m. CSG: 841 m. T.D.: 2056 m. BHT: 51.7 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<841		✓		IBPF is above logged interval Top logged interval 841	X
Acoustic	BHCS						
Long Acoustic						"	
SP	✓					"	
GR	✓					"	
Caliper	✓					Log top 832m	
Neutron	CNL					"	
Density	FDC					"	
Mud Gas	✓						
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

IBPF above logged interval

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 3 NAME: SHELL AKLAVIK A-37
 K.B.: 9.4 m. G.L.: 3.0 m. CSG: 30 m. T.D.: 247 m. BHT: 38 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic SP GR Caliper Neutron Density Mud Gas Sample Open H.Temp GSC Temp. ² Crystal SRS Velocity Other	1-ES BHCS ✓ ✓ ✓	67	103	✓		IBPF at RES inflection point trans at base of gradient Unreliable skips Base of shift 118 Indicated rig caves above 103m Caves above 103m	X

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None Indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 4 NAME: CPOG CROSSLEY LK K-60
 K.B.: 153.3 m. G.L.: 150.9 m. CSG: 215 m. T.D.: 1139 m. BHT: 22 °C

Data Category	Avail	Indicates		Reliable		Reason	Picks ¹
	Type	IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic SP GR Caliper Neutron Density Mud Gas Sample Open H.Temp GSC Temp. ² Crystal SRS Velocity Other	IND BHCS ✓ GRN	<215		✓		IBPF above logged interval	X

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None Indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 5 NAME: UNION WOLVERINE H-34

K.B.: 145.8 m. G.L.: 140.3 m. CSG: 471.2 m. T.D.: 2041 m. BHT: 29 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<471		✓		IBPF above logged interval	X
Acoustic	BHCS						
Long Acoustic							
SP	✓						
GR	✓						
Caliper	✓						
Neutron							
Density							
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to
KB Datum

CONSIDER GAS HYDRATES AT None Indicated INTERVALS
AS INDICATED FROM PETROPHYSICAL LOGS _____
AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

All in very high resistivity, low porosity. No IBPF indicated.
(IBPF does not 'show' well in low porosity media).

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 6 NAME: AMOCO INUVIK D-54
 K.B.: 42.0 m. G.L.: 36.6 m. CSG: 384 m. T.D.: 1561 m. BHT: 33 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<384		✓		IBPF above logged interval	X
Acoustic	BHCS					"	
Long Acoustic							
SP							
GR							
Caliper	✓					"	
Neutron	SNP					"	
Density	FDC					"	
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred
 S = Supportive
² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None Indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

No apparent IBPF below csg. (384m), very high resistivity, low porosity.
 IBPF would be difficult to pick if present.

ORIGINAL PICK DL
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 7 NAME: SHELL NAPOIAK F-31

K.B.: 13.4 m. G.L.: 5.4 m. CSG: 21 m. T.D.: 160.6 m. BHT: 24 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	92	97	✓		IBPF at RES inflection point. Trans at base of gradient.	X
Acoustic							
Long Acoustic	BHCS					Reads thawed zone velocity	
SP							
GR							
Caliper							
Neutron							
Density							
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None Indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 8 NAME: SHELL BEAVER HOUSE H-13

K.B.: 74.7 m. G.L.: 67.7 m. CSG: 25 m. T.D.: 156 m. BHT: 16 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	1-ES	112	135	✓		Hi RES, step at 112	X
Acoustic	BHCS	112	135		✓	Goes to High velocity	S
Long Acoustic							
SP	✓		135		✓	Begins drift	
GR	✓					Uniform Level	
Caliper	✓					No washouts	
Neutron Density							
Mud Gas Sample	✓					High gas 2130-50 2490-2600	
Open H.Temp	✓	98.4					
GSC Temp. ²	✓		E 204			Temp at 0°C at 175m. Ice pick indefinite	
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
S = Supportive KB Datum

CONSIDER GAS HYDRATES AT As below INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS No log indication
 AS INDICATED FROM MUD GAS LOGS Yes

COMMENTS: IBPF/PERMAFROST

COMMENTS: HYDRATE

Possible in shaly section 650 - 655.

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 9 NAME: CPOG KUGALUK N-02

K.B.: 215.9 m. G.L.: 213.5 m. CSG: 246.0 m. T.D.: 1328.6 m. BHT: _____ °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	IND	<246		✓		IBPF above logged interval	S
Acoustic							
Long Acoustic							
SP							
GR							
Caliper							
Neutron	GRN					Gives no indication	
Density							
Mud Gas							
Sample							
Open H.Temp	✓	98			✓	Change in gradient 10.5 after circulation ceased	X
GSC Temp. ²			E104				
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
S = Supportive KB Datum

CONSIDER GAS HYDRATES AT No evidence INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 10 NAME: GULF EAST REINDEER P-60
 K.B.: 115.9 m. G.L.: 110.6 m. CSG: 21.6 m. T.D.: 464.2 m. BHT: 18.3 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic	IEL BHCS	158		✓		Base of gradient Uniform readings throughout	X
SP	✓	160			✓	Anomalous negative shift unrelated to Vsh.	S
GR Caliper Neutron Density Mud Gas Sample Open H.Temp GSC Temp. ² Crystal SRS Velocity Other	✓ ✓ ✓ ✓ ✓	151				Uniform throughout small cave at 149m - 151. 186m - 229m Gives no indication	

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT Possible in shaly section @ 186-229m INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS Not confirmed, no sonic skip
 AS INDICATED FROM MUD GAS LOGS Yes

COMMENTS: IBPF/PERMAFROST
COMMENTS: HYDRATE

Possible hydrate contiguous with base of IBPF.

ORIGINAL PICK YES
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 11 NAME: ESSO NAPARTOK M-01
 K.B.: 15.8 m. G.L.: 5.1 m. CSG: 28.8 m. T.D.: 499 m. BHT: 24 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DISFL	71		✓		Base of sharp gradient	X
Acoustic							
Long Acoustic							
SP	✓	71				Negative shift	S
GR	✓						
Caliper	✓						
Neutron							
Density	✓						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT No INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS N/A

COMMENTS: IBPF/PERMAFROST

GOOD - Strong Pick

ORIGINAL PICK VES

CHECKED & AGREED IPN

IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL

WELL No.: 12 NAME: CHEVRON FISH RIVER B-60
 K.B.: 187.2 m. G.L.: 177.7 m. CSG: 232.2 m. T.D.: 864.1 m. BHT: 19.8 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	<232		✓		IBPF above logged interval	X
Acoustic	BHCS					No anomalies	S
Long Acoustic						No anomalies	
SP	✓					No anomalies	
GR	✓						
Caliper	✓						
Neutron	CNL						
Density	✓						
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT Not indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS N/A

COMMENTS: IBPF/PERMAFROST

CSG (232.2) is below IBPF

ORIGINAL PICK DL/IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 13 NAME: GULF EAST REINDEER C-38
 K.B.: 21.6 m. G.L.: 66.1 m. CSG: 490.1 m. T.D.: 2592.6 m. BHT: 59.4 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<490		✓		None below 490m (csg). No anomalies	X
Acoustic	BHCS						
Long Acoustic							
SP	✓						
GR	✓						
Caliper	✓						
Neutron	SNP						
Density	FDC						
Mud Gas	✓						
Sample							
Open H.Temp						To 85m (in IBPF) No shots above 490m	X
GSC Temp. ²							
Crystal	✓	>85			✓		
SRS Velocity	✓						
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS Shows some gas in shale only

COMMENTS: IBPF/PERMAFROST

Data Gap

IBPF to 85m on Crystal cable and above 490m on RES and Acoustic.

ORIGINAL PICK VES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 14 NAME: GULF OGEOQUEEQ J-06
 K.B.: 84.4 m. G.L.: 75.9 m. CSG: 164.6 m. T.D.: 556.6 m. BHT: 22.2 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic	DIL BHCS	<164		✓		RES No anomalies	X
SP	✓	344			✓	Start of gradual shift. Shows shaliness chg.	
GR	✓						
Caliper							
Neutron Density							
Mud Gas Sample	✓						
Open H.Temp							
GSC Temp. ²							
Crystal	✓					To 22m only	
SRS Velocity	✓					Insufficient data	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT _____ INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS No log support
 AS INDICATED FROM MUD GAS LOGS 911 - 1106

COMMENTS: IBPF/PERMAFROST
 Fresh water sands present from casing, 164m - 580m. RES follows shaliness.
GAS HYDRATE
 Not present - some gas in shale only.

ORIGINAL PICK DL
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 15 NAME: GULF EAST REINDEER A-01
 K.B.: 190.5 m. G.L.: 184.4 m. CSG: 174.7 m. T.D.: 456.6 m. BHT: 21.1 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL					Reflects shaliness	
Acoustic	BHCS	214			✓	Deepest High velocity	X
Long Acoustic							
SP	✓					Does not reflect GR above 286	
GR							
Caliper		214			✓	Deepest caved sand	S
Neutron	SNP						
Density	FDC						
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity	✓					Shallowest station at 457	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT As below INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

COMMENTS: HYDRATES

Hydrates at 360 - 365.8m
 or Coal 472.7 - 478.5 489.2 - 495.3
 (Coal not indicated) on sample log 1

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 16 NAME: Gulf Ikhl I-37
 K.B.: 131.7 m. G.L.: 125.0 m. CSG: 230.4 m. T.D.: 1068.0 m. BHT: 37.2 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	351		✓		Hi RES indicates base of frozen sand	X
Acoustic	BHCS	351		✓		Cycle skips	S
Long Acoustic							
SP	✓	351			✓	Develops more - component above 352	S
GR	✓						
Caliper	✓	351				Base of big cave	S
Neutron Density							
Mud Gas Sample							
Open H.Temp							
GSC Temp. ²		348+8	E354				
Crystal	✓					Unreliable (casing signal)	
SRS Velocity	✓	457			✓	Gross estimate - large interstation depth intervals	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT As below INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS Log not available

COMMENTS: IBPF/PERMAFROST

This sand 328 to 351 could be a gas hydrate at the base of permafrost (actual °C temperature is at 328m.)

ORIGINAL PICK IPN
 CHECKED & AGREED IPN

IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL

WELL No.: 17 NAME: SHELL KIPNIK 0-20

K.B.: 12.3 m. G.L.: 4.0 m. CSG: 26.2 m. T.D.: 170.7 m. BHT: 21.1 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	76		✓		Base of RES gradient Other data starts at 167m	X
Acoustic	SL						
Long Acoustic	✓						
SP	✓						
GR	✓						
Caliper	✓						
Neutron	CNL						
Density	FDC						
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
S = Supportive KB Datum

CONSIDER GAS HYDRATES AT Possible 253 - 261m INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS RES acoustic CNL & FDC

AS INDICATED FROM MUD GAS LOGS YES

COMMENTS: IBPF/PERMAFROST

76m is within a sand indicated on sample log.

COMMENTS: HYDRATE

Believe gas show and log indications of gas is possible hydrate. SP has evidence of co-existence (more negative) but RES is lower than expected and CNL indicates conventional gas effect

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 18 NAME: SHELL UNAK B-11
 K.B.: 10.1 m. G.L.: 2.4 m. CSG: 158.8 m. T.D.: 770.8 m. BHT: 50.6 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	<158		✓		Resistivity follows changes in Vsh	X
Acoustic	BHCS					No anomalies	S
Long Acoustic	✓						
SP	✓						
GR	✓						
Caliper	✓						
Neutron Density							
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST
 No evidence of IBPF in logged interval.

ORIGINAL PICK DL
 CHECKED & AGREED IPN

IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL

WELL No.: 19 NAME: SHELL ULU A-35

K.B.: 11.3 m. G.L.: 2.7 m. CSG: 227.4 m. T.D.: 913.8 m. BHT: 30 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	<227		✓		RES conforms with Vsh No anomalies	X
Acoustic	BHCS						
Long Acoustic							
SP							
GR							
Caliper							
Neutron							
Density							
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²	✓		E99				
Crystal							
SRS Velocity							
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to
KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

IBPF is behind surface casing.

ORIGINAL PICK IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 20 NAME: MOBIL SADENE D-02
 K.B.: 236.8 m. G.L.: 233.0 m. CSG: 127.1 m. T.D.: 503.5 m. BHT: 7.2 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL/DLL					RES remains high through, low porosity carbonate Much skipping above	X
Acoustic	BHCS	307			✓		
Long Acoustic	✓					Deepest unexplained cave	
SP							
GR							
Caliper	✓	271			✓		
Neutron							
Density							
Mud Gas							
Sample	✓						
Open H.Temp							
GSC Temp. ²	✓	318+8	313+				
Crystal							
SRS Velocity							
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT No hydrates evident INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

Weak pick based on depth where sonic cycle skip began.

ORIGINAL PICK IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 21 NAME: IOE BLOW RIVER YT E-47
 K.B.: 117.0 m. G.L.: 112.2 m. CSG: 238.0 m. T.D.: 1261.9 m. BHT: 32.2 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<238		✓		Res follows cleanliness	X
Acoustic	BHCS	<238		✓		Velocity follows cleanliness	S
Long Acoustic							
SP							
GR							
Caliper							
Neutron	SNP						
Density	FDC						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓						
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

IBPF above surface casing (238m)

ORIGINAL PICK YES
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 22 NAME: GULF KAMIK F-38
 K.B.: 27.1 m. G.L.: 21.8 m. CSG: 536.8 m. T.D.: 2279.6 m. BHT: 26.7 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<536		✓		RES conforms with fresh water sands	X
Acoustic	BHCS	<536		✓		No anomalies	S
Long Acoustic							
SP	✓	<536				No anomalies	S
GR	✓						
Caliper	✓					Big caves ran down to 914m	
Neutron							
Density							
Mud Gas	✓					Gas responds to coal seams	
Sample	✓						
Open H.Temp	✓					Not diagnostic	
GSC Temp. ²							
Crystal							
SRS Velocity	✓						
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
COMMENTS: IBPF/PERMAFROST

Base of iBPF in above casing 536m.

ORIGINAL PICK YES
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 23 NAME: GULF KAMIK D-48

K.B.: 33.2 m. G.L.: 28.0 m. CSG: _____ m. T.D.: 1047.9 m. BHT: 22.2 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	390		✓		Large RES increase in Sand Start gradient to level	X
Acoustic	BHCS	387			✓		S
Long Acoustic							
SP							
GR		✓					
Caliper							
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²	✓		Ex 375				
Crystal	✓	>365				Shows IBPF to 365 (deepest reading)	
SRS Velocity	✓					Not detailed enough	
Other							

¹ X = Preferred ² Depth Adjusted to
S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

Strong log pick

ORIGINAL PICK _____ IPN

CHECKED & AGREED _____ IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 24 NAME: GULF KAMIK D-58
 K.B.: 44.8 m. G.L.: 39.3 m. CSG: 165.8 m. T.D.: 1008 m. BHT: 21.1 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic SP GR Caliper Neutron Density Mud Gas Sample Open H.Temp GSC Temp. ² Crystal SRS Velocity Other	DIL BHCS ✓ ✓ ✓ ✓ ✓ ✓	317	332	✓		This is base of last frozen sand	X
		293			✓	8500 - 6600 at 293m. Not detailed enough	S

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None evident INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

RES of sand at 312 - 317m is greater than non-frozen sand at
 344 - 350m.

ORIGINAL PICK YES
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 25 NAME: GULF KAMIK L-60
 K.B.: 67.7 m. G.L.: 61.0 m. CSG: 1148.5 m. T.D.: 3029.1 m. BHT: 16.7 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	<1148				No anomalies	
Acoustic	BHCS					No anomalies	
Long Acoustic							
SP	✓						
GR	✓						
Caliper	✓						
Neutron							
Density	✓						
Mud Gas	✓						
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓	402			✓	Vel change. 15400 - 6700 at 213m 8000 - 6800 at 402m	X
SRS Velocity	✓						
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

Weak pick based on through casing crystal cable pick. No hydrates

ORIGINAL PICK YES
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 27 NAME: GULF PARSONS N-10
 K.B.: 67.7 m. G.L.: 61.6 m. CSG: 223.1 m. T.D.: 1187.8 m. BHT: 33.3 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	332		✓		RES higher than in sands below	X
Acoustic	BHCS						
Long Acoustic							
SP	✓						
GR	✓						
Caliper	✓	332				Deepest cave	S
Neutron							
Density							
Mud Gas	✓						
Sample							
Open H.Temp							
GSC Temp. ²		E347+ 15	E360				
Crystal	✓					IBPF not indicated on crystal cable	
SRS Velocity	✓					Not detailed enough	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS No

COMMENTS: IBPF/PERMAFROST

332 is base of deepest frozen sand.

ORIGINAL PICK VES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 28 NAME: GULF PARSONS N-17
 K.B.: 51.8 m. G.L.: 45.7 m. CSG: 995.8 m. T.D.: 2933.1 m. BHT: 67.2 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<996				Logging started below permafrost No anomalies below casing.	
Acoustic	BHCS						
Long Acoustic						No anomalies below casing.	
SP	✓						
GR	✓					High coal gas at 95m	
Caliper							
Neutron						8000 - 6800 @ 286m	X
Density							
Mud Gas	✓					326+15 E361	
Sample	✓						
Open H.Temp						286	
GSC Temp. ²							
Crystal	✓	286			✓	8000 - 6800 @ 286m	X
SRS Velocity	✓						
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS None indicated

COMMENTS: IBPF/PERMAFROST

IBPF is above logged interval

ORIGINAL PICK VES
 CHECKED & AGREED LIN/IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 29 NAME: GULF PARSONS D-20
 K.B.: 64.9 m. G.L.: 59.4 m. CSG: 1050 m. T.D.: 2995.6 m. BHT: 39.4 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic SP GR Caliper Neutron Density Mud Gas Sample Open H.Temp GSC Temp. ² Crystal SRS Velocity Other	DLL BHCS	<1050		✓		Logs start below IBPF	X
		358+8	E370				

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS No mud log

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 30 NAME: GULF PARSONS 0-27
 K.B.: 42.0 m. G.L.: 36.6 m. CSG: 159.5 m. T.D.: 3570.4 m. BHT: °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	348		✓		RES higher at 348m than sands below Log generally hashy thruout the interval	X
Acoustic	BHCS						
Long Acoustic							
SP	✓	348		✓		SP looses correlation with GR at 348m	S
GR	✓						
Caliper	✓					Overgauge above 335m	
Neutron							
Density							
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²							
Crystal	✓					8700 - 7000 at 243.	
SRS Velocity	✓						
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK YES
 CHECKED & AGREED IPN

IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL

WELL No.: 31 NAME: GULF PARSONS L-37

K.B.: 46.6 m. G.L.: 38.1 m. CSG: 1016.8 m. T.D.: 2232.7 m. BHT: 47.8 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<1016		✓		Logs start below IBPF	X
Acoustic	BHCS						
Long Acoustic							
SP	✓						
GR	✓						
Caliper							
Neutron							
Density							
Mud Gas Sample							
Open H.Temp							
GSC Temp. ²	✓	320+8	x308+				
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
S = Supportive KB Datum

CONSIDER GAS HYDRATES AT No hydrates indicated INTERVALS
AS INDICATED FROM PETROPHYSICAL LOGS _____
AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

IBPF is above logged interval

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 32 NAME: GULF PARSONS P-41
 K.B.: 70.7 m. G.L.: 66.1m. CSG: 308.5 m. T.D.: 2006.2 m. BHT: 40.6 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<308				RES follow GR. No evidence of IBPF Generally hashy throughout Essentially follows GR	
Acoustic	BHCS						
Long Acoustic							
SP	✓						
GR	✓						
Caliper	✓						
Neutron							
Density							
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²							
Crystal	✓	220			✓	10000 - 5000 at 220m	X
SRS Velocity	✓					Not enough detail	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT Not indicated by mud gas INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

IBPF is above logged interval

ORIGINAL PICK YES

CHECKED & AGREED LIN/IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 33 NAME: GULF PARSONS L-43
 K.B.: 64.3 m. G.L.: 55.8 m. CSG: 27.7 m. T.D.: 1037.8 m. BHT: 26.1 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	247		✓		RES higher in sands above 247m	X
Acoustic	BHCS	247			✓	Cycle skips above 247m	S
Long Acoustic							
SP							
GR	✓	247			✓	Lo readings indicate big cave above 247	S
Caliper							
Neutron							
Density							
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²		268+15	E302				
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None Indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK VES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 34 NAME: GULF PARSONS A-44
 K.B.: 63.1 m. G.L.: 53.3 m. CSG: 146.9 m. T.D.: 1023.5 m. BHT: 32.2°C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	352			✓	RES higher above for equivalent zones Base line (SD) shift	X
Acoustic	BHCS	359			✓		
Long Acoustic						Stops conforming to GR	
SP	✓	332			✓		
GR	✓					No caves	
Caliper	✓						
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓					Starts too deep	
SRS Velocity	✓					Starts too deep	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS None indicated

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL & IPN
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 35 NAME: GULF PARSONS P-53
 K.B.: 51.2 m. G.L.: 45.7 m. CSG: 189.0 m. T.D.: 1200.3 m. BHT: 30 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	307			✓	RES higher above for equivalent zn.	X
Acoustic	BHCS	304	320		✓	SD base line shifts	S
Long Acoustic							
SP	✓	320			✓	SP and GR stop conforming (Spurious)	
GR							
Caliper							
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓	317			✓	7000 - 6000 at 317m	
SRS Velocity	✓						
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL & IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 36 NAME: GULF EAST REINDEER 0-04
 K.B.: 52.1 m. G.L.: 46.6 m. CSG: 23.2 m. T.D.: 506.9 m. BHT: 43.3 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	320		✓		Abrupt RES change within a sand	X
Acoustic	BHCS	323			✓	Big base line shift to low velocity	S
Long Acoustic							
SP	✓					Base line shift at 143m	
GR	✓						
Caliper	✓	365			✓	Deepest caved SD	
Neutron Density							
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²							
Crystal	✓	>152				In IBPF at deepest reading 152m	
SRS Velocity	✓					Not enough detail	
Other						Top reading 518m	

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK VES
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 37 NAME: GULF ATIGI 0-48

K.B.: 90.8 m. G.L.: 84.7 m. CSG: 761.1 m. T.D.: 1979.4 m. BHT: 37.8 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<761				Top log 761 no indication of IBPF below.	X
Acoustic	BHCS	<761					
Long Acoustic							
SP	✓						
GR	in csg.					Top log 761m	
Caliper	✓					Top log 761m	
Neutron							
Density	CNL in csg.						
Mud Gas	✓					Coal gas 1525 - 1830m	
Sample	✓						
Open H.Temp							
GSC Temp. ²		570+15	Ex594				
Crystal	✓	509			✓	10500 - 6500 at 509m	X
SRS Velocity	✓						
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS None

COMMENTS: IBPF/PERMAFROST

Log IBPF based on crystal cable data only

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 38 NAME: GULF OGRUKNANG M-31
 K.B.: 108.2 m. G.L.: 103.0 m. CSG: 1614.2 m. T.D.: 2822.4 m. BHT: 53.3 °C

Data Category	Avail	Indicates		Reliable		Reason	Picks ¹
	Type	IBPF	Trans	Hi	Lo		
RES	DIL					Top reading, 1615m	
Acoustic	BHCS	539			✓	Complete loss of signal in this sand (lower sands o.k.).	X
Long Acoustic							
SP	✓						
GR	✓						
Caliper							
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity	✓					Top reading at 1280m	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

IBPF pick made on BHCS/GR data only

ORIGINAL PICK DL & IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 39 NAME: IOE TUNUNUK K-10
 K.B.: 10.9 m. G.L.: 5.4 m. CSG: 23.5 m. T.D.: 829.1 m. BHT: 49.9°C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	IES	96	137	✓		IBPF at abrupt RES incr. Trans at smaller change below Little acoustic data	X
Acoustic	BHCS						
Long Acoustic							
SP	✓	125			✓	Base line gradient change	
GR	✓	96			✓	Low value as above 96m indicates big hole	S
Caliper	✓						
Neutron	✓					Top log 762m	
Density	✓					"	
Mud Gas						"	
Sample							
Open H.Temp	✓	320			✓	320m temp. gradient change	
GSC Temp. ²							
Crystal							
SRS Velocity	✓					Top shot at 920m	
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS No log

COMMENTS: IBPF/PERMAFROST

Open hole temp log was run only 3 hours after circulation ceased, expect little response to the latent heat of IBPF.

ORIGINAL PICK DL & IPN

CHECKED & AGREED LIN/IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 40 NAME: GULF TUNUNUK F-30
 K.B.: 35.9 m. G.L.: 29.9 m. CSG: 166.1 m. T.D.: 994.9 m. BHT: 20.6 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<166			✓	No anomalies below casing	X
Acoustic	BHCS					No anomalies below casing	
Long Acoustic							
SP	✓	290			✓	Base line shift	
GR	✓						
Caliper							
Neutron							
Density							
Mud Gas Sample	✓						
Open H.Temp							
GSC Temp. ²							
Crystal	✓	<301				Top station below IBPF (7400')	
SRS Velocity	✓					Not enough detail. Top shot 408m	
Other							

¹ X = Preferred
 S = Supportive ² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS None indicated
 COMMENTS: IBPF/PERMAFROST

No indications of IBPF below casing.

ORIGINAL PICK VES/IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 41 NAME: SHELL TULLUGAK K-31
 K.B.: 9.6 m. G.L.: 1.1 m. CSG: 27.4 m. T.D.: 177.4 m. BHT: °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	73	102	✓		RES change (inflection point)	X
Acoustic	BHCS	<274				No anomalies below 274 (top log interval)	
Long Acoustic							
SP	✓	73			✓	SP stops conforming with GR above 73m	S
GR	✓						
Caliper	✓	<274				No anomalies below 274m	
Neutron Density							
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None within the hydrate envelope INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS

AS INDICATED FROM MUD GAS LOGS High gas at 1100m - is in shaly sections - low acoustic velocity - possible fault zone.

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL

CHECKED & AGREED IPN

IBPF/PERMAFROST/GAS HYDRATE

ANALYSIS DETAIL

WELL No.: 42 NAME: SHELL KUGPIK 0-13

K.B.: 10.3 m. G.L.: 1.8 m. CSG: 171.0 m. T.D.: 761.7 m. BHT: 36.7°C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL/DIL	<171		✓		No anomalies below casing (171)	X
Acoustic	BHCS	<171				"	
Long Acoustic						"	
SP	✓					"	
GR	✓					"	
Caliper	✓					No caves below casing.	
Neutron Density	FDC						
Mud Gas Sample							
Open H.Temp							
GSC Temp. ²	✓		E103				
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS No mud gas/log

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 43 NAME: SHELL KUGPIK L-24
 K.B.: 12.2 m. G.L.: 2.9 m. CSG: _____ m. T.D.: 246.6 m. BHT: _____ °C

Data Category	Avail	Indicates		Reliable		Reason	Picks ¹
	Type	IBPF	Trans	Hi	Lo		
RES	DLL	88	107	✓		IBPF at point of inflection. Trans at gradient change No signal skip	X
Acoustic	BHCS						
Long Acoustic						No particular anomalies	
SP	✓						
GR	✓					"	
Caliper							
Neutron	CNL						
Density	FDC						
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS All shows associated with coal seams

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL/IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 44 NAME: DOME IMNAK J-29
 K.B.: 18.3 m. G.L.: 10.1 m. CSG: 142.6 m. T.D.: 900.4 m. BHT: 21.1 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	533		✓		Sands above 533 more RES Top log at 900m	X
Acoustic	BHCS						
Long Acoustic						Top log at 900m	
SP	✓						
GR	✓						
Caliper	✓						
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

IBPF picked on RES increase and spike like shape that could be due to caved hole in front of high RES frozen sand.

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 45 NAME: IMP NUNA A-23
 K.B.: 43.6 m. G.L.: 36.6 m. CSG: 159.1 m. T.D.: 931.8 m. BHT: 18.3 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic	DIL	390			✓	Higher RES than sands below	X
SP	✓	387			✓	SP not conforming with GR above 387	S
GR	✓	399			✓	Deepest caved sand	S
Caliper	✓						
Neutron Density Mud Gas Sample	FDC						
Open H.Temp GSC Temp. ²							
Crystal SRS Velocity Other	✓	378			✓	8800 - 6700	

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS No mud log

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 46 NAME: GULF SIKU C-11
 K.B.: 70.1 m. G.L.: 63.4 m. CSG: _____ m. T.D.: 1129.3 m. BHT: 18.9 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	357		✓		RES higher at 357m than sands below Sonic skips above 357	X
Acoustic	BHCS	357			✓		
Long Acoustic							
SP	✓						
GR	✓						
Caliper							
Neutron							
Density							
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²		365+δ	E385				
Crystal							
SRS Velocity							
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK IPN

CHECKED & AGREED LIN/IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 47 NAME: GULF SIKU A-12
 K.B.: 67.7 m. G.L.: 62.2 m. CSG: 1142.7 m. T.D.: 3278.7 m. BHT: _____ °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<1142				No IBPF below casing.	
Acoustic	BHCS	<1142				"	
Long Acoustic							
SP	✓					"	
GR	✓					"	
Caliper	✓					"	
Neutron							
Density							
Mud Gas	✓						
Sample	✓						
Open H.Temp	✓	358			✓	Indicates latent heat of IBPF	X
GSC Temp. ²		348+8	E365				
Crystal							
SRS Velocity	✓					Not enough detail. 1st reading at 2000 feet.	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK IPN
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 48 NAME: GULF SIKU E-21
 K.B.: 64.6 m. G.L.: 55.5 m. CSG: 552.9 m. T.D.: 2283.6 m. BHT: 42.2 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<553				No indication below casing 553m	
Acoustic	BHCS	<553				"	
Long Acoustic							
SP	✓					SP follows GR below casing	
GR	✓						
Caliper							
Neutron							
Density							
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²		398+8	E403				
Crystal		326			✓	8400 - 6300 at 326m	X
SRS Velocity		365+			✓	Not enough detail	
Other							

¹ X = Preferred
 S = Supportive ² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

IBPF at 326m from crystal cable only. All other logs start below IBPF

ORIGINAL PICK IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 49 NAME: GULF SIKU L-55
 K.B.: 39.3 m. G.L.: 33.8 m. CSG: 163.7 m. T.D.: 751.6 m. BHT: 18.3 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	463			✓	RES generally higher (in sand & shale above this depth. Very hashy, signal lost above 440m	X
Acoustic	BHCS						
Long Acoustic							
SP	✓		493		✓		
GR	✓					Caliper stuck at 362m Start below 686m Start below 686m	
Caliper	✓						
Neutron	SNP						
Density	FDC						
Mud Gas	✓						
Sample	✓					Not enough detail	
Open H.Temp							
GSC Temp. ²							
Crystal						Not enough detail	
SRS Velocity	✓	457			✓		
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS Gas appears to be associated with coal only.

COMMENTS: IBPF/PERMAFROST

RES data is poor, bit size is big (400+m) and is probably caved beyond.
 Sonde error is set to drive cond. to zero - so log lacks resolution at
 high resistivity.

ORIGINAL PICK YES

CHECKED & AGREED IPN

IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL

WELL No.: 50 NAME: BA IOE REINDEER D-27
 K.B.: 32.3 m. G.L.: 27.4 m. CSG: 464.2 m. T.D.: 1665.1 m. BHT: 31.1 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	I-ES	<464		✓		No indication below casing	X
Acoustic	BHCS	<464				"	
Long Acoustic							
SP	✓						
GR	✓					GR indicates big cave above 131m	
Caliper							
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²		343+15	E375				
Crystal							
SRS Velocity	✓					Top shot 469 not enough detail	
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS No mud log

COMMENTS: IBPF/PERMAFROST

IBPF located above logged interval

ORIGINAL PICK IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 51 NAME: GULF REINDEER F-36
 K.B.: 15.8 m. G.L.: 10.3 m. CSG: 168.9 m. T.D.: 614.5 m. BHT: 12.2 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	342		✓		Sands above 340 have higher RES than equivalent sands below	X
Acoustic	BHCS						
Long Acoustic							
SP	✓	335			✓	SP stops conforming to GR above 335m	S
GR	✓						
Caliper							
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²		344+8	E363				
Crystal		347				7500 - 6600 at 347m	S
SRS Velocity		304			✓	Not enough detail	
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT 625 to 640m¹ 727 - 732² INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS RES acoustic SP and CAL

AS INDICATED FROM MUD GAS LOGS YES

COMMENTS: IBPF/PERMAFROST
HYDRATE:

1. High RES = 5052, SP more negative than sands below, acoustic has complete loss of signal, caliper average compared to sands below (undergauge)
2. As above RES higher than sands below, loss of acoustic caliper overgauge.
3. Note zone 1168 - 1171 has similar characteristics and tested $.14 \times 10^6$ m³/day gas - it is below the hydrate prone envelope (permafrost +750m = 341 + 750 = 1090m)

ORIGINAL PICK IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 52 NAME: GULF REINDEER A-41
 K.B.: 29.0 m. G.L.: 19.8 m. CSG: 196.3 m. T.D.: 698.3 m. BHT: 26.7 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	335	420		✓	Trans - RES baseline shift IBPF at base of frozen sand Base line shift	X
Acoustic	BHCS	385			✓		
Long Acoustic						Generally conforms with GR	
SP	✓						
GR	✓						
Caliper							
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity	✓					Top shot 701	
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS High gas 825m level

COMMENTS: IBPF/PERMAFROST

HYDRATE: All high gas readings appear to be associated with coal seams.

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 53 NAME: GULF KIKORALOK N-46
 K.B.: 14.9 m. G.L.: 6.1 m. CSG: 161.8 m. T.D.: 521.8m. BHT: 26.7 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<161		✓		Not apparent on RES	X
Acoustic	BHCS	<161				Not apparent on acoustic	
Long Acoustic						Poor quality hashy data.	
SP	✓						
GR	✓						
Caliper							
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity	✓					Top shot 183m, not enough detail	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT As below INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS RES SP caliper acoustic
 AS INDICATED FROM MUD GAS LOGS High gas readings

COMMENTS: IBPF/PERMAFROST

IBPG above logged interval.

HYDRATE:

At the 760m level, all logs indicate good possibility of gas hydrate.

ORIGINAL PICK VES
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 54 NAME: SHELL TITALIK 0-15
 K.B.: 12.2 m. G.L.: 4.5 m. CSG: 18.3 m. T.D.: 153.0 m. BHT: 15.5 °C

Data Category	Avail	Indicates		Reliable		Reason	Picks ¹
	Type	IBPF	Trans	Hi	Lo		
RES	DLL	97	107	✓		IBPF at point of inflection. Trans of gradient change. Top reading 152m Top reading 158m "	X
Acoustic	BHCS						
Long Acoustic	✓						
SP	✓						
GR	✓						
Caliper	✓						
Neutron							
Density							
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred
 S = Supportive ² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS High readings appear to be coal seams
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK VES
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 55 NAME: GULF TITALIK K-26
 K.B.: 11.5 m. G.L.: 4.5 m. CSG: 166.7 m. T.D.: 939.9 m. BHT: 42.2 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic SP GR Caliper Neutron Density Mud Gas Sample Open H.Temp GSC Temp. ² Crystal SRS Velocity Other	DIL BHCS SNP FDC	<167				Top log interval 167m	
	✓	<55	72+	✓		Top shot at 55m is below IBPF	X

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

IBPF is above logged interval (167m)

ORIGINAL PICK IPN
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 56 NAME: IMP DELTA 5 KURK M-39

K.B.: 8.7 m. G.L.: 1.7 m. CSG: 165.8 m. T.D.: 576.7 m. BHT: 16.7 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic SP GR Caliper Neutron Density Mud Gas Sample Open H.Temp GSC Temp. ² Crystal SRS Velocity Other	DLL BHCS CNL FDC ✓	<167				Not apparent in logged interval 167m Top acoustic log 488m 8400 - 5000 @ 61m	 X

¹ X = Preferred
S = Supportive

² Depth Adjusted to
KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS No mud gas log

COMMENTS: IBPF/PERMAFROST

IBPF above 167m (top of logged interval)

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 57 NAME: IOE ELLICE 0-14
 K.B.: 5.1 m. G.L.: 0.9 m. CSG: 240.5 m. T.D.: 779.1 m. BHT: 25.6 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	IES	<240				IBPF above logged interval	
Acoustic	BHCS						
Long Acoustic							
SP	✓						
GR	✓						
Caliper							
Neutron Density	SNP						
Mud Gas Sample	FDC						
Open H.Temp							
GSC Temp. ²							
Crystal	✓	38			✓	9000 - 6200 @ 38m	X
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT NONE INDICATED INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

IBPF above logged interval

ORIGINAL PICK YES
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 58 NAME: IOE SPRING RIVER YT N-58

K.B.: 96.9 m. G.L.: 92.7 m. CSG: 159.4 m. T.D.: 604.1 m. BHT: °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic SP	DIL BHCS ✓	<160				Not evident in logged interval	
GR Caliper Neutron Density Mud Gas Sample		46			✓	Abnomaly low GR indicates big cave	X
Open H.Temp GSC Temp. ² Crystal SRS Velocity Other	✓ ✓ ✓	46				Abrupt change in gradient (latent Heat of ice) Acoustic velocity too high by crystal cable Not detail enough - top shot 304m	S

¹ X = Preferred ² Depth Adjusted to
S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None Indicated INTERVALS
AS INDICATED FROM PETROPHYSICAL LOGS _____
AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

IBPF above logged interval. O.H. temp survey and GR indicate IBPF at 46m.

ORIGINAL PICK VES/IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 59 NAME: IOE ESKIMO J-07
 K.B.: 27.1 m. G.L.: 21.0 m. CSG: 24.1 m. T.D.: 550.8 m. BHT: 49.4 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	I-ES	155	201	✓		IBPF is base of deepest frozen sand, trans is grad. chg. Loss of signal	X
Acoustic	BHCS	155					S
Long Acoustic							
SP	✓		201		✓		S
GR	✓						
Caliper							
Neutron	GRN						
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓					9400 to 152 (still in IBPF)	
SRS Velocity	✓					Not detailed enough	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT _____ INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 60 NAME: IOE TUKTU 0-19
 K.B.: 30.5 m. G.L.: 25.6 m. CSG: 620 m. T.D.: 2308 m. BHT: 50 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<620				No IBPF below casing.	
Acoustic	BHCS	<620				"	
Long Acoustic						"	
SP	✓					"	
GR	✓					"	
Caliper	✓					"	
Neutron Density	FDC						
Mud Gas Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓	335			✓	9000 - 7200 @ 335	X
SRS Velocity	✓					Top shot 457m, not enough detail	
Other							

¹ X = Preferred
 S = Supportive ² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

IBPF is above logged interval.

ORIGINAL PICK YES
 CHECKED & AGREED IPN

IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL

WELL No.: 61 NAME: IOE TUK F-18
 K.B.: 25.9 m. G.L.: 18.3 m. CSG: 575 m. T.D.: 1943.7 m. BHT: 36.7 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	ES	<575				Top logged interval is 575m	X
Acoustic							
Long Acoustic							
SP	✓					Top logged interval is 575m	
GR	✓					Insufficient data	
Caliper							
Neutron	GRN						
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity	✓	305			✓	Not enough detail, shots at 305, 710	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

Insufficient data.

ORIGINAL PICK VES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 62 NAME: IMP WAGNARK G-12
 K.B.: 38.4 m. G.L.: 30.5 m. CSG: 160.9 m. T.D.: 931.5 m. BHT: 24.4 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	387		✓		Base of top frozen sand	X
Acoustic	BHCS	424			✓	Skips above 424	
Long Acoustic						Little character throughout	
SP	✓						
GR	✓						
Caliper	✓						
Neutron	CNL						
Density	FDC						
Mud Gas Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓	369			✓	8000 - 6700 @ 369	
SRS Velocity							
Other							

¹ X = Preferred
 S = Supportive
² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 63 NAME: IMP DELTA 5 WAGNARK C-23
 K.B.: 30.5 m. G.L.: 23.1 m. CSG: 564 m. T.D.: 3256.5 m. BHT: °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<864				Top log interval 864m	
Acoustic	BHCS					"	
Long Acoustic							
SP	✓					Top log interval 864m	
GR	✓	487			✓	GR indicates big hole above 487m	
Caliper							
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓	518			✓	12800-8500, 424; 8500-6500, 518	X
SRS Velocity	✓					Not enough detail, top shot 610m	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

IBPF above logged interval

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 64 NAME: GULF RED FOX P-21
 K.B.: 31.7 m. G.L.: 23.5 m. CSG: 167.0 m. T.D.: 1280 m. BHT: 21.1 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	610	640	✓		IBPF at base of deepest. Frozen silt. trans is gradient change Loss of signal	X
Acoustic	BHCS	610					S
Long Acoustic							
SP	✓	625					
GR	✓						
Caliper							
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²	✓		>583				
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK IPN
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 65 NAME: GULF YA YA I-17
 K.B.: 26.5 m. G.L.: 18.3 m. CSG: 160.9 m. T.D.: 1321 m. BHT: 27 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES Acoustic	DIL	685	721	✓		IBPF is base of frozen sand. Trans is base of gradient	X
Long Acoustic	BHCS	591			✓		
SP	✓					Loss of signal	
GR	✓					Little effect	
Caliper						Mostly sands	
Neutron Density							
Mud Gas Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓	573			✓	9500 - 7000 at 573	
SRS Velocity	✓	610			✓	Not enough detail	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

Conflict between log and Xtal IBPF

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 66 NAME: GULF YA YA A-28
 K.B.: 48.8 m. G.L.: 39.6m. CSG: 160.0 m. T.D.: 1212 m. BHT: 16 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	673	728		✓	IBPF at base of frozen sand. Trans at gradient change Very hashy throughout	X
Acoustic	BHCS						
Long Acoustic							
SP	✓						
GR	✓						
Caliper							
Neutron							
Density							
Mud Gas	✓						
Sample	✓						
Open H.Temp						10,200 - 6800 at 573m Not enough detail	
GSC Temp. ²	✓		Ex 674				
Crystal	✓	573			✓		
SRS Velocity	✓	762					
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

Conflict with crystal cable data.

ORIGINAL PICK IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 67 NAME: GULF YA YA M-33
 K.B.: 49.1 m. G.L.: 42.7 m. CSG: 158.2 m. T.D.: 898 m. BHT: 20 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	470	548	✓		IBPF at major RES change	X
Acoustic	BHCS	468			✓	Signal loss above 468	S
Long Acoustic							
SP	✓					Gradient change at 631	
GR	✓					Mostly shale	
Caliper	✓	468				Deepest big cave	S
Neutron Density							
Mud Gas Sample	✓						
Open H.Temp							
GSC Temp. ²							
Crystal	✓	423			✓	9500 - 6800 at 423	
SRS Velocity	✓					Top shot 710m	
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT No hydrates indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK VES
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 68 NAME: GULF YA YA P-53

K.B.: 41.4 m. G.L.: 36.9 m. CSG: 229.2 m. T.D.: 1058 m. BHT: 31 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	402	438	✓		IBPF at base of frozen sand. Trans at gradient chg. Goes to level above 402m	X
Acoustic	BHCS	402			✓		S
Long Acoustic							
SP	✓						
GR	✓						
Caliper	✓	338			✓	Big cave above 338m K.B.	
Neutron Density							
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²	✓	407+15	E438				
Crystal	✓	351			✓	10,900 - 6800 at 351	
SRS Velocity	✓	457				Not enough detail	
Other							

¹ X = Preferred ² Depth Adjusted to
S = Supportive KB Datum

CONSIDER GAS HYDRATES AT As below INTERVALS
AS INDICATED FROM PETROPHYSICAL LOGS _____
AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

HYDRATES:

No bona fide reservoir but possible hydrated gas in shaly section 670-701m. High mud gas, loss of sonic signal - but low resistivity. Similar shows exist to base of the hydrate prone envelope (1150m), shows below are associated with shale and coal.

ORIGINAL PICK IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 69 NAME: GULF TORPOLOK H-24
 K.B.: 15.8 m. G.L.: 10.6 m. CSG: 161.5 m. T.D.: 1221.9 m. BHT: 16.7 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	335	357	✓		IBPF at base of frozen silt. Trans base of gradient Loss of signal above 320	X
Acoustic	BHCS	320			✓		
Long Acoustic						Big caves above 320m	
SP	✓						
GR	✓						
Caliper	✓	320			✓		
Neutron	✓						
Density							
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²							
Crystal	✓	330			✓	10,600 - 6,600 at 330m	
SRS Velocity	✓						
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

NOTE: Logs represent dramatically the freezing of DS (320m) and less dramatically the freezing of silt (335m)

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 70 NAME: GULF TORPOLOK 0-54
 K.B.: 11.5 m. G.L.: 3.0 m. CSG: 189.9 m. T.D.: 1336.5 m. BHT: 25.5 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIFL	207	216	✓		IBPF at abrupt shift. Base of SD, trans at start of gradient. Loss of signal	X
Acoustic	BHCA	204			✓		S
Long Acoustic							
SP	✓						
GR	✓						
Caliper							
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal		<280				Not frozen below 280	
SRS Velocity						Not detailed enough	
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT 406 - 488 INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS No logs

AS INDICATED FROM MUD GAS LOGS 449 - 494

COMMENTS: IBPF/PERMAFROST

HYDRATE:

None in bona fide reservoirs, show above relatively low resistivity conglomerate, relatively clean acoustic log cycle skips.

ORIGINAL PICK DL/IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 71 NAME: SHELL KUMAK J-06
 K.B.: 17.6 m. G.L.: 9.1 m. CSG: 159.7 m. T.D.: 617.2 m. BHT: °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic SP GR Caliper Neutron Density Mud Gas Sample Open H.Temp GSC Temp. ² Crystal SRS Velocity Other	DIL BHCS Sonic ✓ ✓	243	291		✓	IBPF at High RES & separation between 1LD, 1LN. Trans at start of gradient Skips throughout Indicates Very big hole above 208m Wide open in 470mm hole	X

¹ X = Preferred
S = Supportive ² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT As below INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS Not indicated on logs

AS INDICATED FROM MUD GAS LOGS High gas 664-710, gas is from poor data, 470mm hole

COMMENTS: IBPF/PERMAFROST

COMMENTS: Hydrate

3m resistive stringer at 664 - producing interval indicated on open hole temp survey.

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 72 NAME: SHELL KUMAK K-16
 K.B.: 11.5 m. G.L.: 3.0 m. CSG: 160.6 m. T.D.: 606.9 m. BHT: 11.1 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	241	311	✓		IBPF at abrupt RES change. Trans at base of gradient Signal lost above 256m	X
Acoustic	BHCS	256			✓		
Long Acoustic						Big hole above 264m	
SP							
GR							
Caliper	✓	264			✓		
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS Moderate gas readings in shaly zones.

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK VES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 73 NAME: SHELL KUMAK C-58
 K.B.: 10.9 m. G.L.: 2.4 m. CSG: 134.7 m. T.D.: 614.8 m. BHT: 7.8 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL/DLL	247	283	✓		Abrupt RES chg. within Sd. Trans is base of gradeint. All skips above 228'	X
Acoustic	BHCS	228					
Long Acoustic						Caved above 220	
SP							
GR							
Caliper		220			✓		
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred
 S = Supportive ² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS Mud gas readings in 320m level are associated with
 COMMENTS: IBPF/PERMAFROST shale and coal.

ORIGINAL PICK DL
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 74 NAME: SHELL KUMAK E-58
 K.B.: 10.6 m. G.L.: 2.1 m. CSG: 253.6 m. T.D.: 735.5 m. BHT: 27.2 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	217	288	✓		IBPF abrupt RES change. Trans at start of gradient Abrupt change to low velocity	X
Acoustic	BHCS	217					S
Long Acoustic	✓					Big caves above 216m	S
SP	✓						
GR	✓						
Caliper	✓	216			✓		
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²	✓		E283				
Crystal							
SRS Velocity							
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT 1055 - 1223 - possible INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS RES, Acoustic

AS INDICATED FROM MUD GAS LOGS Not enough gas for hydrate

COMMENTS: IBPF/PERMAFROST

COMMENTS: HYDRATE

Above zones have low (but not lost) velocity. Are high resistivity with SP generally not conforming to GR. Mud log is not high enough - suspect fresh water above 1186m.

ORIGINAL PICK IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 75 NAME: SHELL NIGLINTGAK B-19
 K.B.: 10.6 m. G.L.: 2.1 m. CSG: 33.5 m. T.D.: 334.1 m. BHT: 25.6 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	181	198	✓		IBPF at abrupt RES chg. Trans at base of gradient Starts below IBPF	X
Acoustic	BHCS						
Long Acoustic	Sonic					Starts below IBPF	
SP	✓						
GR	✓						
Caliper	✓						
Neutron							
Density							
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²	✓	176+15	E181				
Crystal							
SRS Velocity							
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT 872m 998m INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS RES, Acoustic, GR, SP

AS INDICATED FROM MUD GAS LOGS Yes, High mud gas readings from 518m down 1525m

COMMENTS: IBPF/PERMAFROST

HYDRATES:

Other than 872 - 998 the high mud gas is associated with shales, above zone has high RES. Much cycle skipping is clean by the GR. SP conforms reasonably well, may be free gas - it is below the base of hydrate prone envelope.

ORIGINAL PICK IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 76 NAME: SHELL NIGLINTGAK M-19
 K.B.: 10.0 m. G.L.: 1.5 m. CSG: 160.0 m. T.D.: 546.5 m. BHT: 21.7°C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic SP GR Caliper Neutron Density Mud Gas Sample Open H.Temp GSC Temp. ² Crystal SRS Velocity Other	DIL/DLL BHCS ✓ ✓	58 57	213 > 148		✓	Resistive point of inflection. Trans at base of gradient Much skips above 238 Much overgauge above 225	X

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT 806 to 851 INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS DIL, DLL, Acoustic, GR, SP
 AS INDICATED FROM MUD GAS LOGS YES

COMMENTS: IBPF/PERMAFROST

Poor data, RES only, possibly IBPF is a lens only.

COMMENTS: HYDRATES

RES logs were obtained on July 24, 29 and 31. and all indicate little invasion, acoustic has lost signal, SP & GR generally conform hole is on gauge. Low probability of hydrate as it is below the depth for methane hydrate

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 77 NAME: SHELL UNIPKAT 1-22
 K.B.: 9.7 m. G.L.: 1.5 m. CSG: 26.8 m. T.D.: 182.0 m. BHT: 25.5 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	58	88	✓		IBPF based on abrupt RES cg. Trans based on gradient base Skips throughout	X
Acoustic	BHCS						
Long Acoustic						Big caves above 88m	
SP							
GR							
Caliper	✓						
Neutron							
Density	FDC						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²	✓		E94				
Crystal							
SRS Velocity							
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK IPN
 CHECKED & AGREED IPN

IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL

WELL No.: 78 NAME: SHELL NIGLINTGAK H-30
 K.B.: 10.0 m. G.L.: 1.8 m. CSG: 159.7 m. T.D.: 549.6 m. BHT: 32.2 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	89	189		✓	Resistivity higher than expected. Trans based on gradient Chg. All skips (fr. 172m)	X
Acoustic	BHCS				✓		
Long Acoustic						Big caves down to 239m	
SP							
GR							
Caliper	✓	239			✓		
Neutron	CNL						
Density	FDC						
Mud Gas							
Sample							
Open H.Temp	✓						
GSC Temp. ²	✓	77	E152				
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT 762 - 787, 902 - 924, 954 - 994, 1058-1073 INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS DIL, Acoustic, GR, SP
 AS INDICATED FROM MUD GAS LOGS Moderate mud gas levels only.

COMMENTS: IBPF/PERMAFROST - All poor data, pick based on RES only. Suspect discontinuous IBPF.

COMMENTS: HYDRATE - The 762-787 zone has hydrate qualities, High RES, low invasion, poor SP development, acoustic log has lost signal. It is at the base of hydrate prone envelope. Some possibility that this and equivalent at M-19 are coal (coal not logged in samples). The 902 - 924, 954-994, 1058-1073 zones are similar but they have developed SP, (+) acoustic velocity in similar to coal or higher coal not logged in samples. Moderate mud gas levels, all zones are too deep for methane hydrates.

ORIGINAL PICK _____ IPN

CHECKED & AGREED _____ IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 79 NAME: IMP LANGLEY E-29
 K.B.: 10.6 m. G.L.: 0.9 m. CSG: 153mm. T.D.: 939.4 m. BHT: 8.9 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DISFL	67	82	✓		IBPF at abrupt RES shift. Trans at gradient base	X
Acoustic	BHCS						
Long Acoustic						SP starts below IBPF	
SP	✓						
GR	✓						
Caliper							
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓					7500 - 4500 at 21m	
SRS Velocity	✓					Not enough detail	
Other							

¹ X = Preferred
 S = Supportive ² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK YES
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 80 NAME: NORTH ELLICE J-23
 K.B.: 10.9 m. G.L.: 0.9 m. CSG: 158 m. T.D.: 1234 m. BHT: 23.9°C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	<158		✓		Not evident log top 158m	X
Acoustic							
Long Acoustic	BHCS					Top interval 1486m	
SP							
GR							
Caliper							
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²		62+ 8	E 84				
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

IBPF above logged interval

ORIGINAL PICK IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 81 NAME: IMP IKATTOK J-17
 K.B.: 8.9 m. G.L.: -7.6 m. CSG: 182.6 m. T.D.: 426 m. BHT: 26 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<170		✓		IBPF above top logged interval	X
Acoustic	BHCS						
Long Acoustic						SP & GR generally conform	
SP	✓	<170					
GR	✓						
Caliper							
Neutron	CNL						
Density	FDC						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓					4500 from surface to 152m	
SRS Velocity							
Other							

¹ X = Preferred
 S = Supportive ² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

IBPF above top of logged interval, 170m

ORIGINAL PICK _____

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 82 NAME: ARCO SMOKING HILLS A-23

K.B.: 292.1 m. G.L.: 289.7m. CSG: _____ m. T.D.: _____ m. BHT: _____ °C

Data Category	Avail	Indicates		Reliable		Reason	Picks ¹
	Type	IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic SP GR Caliper Neutron Density Mud Gas Sample Open H.Temp GSC Temp. ² Crystal SRS Velocity Other						NO LOGS RUN	

¹ X = Preferred ² Depth Adjusted to
S = Supportive KB Datum

CONSIDER GAS HYDRATES AT NO LOGS RUN INTERVALS
AS INDICATED FROM PETROPHYSICAL LOGS _____
AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

NO DATA

ORIGINAL PICK _____

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 83 NAME: ELF ET AL KILIGVAK I-29
 K.B.: 17.4 m. G.L.: 13.7 m. CSG: 159.4 m. T.D.: 459.9 m. BHT: 27.8 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic SP GR Caliper Neutron Density Mud Gas Sample Open H.Temp GSC Temp. ² Crystal SRS Velocity Other	DIL BHCS	<159		✓		IBPF above top logged interval 159m	X

¹ X = Preferred
 S = Supportive
² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

IBPF ABOVE TOP OF LOGGED INTERVAL

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 84 NAME: IMP AKKU F-14
 K.B.: 40.2 m. G.L.: 33.5 m. CSG: 25.9 m. T.D.: 699.5 m. BHT: 10 °C

Data Category	Avail	Indicates		Reliable		Reason	Picks ¹
	Type	IBPF	Trans	Hi	Lo		
RES	DIL	229			✓	Base of significant frozen sand Hi velocity of frozen sand above	X
Acoustic	BHCS	229			✓		S
Long Acoustic						SP & GR generally conform Very big hole above 129m	
SP	✓						
GR	✓					Much big hole above 207m	
Caliper	✓	207			✓		
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity	✓	228			✓	Not enough detail	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
COMMENTS: IBPF/PERMAFROST

Indefinite IBPF, some minor frozen lenses below pick of 229m

ORIGINAL PICK YES
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 85 NAME: IOE PIKIOLIK M-26
 K.B.: 24.0 m. G.L.: 17.4 m. CSG: 164.0 m. T.D.: 621.2 m. BHT: 18 °C

Data Category	Avail	Indicates		Reliable		Reason	Picks ¹
	Type	IBPF	Trans	Hi	Lo		
RES	DIL	340			✓	IBPF where RES rises	X
Acoustic	BHCS	340	356		✓	IBPF where vel. goes High. Much skipping above 356m	S
Long Acoustic							
SP	✓					SP & GR conform throughout	
GR	✓					Top reading 619m.	
Caliper							
Neutron	CNL						
Density	FDC						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²	✓		368+				
Crystal	✓					12,500-7800 @158m (csg.)	
SRS Velocity	✓	305			✓	7,800-6600 @ 305m	
Other						Not enough detail	

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK _____ DL
 CHECKED & AGREED _____ IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 86 NAME: IMP PILIOLOK E-54
 K.B.: 24.4 m. G.L.: 17.6 m. CSG: 153.6 m. T.D.: 759.6 m. BHT: 16.7 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	425			✓	IBPF at abrupt RES increase Deepest skip	X
Acoustic	BHCS	427					
Long Acoustic						SP generally conforms with GR	
SP	✓						
GR	✓						
Caliper							
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²	✓		439+				
Crystal							
SRS Velocity							
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT _____ INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

From IBPF (425) to 549 the RES (R1LD) shows ice/hydrate presence in each cleaner section. This is not supported by RLL8 or R1LM and I suspect sonde error of 1LD is set too low.

ORIGINAL PICK IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 87 NAME: ESSO MAYOGIAK M-16
 K.B.: 18.9 m. G.L.: 8.2 m. CSG: 152.5 m. T.D.: 912 m. BHT: 26 °C

Data Category	Avail	Indicates		Reliable		Reason	Picks ¹
	Type	IBPF	Trans	Hi	Lo		
RES	DIL	411			✓	IBPF based on abrupt RES increase	X
Acoustic							
Long Acoustic							
SP	✓					Little SP activity	
GR							
Caliper							
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred
 S = Supportive ² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

IPBF based on RES data only

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 88 NAME: IOE MAYOGIAK J-17
 K.B.: 22.5 m. G.L.: 17.6 m. CSG: 694.3 m. T.D.: 1251.2 m. BHT: 27.7 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<694				IBPF above log top 694m	
Acoustic	BHCS						
Long Acoustic							
SP	✓						
GR	✓					GR indicates big caves above 433. Hole enlarged above 762m	
Caliper	✓						
Neutron Density							
Mud Gas Sample						Latent heat above 433	x
Open H.Temp	✓	433			✓		
GSC Temp. ²							
Crystal SRS Velocity							
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

No open hole logs above 694m. IBPF pick based on GR and O.H. temp.

ORIGINAL PICK YES
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 89 NAME: IMP MAYOGIAK L-39
 K.B.: 14.3 m. G.L.: 4.9 m. CSG: 156.7 m. T.D.: 925.1 m. BHT: 26.7 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	636			✓	RES higher than equiv. sands below Top reading 920m	X
Acoustic	SL						
Long Acoustic						Generally conforms to GR up to 655m	
SP	✓						
GR	✓					All caved above 549. 3m cave at 673m	
Caliper	✓	549			✓		
Neutron	CNL						
Density	FDC						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓	>542				Still at 10,500 at 542m	
SRS Velocity	✓	<914				Top shot 914m	
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to
KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

IBPF base at 636 with a 3m lens below at 673m.

ORIGINAL PICK _____ DL _____

CHECKED & AGREED _____ IPN _____

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 90 NAME: GULF KILAGMIOTAK M-16
 K.B.: 29.8 m. G.L.: 24.4 m. CSG: 153.0 m. T.D.: 972.3 m. BHT: 15.5 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	740	790	✓		IBPF on abrupt RES increase. Trans is base of gradient Hi velocity ice above 723	X
Acoustic	BHCS	723					S
Long Acoustic						Little conforming with GR anywhere	S
SP	✓						
GR	✓						
Caliper	✓	724			✓	Big caves above 724	
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓	707			✓	9500 - 6500 at 707m	
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK YES
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 91 NAME: GULF KILAGMIOTAK F-48

K.B.: 26.5 m. G.L.: 19.8 m. CSG: 650.1 m. T.D.: 2492.3 m. BHT: 35°C

Data Category	Avail	Indicates		Reliable		Reason	Picks ¹
	Type	IBPF	Trans	Hi	Lo		
RES	DIL	716	747	✓		IPBF based on abrupt RES chg. Trans at Gradient change Much skipping above	X
Acoustic	BHCS	707			✓		
Long Acoustic						SP conforms with GR throughout	
SP	✓						
GR	✓						
Caliper	✓						
Neutron	✓						
Density	✓						
Mud Gas Sample							
Open H.Temp							
GSC Temp. ²	✓		X607				
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
S = Supportive KB Datum

CONSIDER GAS HYDRATES AT _____ INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK _____ IPN _____

CHECKED & AGREED _____ IPN _____

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 92 NAME: IMP UMIAK N-10
 K.B.: 43.9 m. G.L.: 34.4 m. CSG: 167 m. T.D.: 904.5 m. BHT: °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	701	768	✓		Top reading 904m	X
Acoustic	BHCS						
Long Acoustic							
SP	✓						
GR	✓					Big caves above 701m	S
Caliper	✓	701			✓		
Neutron	CNL						
Density	FDC						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓					Still 9500 at 631m Top shot 720m	
SRS Velocity	✓	>631					
Other							

¹ X = Preferred
S = Supportive ² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT _____ INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 93 NAME: IMP UMIAK J-37
 K.B.: 28.9 m. G.L.: 20.4 m. CSG: 158.8 m. T.D.: 936 m. BHT: 16.1 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	669	733	✓		IBPF at abrupt RES increase. Trans at base of gradient	X
Acoustic	BHCS	669		✓		Base of High velocity at 669	S
Long Acoustic							
SP	✓					Generally conforms with GR	
GR	✓						
Caliper	✓	669			✓	Big caves above 669m	
Neutron Density							
Mud Gas Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓					8800 - 6500 @ 665	
SRS Velocity	✓					Not enough detail	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 94 NAME: IMP MALLIK A-06
 K.B.: 33.5 m. G.L.: 25.9 m. CSG: 160.6 m. T.D.: 920.5 m. BHT: 12.2 °C

Data Category	Avail	Indicates		Reliable		Reason	Picks ¹
	Type	IBPF	Trans	Hi	Lo		
RES	DIL	640		✓		IBPF at abrupt RES change Generally poor above 640m	X
Acoustic	BHCS						
Long Acoustic							
SP	✓					SP & GR conform well	
GR	✓						
Caliper	✓					Hole caved above 732m	
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp	✓	640		✓		Inflection on shift from latent heat above	S
GSC Temp. ²	✓		> 258				
Crystal	✓	603				Still at 8900 at 603m	
SRS Velocity	✓	655			✓	Short spaced SRS	S
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT No hydrates indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

IBPF is at base of sand unit with shale below

ORIGINAL PICK IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 95 NAME: IMP MALLIK J-37
 K.B.: 10.4 m. G.L.: 7.0 m. CSG: 160 m. T.D.: 883.9 m. BHT: °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	622	652	✓		IBPF at base of frozen sand stringer Trans at base of gradient	X
Acoustic	BHCS						
Long Acoustic							
SP	✓					SP generally conforms with GR up to 564m	
GR	✓						
Caliper	✓					Hole is big above 884m	
Neutron	CNL						
Density	FDC						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓	573				11,700 - 7100 at 573m	
SRS Velocity	✓					Not enough detail	
Other							

¹ X = Preferred
S = Supportive ² Depth Adjusted to
KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS No logs

AS INDICATED FROM MUD GAS LOGS Not indicated

COMMENTS: IBPF/PERMAFROST

COMMENTS: HYDRATES

Considered only as it is near a known hydrate well - no support
from mud log or resistivity.

ORIGINAL PICK IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 96 NAME: IOE MALLIK L-38
 K.B.: 9.7 m. G.L.: .9 m. CSG: 163.7 m. T.D.: 906.5 m. BHT: 9 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	613	637	✓		IBPF at abrupt RES change. Trans at gradient change. Hi velocity above 575m.	X
Acoustic	BHCS	575			✓		
Long Acoustic						Little response	
SP	✓						
GR	✓					Top log 906m "	
Caliper							
Neutron	SNL					Appears to be still in IBPF at 573m (Deepest reading)	
Density	FDC						
Mud Gas						Signal dominated by casing velocity Top shot 884	
Sample							
Open H.Temp	T.L.	>573					
GSC Temp. ²							
Crystal	✓						
SRS Velocity	✓						
Other							

¹ X = Preferred
 S = Supportive ² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT 820 to 1113 level INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS RES, SP, Acoustic
 AS INDICATED FROM MUD GAS LOGS Yes

COMMENTS: IBPF/PERMAFROST

COMMENTS: HYDRATES

Classic case of hydrate, gas and water. We concur completely with prior evaluation⁵, which is attached overleaf.

ORIGINAL PICK IPN

CHECKED & AGREED IPN

C. BILY and J. W. L. DICK

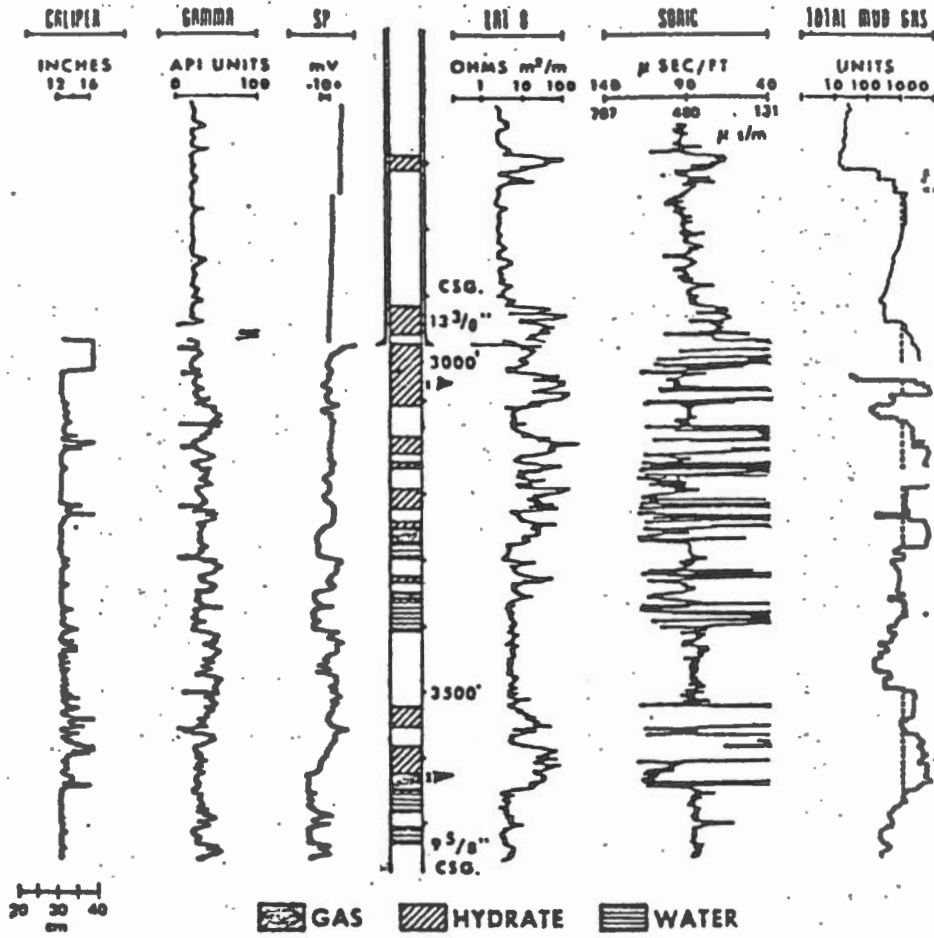


Fig. 9. Hydrate characteristics, IMP 10E Mallik L-38.

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 97 NAME: IMP MALLIK P-59
 K.B.: 8.2 m. G.L.: 0.9 m. CSG: 159 m. T.D.: 1004 m. BHT: 23.9 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	645	707	✓		IBPF at abrupt change. Trans at base of gradient Some loss of signal above 707m.	X
Acoustic	BHCS				✓		
Long Acoustic						SP conforms poorly with GR	
SP	✓						
GR	✓						
Caliper	✓						
Neutron Density							
Mud Gas Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity	✓	640			✓	Short interval (61m) SRSS	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT No hydrates indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST
COMMENTS: HYDRATES

Considered as it is close to known hydrate well (MALLIK L-38).
 No indications here.

ORIGINAL PICK IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 98 NAME: IOE TAGLU G-33
 K.B.: 7.9 m. G.L.: 1.8 m. CSG: 929 m. T.D.: 2330.5 m. BHT: 41.9°C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<929				IBPF above logged interval	
Acoustic	BHCS						
Long Acoustic							
SP	✓						
GR	✓						
Caliper							
Neutron Density							
Mud Gas Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓	543			✓	9000 - 7500 at 543	X
SRS Velocity	✓	457			✓	Not enough detail	
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

IBPF above O.H. logged interval

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 99 NAME: IOE TAGLU C-42
 K.B.: 12.2 m. G.L.: 1.6 m. CSG: 167.6 m. T.D.: 791.3 m. BHT: 6.7°C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIFL	564	670	✓		IBPF at abrupt RES change in a sand Trans at base of gradient change. Generally poor data above 564m	X
Acoustic	BHCA	564					S
Long Acoustic						Generally conforms with GR below 545m	
SP	✓						
GR	✓						
Caliper							
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²	✓		X610+				
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 100 NAME: IOE TAGLU D-43
 K.B.: 11.8 m. G.L.: 1.5 m. CSG: 28.7 m. T.D.: 977.5 m. BHT: 25.6 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	548	618	✓		IBPF at abrupt change. Trans at base of gradient Skips above 548m	X
Acoustic	BHCS	548					S
Long Acoustic						Stops conforming above 558	
SP	✓						
GR	✓						
Caliper							
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²	✓		X633				
Crystal	✓	518				9600-7800 @ 387, 7800-6500 @ 518	
SRS Velocity	✓	457				Not enough detail	
Other Deep ES		548				RES deep ES >RLL8 above 548	S

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK VES
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 101 NAME: IOE TAGLU H-54
 K.B.: 10.6 m. G.L.: 1.5 m. CSG: 28.3 m. T.D.: 927.5 m. BHT: 21.1 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	515			✓	IBPF at base of frozen sand Top logged interval 921	X
Acoustic	BHCS						
Long Acoustic						Conforms with GR throughout	
SP	✓						
GR	✓						
Caliper	✓						
Neutron	CNL						
Density	FDC						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²		513+15	542				
Crystal	✓					12,000-7600 @ 335, 7600-5500 @ 445	
SRS Velocity	✓	609				Not enough detail	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT 1100m level INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS RES log

AS INDICATED FROM MUD GAS LOGS Not confirmed

COMMENTS: IBPF/PERMAFROST

COMMENTS: HYDRATE

RES zones are tight (FDC data)

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 102 NAME: IOE TAGLU D-55
 K.B.: 11.5 m. G.L.: 1.2 m. CSG: 167.6m T.D.: 536.5 m. BHT: 7.2 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	> 533			✓	Run 1 still in IBPF @ 533 Run 2 top 884 below IBPF Top logged interval 884	X
Acoustic	BHCS	< 884					
Long Acoustic							
SP	✓						
GR	✓						
Caliper							
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²	✓		510+				
Crystal	✓					11,000-6700 @ 335m. Not below deepest IBPF.	
SRS Velocity	✓						
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to
KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 103 NAME: IOE TAGLU WEST P-03
 K.B.: 8.5 m. G.L.: 1.2 m. CSG: 907.4 m. T.D.: 2491.7 m. BHT: °C

Data Category	Avail	Indicates		Reliable		Reason	Picks ¹
	Type	IBPF	Trans	Hi	Lo		
RES	DIL	<907				IBPF above top log interval	
Acoustic	BHCS					"	
Long Acoustic							
SP							
GR							
Caliper							
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓	482			✓	9400 - 6400 @ 482	X
SRS Velocity	✓	481			✓	Short interval (40m) SRS	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

IBPF is above logged interval

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 104 NAME: CHEVRON UPLUK C-21
 K.B.: 23.1 m. G.L.: 15.2 m. CSG: 481.9 m. T.D.: 481.9 m. BHT: 21.1 °C

Data Category	Avail	Indicates		Reliable		Reason	Picks ¹
	Type	IBPF	Trans	Hi	Lo		
RES	DIL	233			✓	Deepest IBPF range resistivity Poor data. Poor quality data throughout	X
Acoustic	BHCS						
Long Acoustic						Indicates big hole above 260m	
SP	✓						
GR	✓						
Caliper							
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓	247				7800 - 5650 @ 247m	
SRS Velocity							
Other							

¹ X = Preferred
S = Supportive ² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 105 NAME: CHEVRON UPLUK M-38
 K.B.: 25.6 m. G.L.: 17.0 m. CSG: 159.7 m. T.D.: 744.6 m. BHT: 18.3 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	409	433	✓		IBPF at abrupt RES change in sand Trans at base of ice lens Generally poor above 433	X
Acoustic	BHCS						
Long Acoustic						Little SP activity Very big hole above 381m	
SP	✓						
GR	✓						
Caliper	✓						
Neutron	CNL						
Density	FDC						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred
S = Supportive ² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None Indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK VES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 106 NAME: CCL UPLUK A-42
 K.B.: 22.3 m. G.L.: 13.7 m. CSG: 159 m. T.D.: 922.3 m. BHT: 13.9 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	348	378	✓		IBPF at top of gradient. Trans at base of gradient Top logged interval 919m	X
Acoustic	BHCS						
Long Acoustic						Little activity, SP generally conforming to GR	
SP	✓						
GR	✓					Indicates trans in shaly section	
Caliper							
Neutron							
Density							
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred
S = Supportive ² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None Indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 107 NAME: SUN GARRY P-04
 K.B.: 8.5 m. G.L.: 1.2 m. CSG: 910.7 m. T.D.: 2441.5 m. BHT: 39.6 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<911				Top logged interval 911m	
Acoustic	BHCS	486			✓	Some loss of signal above 486	X
Long Acoustic							
SP	✓					Top SP logged interval 911m	
GR	✓						
Caliper	✓	>482 <512			✓	Deepest massive caved sand 415m Small sand at 482 vaced, one at 512.	S
Neutron	CNL					Top logged interval 911m	
Density	FDC						
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²	✓	509+					
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 108 NAME: SUN GARRY G-07
 K.B.: 17.4 m. G.L.: 8.8m. CSG: 178.6 m. T.D.: 969.3 m. BHT: 11.1 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	422		✓		IBPF at abrupt RES increase (base of sand)	X
Acoustic	BHCS						
Long Acoustic						Top log interval 909m	
SP	✓						
GR	✓						
Caliper	✓						
Neutron	CNL						
Density	FDC						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred
S = Supportive ² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 109 NAME: IMP ADGO C-15
 K.B.: 9.7 m. G.L.: 1.5 m. CSG: 38.4 m. T.D.: 243.2 m. BHT: °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<38		✓		IBPF above logged interval (38m) Top log interval 290m	X
Acoustic	BHCS						
Long Acoustic						Top log interval 290m	
SP	✓						
GR	✓						
Caliper	✓						
Neutron	CNL						
Density	FDC						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓					4500-6200 @ 122m No IBPF present	
SRS Velocity	✓					Not enough detail, top shot 610m	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT 300m interval INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS not seen on RES

AS INDICATED FROM MUD GAS LOGS moderate gas readings

COMMENTS: IBPF/PERMAFROST

COMMENTS: HYDRATE

Moderate gas may be free gas in water - no resistive anomaly

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 110 NAME: IMP ADGO P-25
 K.B.: 8.2 m. G.L.: -1.8 m. CSG: 169.8 m. T.D.: 486.5 m. BHT: 17.8 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL, DLL	<170			✓	Top DLL interval 170m	X
Acoustic	BHCS	<170				Top logged interval 170m	
Long Acoustic							
SP	✓						
GR	✓						
Caliper	✓					Very little caving	
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp	✓					No definite gradient change	
GSC Temp. ²	✓		0			Temperature above 0° throughout	
Crystal							
SRS Velocity	✓					Top shot 457m	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT Check 701 to 793 either coal or hydrate INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS RES and acoustic
 AS INDICATED FROM MUD GAS LOGS High gas present

COMMENTS: IBPF/PERMAFROST

COMMENTS: HYDRATE

Zone is deep for methane hydrate suspect free gas or gas & water.

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 111 NAME: ESSO ADGO J-27
 K.B.: 12.7 m. G.L.: -1.8 m. CSG: 195 m. T.D.: 705.5 m. BHT: 35 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DISFL	<195		✓		IBPF above logged interval (195m) Top logged interval 705m	X
Acoustic	BHCS						
Long Acoustic						Top logged interval 705m	
SP	✓						
GR	✓					"	
Caliper	✓						
Neutron	CNL					"	
Density	FDC						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal						Not detailed enough	
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT 900 - 950m INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS RES and acoustic
 AS INDICATED FROM MUD GAS LOGS Moderate high gas readings

COMMENTS: IBPF/PERMAFROST
COMMENT: HYDRATE

RES and acoustic are consistent with hydrate or free gas being present
 895 to 950m - depth predicts hydrate, probably free gas.

ORIGINAL PICK DL
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 112 NAME: IMP ADGO F-28
 K.B.: 8.2 m. G.L.: -2.1 m. CSG: 150.6 m. T.D.: 940 m. BHT: 26.1 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<151		✓		IBPF above top logged interval Top logged interval 940m	X
Acoustic	BHCS						
Long Acoustic						Little character Top GR at 940m	
SP	✓						
GR	✓					Top Caliper at 940m	
Caliper	✓						
Neutron	CNL						
Density	FDC						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal						Not enough detail. Top shot 152m.	
SRS Velocity	✓						
Other							

¹ X = Preferred
S = Supportive ² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT 490m level INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS RES log only
 AS INDICATED FROM MUD GAS LOGS Not available

COMMENTS: IBPF/PERMAFROST

COMMENT: HYDRATE

RES only indicates possible hydrate - higher than normal resistivity.

ORIGINAL PICK DL
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 113 NAME: IMP SARPIK B-35

K.B.: 10.0 m. G.L.: -4.3 m. CSG: 38.4 m. T.D.: 581.3 m. BHT: 21.7 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<38		✓		IBPF above logged interval 38m Top logged interval 574m	X
Acoustic	BHCS						
Long Acoustic							
SP	✓						
GR	✓						
Caliper							
Neutron	CNL						
Density	FDC						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓					5000 - 6000 @ 189m No. IBPF present	
SRS Velocity	✓						
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to
KB Datum

CONSIDER GAS HYDRATES AT 450m level INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS RES, Cal. and acoustic

AS INDICATED FROM MUD GAS LOGS Not recognized by mud log

COMMENTS: IBPF/PERMAFROST

COMMENT: HYDRATE

Log indications not supported by mud gas data.

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 114 NAME: PACIFIC ROLAND BAY YT L-41
 K.B.: 20.1 m. G.L.: 12.5 m. CSG: 140.2 m. T.D.: 607.8 m. BHT: °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<142			✓	RES follows velocity and density throughout Skips 350-375m (fractures?)	X
Acoustic	BHCS						
Long Acoustic						SP Generally follows GR	
SP	✓						
GR	✓						
Caliper	✓						
Neutron							
Density	FDC						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓					Still at 12,000 at 555m (correct for 80 usec formation. Not enough detail top shot 549m	
SRS Velocity							
Other							

¹ X = Preferred
S = Supportive ² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

No evidence of IBPF in logged interval.

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 115 NAME: AMAGUK H-16
 K.B.: 20.1 m. G.L.: 17.0 m. CSG: 157.6 m. T.D.: 609.6 m. BHT: 17.8 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic	DIL BHCS	210			✓	IBPF pick at deepest non-conforming with acoustic	X
SP	✓	213			✓	SP diverts from GR at 213	S
GR	✓						
Caliper	✓						
Neutron Density							
Mud Gas Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to KB Datum
 S = Supportive

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 116 NAME: IOE MAGUK A-32
 K.B.: 35.0 m. G.L.: 30.7 m. CSG: 617.8 m. T.D.: 1670.6 m. BHT: °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<618				IBPF above logged interval (618m)	
Acoustic	BHCS					"	
Long Acoustic							
SP	✓					Generally conforms to GR to 186m	
GR	✓					GR indicates very big hole above 174m	
Caliper							
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp	✓	320				Min. temp at 320m	
GSC Temp. ²							
Crystal	✓	240			✓	9000 - 6400 at 240m	
SRS Velocity	✓	<304				Top shot 304m	
Other	ES	236		✓		IBPF at abrupt RES increase (at base of a sand)	X

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL & IPN
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 117 NAME: IOE KIMIK D-29
 K.B.: 18.6 m. G.L.: 10.0 m. CSG: 758.0 m. T.D.: 2646.6 m. BHT: 47.8 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<759				IBPF above logged interval	
Acoustic	BHCS					IBPF above logged interval	
Long Acoustic							
SP	✓						
GR	✓						
Caliper	✓						
Neutron	SNP						
Density	FDC						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²			X672				
Crystal	✓	631		✓		8500 - 6200 @ 631	X
SRS Velocity	✓	610			✓	Not enough detail	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 118 NAME: IMP ATERTAK E-41
 K.B.: 19.8 m. G.L.: 12.5 m. CSG: 159.1 m. T.D.: 615.4 m. BHT: 15.6 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	527	553	✓		IBPF at abrupt RES increase	X
Acoustic	BHCS	527			✓	Shift to higher velocity above 527m	S
Long Acoustic							
SP	✓					Poor conforming with GR above 700m	
GR	✓						
Caliper	✓					Top logged interval 612.	
Neutron Density	SNP FDC						
Mud Gas Sample							
Open H.Temp							
GSC Temp. ²			542+				
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 119 NAME: IMP KUGMALLIT H-59
 K.B.: 11.5 m. G.L.: -5.5 m. CSG: 177.4 m. T.D.: 754.7 m. BHT: 10 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	LL8	690			✓	IBPF at base of deepest RES. sand Skips above 671m	X
Acoustic	MSFL						
Long Acoustic	BHCS					Deepest paved sand	
SP	✓						
GR	✓					Deepest paved sand	
Caliper	✓	690					
Neutron	CNL					Deepest paved sand	
Density	FDC						
Mud Gas						Deepest paved sand	
Sample							
Open H.Temp						Deepest paved sand	
GSC Temp. ²							
Crystal						Deepest paved sand	
SRS Velocity	✓	793			✓		
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 120 NAME: IMP IVIK N-17
 K.B.: 35.3 m. G.L.: 28.3m. CSG: 157.9 m. T.D.: 885.1 m. BHT: 15.6 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	672	697	✓		IBPF where RES rises abruptly. Trans at base of gradient Sonic erratic above 710	X
Acoustic	BHCS						
Long Acoustic							
SP	✓	655			✓	SP conforms with GR below 655	
GR							
Caliper	✓	674			✓	Sands caved above 674	S
Neutron	SNP						
Density	FDC						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity	✓	588				Not enough detail	
Other							

¹ X = Preferred ² Depth Adjusted to
 'S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 121 NAME: IMP IVIK J- 26
 K.B.: 30.5 m. G.L.: 23.1 m. CSG: 154.8 m. T.D.: 843.1 m. BHT: 12.1 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	646	678	✓		IBPF at RES, increase in a sand Trans at base of gradient (sand) High velocity above 648m	X
Acoustic	BHCS						S
Long Acoustic							
SP	✓	646			✓	SP not conforming with GR above 646m	S
GR	✓						
Caliper	✓					Sands cave down to 939m Top log interval 838	
Neutron	S&P						
Density	FDC						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²			X507				
Crystal	✓	>506				11,700 at 506m still in IBPF	
SRS Velocity	✓	610			✓	Not enough detail	
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to
KB Datum

CONSIDER GAS HYDRATES AT 980 - 1021 INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS Yes

COMMENTS: IBPF/PERMAFROST

COMMENTS: HYDRATE

Classic example, previously published⁵. We concur completely with prior evaluation, which is enclosed overleaf.

ORIGINAL PICK IPN

CHECKED & AGREED IPN

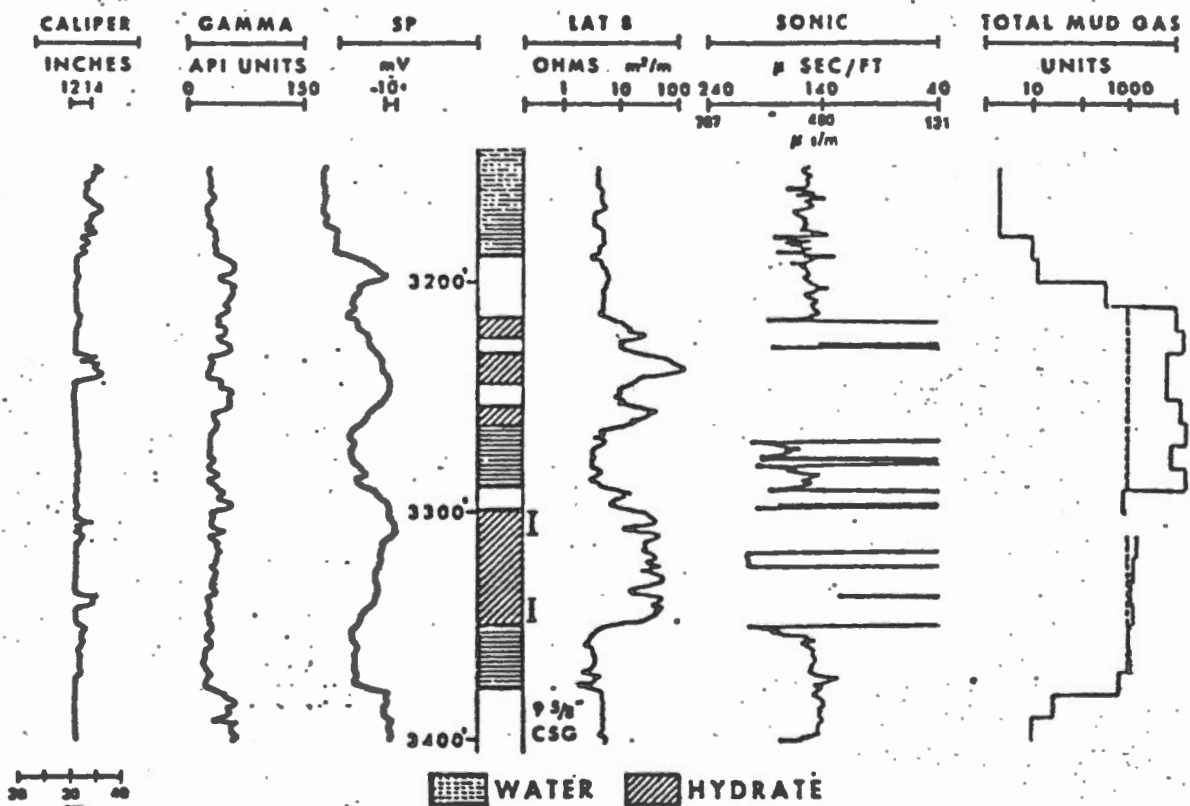


Fig. 10. Hydrate characteristics, IMP Ivik J-26.

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 122 NAME: IMP IVIK C-52
 K.B.: 21.3 m. G.L.: 13.1 m. CSG: 160.3 m. T.D.: 935.4 m. BHT: 14.4 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	649		✓		IBPF at abrupt RES increase	X
Acoustic	BHCS	646			✓	Higher velocity above 646	S
Long Acoustic							
SP	✓	649			✓	SP stops conforming with GR above 649m	S
GR							
Caliper							
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓	649		✓		10,200 - 6700 @ 649m	S
SRS Velocity	✓	610			✓	Not enough detail	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK IPN
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 123 NAME: IMP IVIK K-54
 K.B.: 42.3 m. G.L.: 32.9 m. CSG: 160.0 m. T.D.: 1018.0 m. BHT: 26.1 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	668	726	✓		IBPF at abrupt RES increase. Trans at base of gradient Step to high velocity above 660	X
Acoustic	BHCS						
Long Acoustic						SP not conforming with GR above 608	S
SP	✓	668					
GR	✓					Top log interval 1524m	
Caliper	✓						
Neutron	SNP						
Density	FDC						
Mud Gas Sample							
Open H.Temp						10,000 - 6500	
GSC Temp. ²							
Crystal	✓	625		✓		Not enough detail	
SRS Velocity	✓	610			✓		
Other							

¹ X = Preferred
S = Supportive ² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK IPN
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 124 NAME: SUN BVX ET AL UNARK L-24
 K.B.: 9.7 m. G.L.: -1.8 m. CSG: 1205.2m. T.D.: 2728.6 m. BHT: 40 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic SP GR Caliper Neutron Density Mud Gas Sample Open H.Temp GSC Temp. ² Crystal SRS Velocity Other	BHCS ✓ ✓ CNL FDC	649			✓	High velocity above 655 All sand above 655 and below 692 Top logged interval 1220 " "	X

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

IBPF based on acoustic log only appears shale interval 655 to 692. Separates
 IBPF from non-frozen sand below.

ORIGINAL PICK DL/IPN
 CHECKED & AGREED IPN

IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL

WELL No.: 125 NAME: IMP IMMERS B-48
 K.B.: 13.7 m. G.L.: -3.0 m. CSG: 178 m. T.D.: 925.7 m. BHT: 40.6 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	542			✓	Abrupt RES increase at base of sand	X
Acoustic	BHCS						
Long Acoustic							
SP	✓	509				SP not conforming to GR above 509	
GR	✓						
Caliper	✓	542				Deepest caved sand	S
Neutron							
Density	FDC						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓	304		✓		9500 - 6500 at 384	
SRS Velocity	✓	396			✓	Not enough detail	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

IBPF is base of deepest IBPF. There is an unfrozen section above the base.

ORIGINAL PICK DL
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 126 NAME: SUN PELLY B-35
 K.B.: 8.2 m. G.L.: -3.7 m. CSG: 175.6 m. T.D.: 655.9 m. BHT: 8.3 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	451		✓		IBPF at abrupt RES change	X
Acoustic	BHCS	451				Sudden shift to low velocity	S
Long Acoustic	BHCS	451				"	S
SP	✓					Little SP activity	
GR	✓						
Caliper	✓						
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT Possible at 793 INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS RES and acoustic

AS INDICATED FROM MUD GAS LOGS Not available

COMMENTS: IBPF/PERMAFROST

COMMENTS: HYDRATE

Three intervals 759 - 768, 795-799, 838-841 all have high resistivity, loss of acoustic signal, caved. Acoustic signal is lost from base of deepest sand (841) to top of run (654).

ORIGINAL PICK VES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 127 NAME: IMP NETSERK F-40
 K.B.: 12.7 m. G.L.: -7.6 m. CSG: 169.2 m. T.D.: 572.4 m. BHT: 26.7 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	518			✓	IBPF at base of deepest RES. sand Top logged in interval 570m	X
Acoustic	BHCS						
Long Acoustic						Big caves, above 518. Less caving below	
SP	✓						
GR	✓						
Caliper	✓						
Neutron							
Density	FDC						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓	366				7500 - 6500 @ 366m	
SRS Velocity	✓					Top shot 548	
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to
KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 128 NAME: IMP NETSERK B-44

K.B.: 13.4 m. G.L.: -1.5 m. CSG: 176.5 m. T.D.: 541.9 m. BHT: °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	378		✓		IBPF at abrupt RES increase (at top of sand) Top logged interval 543	X
Acoustic	BHCS						
Long Acoustic						Little activity	
SP	✓						
GR	✓						
Caliper	✓						
Neutron	FDC						
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓	487				7400 - 6300 @ 487m	
SRS Velocity	✓					Top shot 549.	
Other							

¹ X = Preferred ² Depth Adjusted to
S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
AS INDICATED FROM PETROPHYSICAL LOGS _____
AS INDICATED FROM MUD GAS LOGS _____
COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK VES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 129 NAME: IOE NATAGNAK K-23
 K.B.: 26.8 m. G.L.: 22.8 m. CSG: 24.1 m. T.D.: 748.3 m. BHT: °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	IES	535		✓		Abrupt incr. in RES (Base of frozen sand) Log is erratic above 527m Does not conform with GR above 535m 521 is deepest cave Top logged interval 732m	X
Acoustic	BHCS						
Long Acoustic							
SP	✓						
GR	✓						
Caliper	✓						
Neutron	SNP						
Density	FDL						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS None indicated
COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 130 NAME: IOE NATAGNAK H-50
 K.B.: 6.4 m. G.L.: 0.9 m. CSG: 25.3 m. T.D.: 762.6 m. BHT: 9.4 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	538	546	✓		IBPF at RES increase in a sand Trans at base of gradient Weak signal above 591. Signal lost above 546	X
Acoustic	BHCS						
Long Acoustic						Does not conform to GR	
SP	✓						
GR	✓					Big caves above 540 base of sands all shale below	S
Caliper	✓	540					
Neutron	SNL						
Density	FDL						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal						Top shot 518m	
SRS Velocity	✓						
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 131 NAME: IMP NATAGNAK K-53
 K.B.: 20.1 m. G.L.: 13.4 m. CSG: 159.1 m. T.D.: 652.9 m. BHT: 12.8 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	561	576	✓		IBPF at abrupt RES increase. Trans at deepest non-conforming RES vs GR Abrupt shift to high velocity	X
Acoustic	BHCS	561					S
Long Acoustic						Generally conforms except 549-571 (sands)	
SP	✓						
GR	✓						
Caliper	✓						
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓	524				8600 - 6300 at 524m	
SRS Velocity	✓					Top shot 457 - not enough detail	
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK VES
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 132 NAME: IOE ATKINSON H-25
 K.B.: 8.5 m. G.L.: 3.9 m. CSG: 612 m. T.D.: 1765.1 m. BHT: 36.7°C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<612				IBPF above top of logged interval Higher velocity above 466m	
Acoustic	BHCS						
Long Acoustic							
SP	✓						
GR	✓						
Caliper	✓	533			✓	Deepest substantial caved sand Top logged interval 612	X
Neutron	SNL						
Density	FDL						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity	✓	457				Not enough detail	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

IBPF based on caliper data indicating depth of deepest caved sand.

ORIGINAL PICK DL
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 133 NAME: IOE ATKINSON M-53

K.B.: 12.8 m. G.L.: 7.6 m. CSG: 18.3 m. T.D.: 762 m. BHT: 12.8 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	490	512	✓		IBPF at abrupt RES increase Trans at base of gradient	X
Acoustic	BHCS						
Long Acoustic							
SP	✓					SP includes extraneous activity	
GR	✓						
Caliper	✓					Big caves above 505m	S
Neutron	SNL						
Density	FDL						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity	✓					11000 - 7900 @ 381 7900 - 6400 @ 473	
Other							

¹ X = Preferred ² Depth Adjusted to
S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
AS INDICATED FROM PETROPHYSICAL LOGS _____
AS INDICATED FROM MUD GAS LOGS _____
COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 134 NAME: IMP ATKINSON A-55
 K.B.: 8.8 m. G.L.: 2.1 m. CSG: 159.7 m. T.D.: 813.2 m. BHT: 20 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	565			✓	IBPF at base of deepest frozen sd. Top logged interval 813m	
Acoustic	BHCS						
Long Acoustic							
SP	✓						
GR	✓					Top logged interval 813m	
Caliper	✓						
Neutron Density							
Mud Gas Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓	619		✓		8000 - 6600 at 619	X
SRS Velocity	✓	457				Not enough detail	
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 135 NAME: IMP ARNAK L-30
 K.B.: 14.9 m. G.L.: -8.2 m. CSG: 174.9 m. T.D.: 737.6 m. BHT: 21.1 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	662		✓		IBPF at abrupt RES increase (within a sand) Top logged interval 832m	X
Acoustic	BHCS						
Long Acoustic						Deepest caved sand	
SP							
GR	✓						
Caliper	✓	660					
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓	>646		✓		Still in IBPF (9400)	
SRS Velocity	✓	655			✓	Not enough detail	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL/IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 136 NAME: IMP PULLEN E-17
 K.B.: 12.8 m. G.L.: -1.8 m. CSG: 161.5 m. T.D.: 924.2 m. BHT: 18.3 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	604			✓	IBPF at abrupt RES increase Top of logged interval 911	X
Acoustic	BHCS						
Long Acoustic						Does not generally conform with GR	
SP	✓						
GR	✓					Deepest substantial cave	S
Caliper	✓	604					
Neutron							
Density	FDL						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK YES
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 137 NAME: IMP NUKTAK C-22
 K.B.: 47.5 m. G.L.: 38.1 m. CSG: 174.9 m. T.D.: 913.8 m. BHT: 18.3 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DILF	701		✓		IBPF at abrupt RES increase Loss of signal above 695	X
Acoustic	BHCA						
Long Acoustic						SP conforms with GR below 701m	
SP	✓						
GR	✓					Top logged interval 848m	
Caliper							
Neutron	SNL						
Density	CDL						
Mud Gas Sample						Still in IBPF at 686m Top shot 610 (7300)	
Open H.Temp							
GSC Temp. ²							
Crystal	✓	>686		✓			
SRS Velocity	✓						
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT _____ INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS 945m and deeper

COMMENTS: IBPF/PERMAFROST

COMMENT: HYDRATE - high gas readings are not supported by resistivity.

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 138 NAME: DOME NATSEK E-56

K.B.: 12.2 m. G.L.: -55.0 m. CSG: 149 m. T.D.: 534 m. BHT: 18 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL/DLL	<149				IBPF above logged interval 149m Top logged interval 1650m	S
Acoustic							
Long Acoustic	✓						
SP	✓						
GR	✓						
Caliper	✓						
Neutron	CNL						
Density	FDC					Top logged interval 1650m	
Mud Gas Sample							
Open H.Temp						No IBPF indicated (4600 surf. to 60m)	X
GSC Temp. ²							
Crystal	✓	0			✓		
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to KB Datum
S = Supportive

CONSIDER GAS HYDRATES AT None indicated INTERVALS
AS INDICATED FROM PETROPHYSICAL LOGS _____
AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

NO IBPF

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 139 NAME: ELF HORTON RIVER G-02
 K.B.: 38.1 m. G.L.: 33.5 m. CSG: 371 m. T.D.: 1466 m. BHT: 35 °C

Data Category	Avail	Indicates		Reliable		Reason	Picks ¹
	Type	IBPF	Trans	Hi	Lo		
RES	IEL	<371		✓		IBPF above logged interval	X
Acoustic	BHCS						
Long Acoustic							
SP	✓						
GR	✓						
Caliper	✓						
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²	✓		E146				
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 140 NAME: NICHOLSON N-45
 K.B.: 16.7 m. G.L.: 14.6 m. CSG: 89.6 m. T.D.: 863.5 m. BHT: °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic SP GR Caliper Neutron Density Mud Gas Sample Open H.Temp GSC Temp. ² Crystal SRS Velocity Other	EL		198		✓	Base of gradient change	X

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

Shale section, hence long gradual transition of zone.

ORIGINAL PICK DL/IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 141 NAME: TEXCAN NICHOLSON G-56
 K.B.: 73.5 m. G.L.: 71.3 m. CSG: 158.2 m. T.D.: 863.5 m. BHT: 14.4 °C

Data Category	Avail	Indicates		Reliable		Reason	Picks ¹
	Type	IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic SP GR Caliper Neutron Density Mud Gas Sample Open H.Temp GSC Temp. ² Crystal SRS Velocity Other	EL		378		✓	Base of gradient change	X

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

Shale section hence long gradual transition zone

ORIGINAL PICK DL/IPN
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 142 NAME: IMP KAPIK J-39
 K.B.: 13.4 m. G.L.: 6.4 m. CSG: 160.0 m. T.D.: 758.6 m. BHT: 12.8 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	509	527	✓		IBPF at abrupt RES increase. Trans at gradient change. Generally off scale and cycle skipping	X
Acoustic	BHCS						
Long Acoustic							
SP	✓					SP generally follows GR below 475m IBPF is through deepest DS	
GR	✓						
Caliper	✓					Appears stuck at 9" in 8.75" hole	
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓	463		✓		8600 - 6500 at 463m Top shot 762m	
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 143 NAME: IOE NUVORAK 0-09
 K.B.: 10.9 m. G.L.: 6.1 m. CSG: 23.5 m. T.D.: 629.4 m. BHT: 1.1 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic	I-ES DIL BHCS	360		✓		IBPF RES higher than expected DIL top log 632	X
SP	✓					SP generally does not conform	
GR	✓						
Caliper	✓	355			✓	Big caves above 355m Top log 632	S
Neutron Density	SNL FDL						
Mud Gas Sample							
Open H.Temp GSC Temp. ²							
Crystal SRS Velocity	✓	350			✓	Not enough detail	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 144 NAME: IMP AMOROK N-44
 K.B.: 19.2 m. G.L.: 12.5 m. CSG: 159.4 m. T.D.: 906.5 m. BHT: 12.8 °C

Data Category	Avail	Indicates		Reliable		Reason	Picks ¹
	Type	IBPF	Trans	Hi	Lo		
RES	DIL	350		✓		IBPF at RES increase Top log reading 903m SP drifting and not conforming	X
Acoustic	BHC						
Long Acoustic							
SP	✓						
GR	✓						
Caliper	✓						
Neutron							
Density	FDL						
Mud Gas							
Sample							
Open H.Temp						8000 - 6000 at 348m	S
GSC Temp. ²							
Crystal	✓	348		✓			
SRS Velocity	✓	457			✓	Not enough detail	
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 145 NAME: IOE KANGUK I-24
 K.B.: 11.3 m. G.L.: 7.3 m. CSG: 613.3 m. T.D.: 1601.4 m. BHT: 39.4 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<613				IBPF above logged interval	
Acoustic	BHCS					"	
Long Acoustic						"	
SP	✓					"	
GR	✓					"	
Caliper	✓					Top caliper 613m	
Neutron Density							
Mud Gas Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓	421			✓	7700 - 6500 at 421m	X
SRS Velocity	✓	305+			✓	Not enough detail	
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

IBPF from crystal data only

ORIGINAL PICK YES
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 146 NAME: IMP CIGOL KANGUK F-42
 K.B.: 7.9 m. G.L.: 1.2 m. CSG: 160.6 m. T.D.: 649.2 m. BHT: 14.4 °C

Data Category	Avail	Indicates		Reliable		Reason	Picks ¹
	Type	IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic SP GR Caliper Neutron Density Mud Gas Sample Open H.Temp GSC Temp. ²	DIL BHCS ✓ ✓ ✓	473	479		✓	RES increase within a sand Trans at base of gradient Unstable above 498m Generally poor conforming with GR Deepest significant cave 409m	X
Crystal SRS Velocity Other	✓ ✓	476		✓		7800 - 6300 at 476m Top shot 534m	S

¹ X = Preferred
S = Supportive ² Depth Adjusted to
KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK YES
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 148 NAME: IMP ISSERK E-27
 K.B.: 11.3 m. G.L.: 12.8 m. CSG: 181.7 m. T.D.: 855.6 m. BHT: 6.7 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic SP GR	DIL BHCS	674		✓		Abrupt RES increase in a sand Log top 864m	X
Caliper Neutron Density Mud Gas Sample Open H.Temp GSC Temp. ² Crystal SRS Velocity Other	✓ CNL FDC	674			✓	Deepest caved sand	S

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 149 NAME: DOME TARSUUT A-25
 K.B.: 12.2 m. G.L.: -22.9 m. CSG: 413.6 m. T.D.: 1536.0 m. BHT: 27 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<1521				IBPF above logged interval Reasonable data to casing	
Acoustic	LSS	< 413					
Long Acoustic							
SP							
GR	✓						
Caliper							
Neutron	CNL					Log top 413m	
Density	FDC					"	
Mud Gas							
Sample	✓						
Open H.Temp	✓					Temperature decreases to min at 150m	
GSC Temp. ²							
Crystal	✓	0			✓	4700 from surface	X
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT 580-605, 710-812 INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS Acoustic

AS INDICATED FROM MUD GAS LOGS As above plus 518-525

COMMENTS: IBPF/PERMAFROST

No evidence of IBPF

COMMENTS: HYDRATES

Upper 2 gas kicks are in shale but lower (710-812) gives acoustic velocity of water. It is in a big cave, samples show shaly sand. Gas analysis indicates C₁, depth is outside the envelope for methane which precludes these as hydrate zones.

ORIGINAL PICK DL/IPN

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 150 NAME: IMP RUSSELL G-23
 K.B.: 10.6 m. G.L.: 3.9 m. CSG: 158.2m. T.D.: 768.4 m. BHT: 21.1 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	455	506	✓		IBPF at hi res thin sand. Trans to base of gradient Log top 768m	X
Acoustic	BHCS						
Long Acoustic						Conforms little with GR	
SP	✓						
GR	✓					All sand caved. Deepest sand 455	S
Caliper	✓						
Neutron	CNL						
Density	FDC						
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None evident INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK YES
 CHECKED & AGREED IPN

IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL

WELL No.: 151 NAME: IMP KANNERK G-42
 K.B.: 12.2 m. G.L.: -8.5 m. CSG: 184.4 m. T.D.: 893.1 m. BHT: 30.6 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic SP GR	DLL BHCS	601	665	✓		IBPF at abrupt RES increase. Trans at base of gradient Log top 688m	X
Caliper Neutron Density Mud Gas Sample Open H.Temp GSC Temp. ² Crystal SRS Velocity Other	✓ CNL FDC	601				Deepest frozen sand	S

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS _____
 AS INDICATED FROM MUD GAS LOGS _____
 COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK YES
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 152 NAME: DOME UKALERK C-50
 K.B.: 11.5 m. G.L.: -41.5 m. CSG: 288.3 m. T.D.: 759.3 m. BHT: 27.7 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	689		✓		IBPF at abrupt RES increase	X
Acoustic							
Long Acoustic	Sonic						
SP	✓						
GR	✓						
Caliper	✓	704				Sands caved above 704m Log top 753 "	
Neutron	CNL						
Density	FDC						
Mud Gas	✓						
Sample	✓						
Open H.Temp	✓	716				Gradient change	
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred
S = Supportive ² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT 1150 - 1250m INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS RES and acoustic

AS INDICATED FROM MUD GAS LOGS Moderate gas levels

COMMENTS: IBPF/PERMAFROST

COMMENT: HYDRATE

This interval @ 1150m has relatively high resistivity and high acoustic velocity - consistent for frozen hydrate.

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 153 NAME: DOME UKALERK 2C-50
 K.B.: 11.6 m. G.L.: -29.9 m. CSG: 596.8 m. T.D.: 1366.4 m. BHT: 26.7 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	677	690	✓		IBPF at abrupt change. Trans deepest abnormal RES.	X
Acoustic							
Long Acoustic	Sonic					Deepest caved sand	S
SP	✓						
GR	✓						
Caliper	✓	677					
Neutron	CNL						
Density	FDC						
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²							
Crystal	✓	607			✓	10,000 - 6000 @ 607	
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS No indication on RES log.

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

COMMENTS: HYDRATE

Considered hydrate as Ukalerk C-50 had show at 1300 - 1400m on RES log and mud gas. This well shows no resistivity evidence of hydrate.

ORIGINAL PICK YES

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 154 NAME: ESSO ISSUNGNAK
 K.B.: 7.9 m. G.L.: -1.2 m. CSG: 903 m. T.D.: 2667 m. BHT: 63 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	<900		✓		IBPF above logged interval	X
Acoustic	BHCS					Top log 900m	
Long Acoustic						"	
SP	✓						
GR	✓						
Caliper	✓						
Neutron	CNL					Top log 900m	
Density	FDC					Top log 900m	
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred
 S = Supportive ² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT 1067 - 73m INTERVALS
 AS INDICATED FROM PETROPHYSICAL LOGS RES, Acoustic
 AS INDICATED FROM MUD GAS LOGS No mud log.
 COMMENTS: IBPF/PERMAFROST - IBPF above logged interval (900m)

COMMENTS: HYDRATE - The RES and acoustic data are consistent for hydrate (high RES no acoustic signal).

ORIGINAL PICK DL
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 155 NAME: DOME TINGMIARK K-91
 K.B.: 11.5 m. G.L.: -28.0 m. CSG: 1219.2 m. T.D.: 2194.3 m. BHT: 80.6 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<1219				IBPF above interval logged	
Acoustic							
Long Acoustic	BHCS					"	
SP							
GR							
Caliper	✓						
Neutron	GRH						
Density							
Mud Gas							
Sample							
Open H.Temp	✓	552			✓	Temp gradient change	X
GSC Temp. ²							
Crystal							
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL

CHECKED & AGREED IPN

IBPF/PERMAFROST/GAS HYDRATE

ANALYSIS DETAIL

WELL No.: 156 NAME: DOME NERLERK M-98

K.B.: 11.5 m. G.L.: -52.1 m. CSG: 535.5 m. T.D.: 1524.0 m. BHT: °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	688			✓	IBPF at abrupt RES increase (in a sand)	X
Acoustic							
Long Acoustic	Sonic					Acoustic velocity of water is being read in caves	
SP	✓						
GR	✓						
Caliper	✓	695				Deepest substantial cave	
Neutron							
Density							
Mud Gas							
Sample							
Open H.Temp							
GSC Temp. ²							
Crystal	✓					9000 - 6700 at 253 (deepest level 414.6)	
SRS Velocity							
Other							

¹ X = Preferred ² Depth Adjusted to
 S = Supportive KB Datum

CONSIDER GAS HYDRATES AT The base of IBPF INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS RES and acoustic

AS INDICATED FROM MUD GAS LOGS at 550 - 700m

COMMENTS: IBPF/PERMAFROST - crystal cable gives base of upper IBPF section, but was not recorded deep enough to measure the deepest IBPF.

COMMENTS: HYDRATE - Possible hydrates in 550 to 700m level, Log qualities of IBPF/ hydrate and high mud gas, lower mud gas readings at 1200m are also supported by resistivity and acoustic data

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 157 NAME: HUNT KOPANOAR M-13
 K.B.: 12.5 m. G.L.: -57.3 m. CSG: 699.8 m. T.D.: 1643.2 m. BHT: 33.3 °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DIL	<700				IBPF above logged interval	
Acoustic							
Long Acoustic	Sonic					Top reading 700m	
SP	✓					"	
GR	✓						
Caliper							
Neutron	CNL					Through casing data	
Density							
Mud Gas							
Sample							
Open H.Temp	✓	402				Min temp. at 61m. Gradient change at 402m.	S
GSC Temp. ²							
Crystal	✓	402			✓	6000 - 4500 at 402.	X
SRS Velocity							
Other							

¹ X = Preferred
 S = Supportive ² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT 700 - 730m level INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS RES, GR, Acoustic

AS INDICATED FROM MUD GAS LOGS Moderate levels

COMMENTS: IBPF/PERMAFROST - IBPF based on Temp and crystal data

COMMENTS: HYDRATES - High resistivity, lost acoustic signal characteristics are 300m below temp. crystal IBPF pick. Could be contiguous hydrate. Lower high mud gas values are not supported by Resistivity readings.

ORIGINAL PICK DL
 CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 158 NAME: HUNT KOPANOAR D-14

K.B.: _____ m. G.L.: _____ m. CSG: _____ m. T.D.: _____ m. BHT: _____ °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic SP GR Caliper Neutron Density Mud Gas Sample Open H.Temp GSC Temp. ² Crystal SRS Velocity Other						NO LOGS AVAILABLE	

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT _____ INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK _____

CHECKED & AGREED _____

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 159 NAME: DOME ET AL KOPANOAR I-44
 K.B.: 12.2 m. G.L.: -54.0 m. CSG: 200 m. T.D.: 510 m. BHT: °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	408			✓	IBPF at abrupt RES increase in a shaly sand	X
Acoustic							
Long Acoustic	Sonic					Bit size 660mm to 195m, 445 to 500.	
SP	✓						
GR	✓						
Caliper	✓						
Neutron Density						Top shot 1000m	
Mud Gas Sample							
Open H.Temp							
GSC Temp. ²							
Crystal							
SRS Velocity	✓						
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 160 NAME: DOME ET AL NEKTORALIK K-59
 K.B.: 13.1 m. G.L.: -64.3 m. CSG: 320.3 m. T.D.: 784.9 m. BHT: 22.20C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES	DLL	<320				IBPF above logged interval Log top 773m	
Acoustic							
Long Acoustic	Sonic						
SP	✓						
GR	✓						
Caliper	✓						
Neutron	CNL						
Density	FDC						
Mud Gas	✓						
Sample	✓						
Open H.Temp							
GSC Temp. ²							
Crystal	✓	<232			✓	At 5200 at 232m	X
SRS Velocity							
Other							

¹ X = Preferred
S = Supportive

² Depth Adjusted to KB Datum

CONSIDER GAS HYDRATES AT None indicated INTERVALS

AS INDICATED FROM PETROPHYSICAL LOGS _____

AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK DL

CHECKED & AGREED IPN

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS DETAIL**

WELL No.: 161 NAME: DOME KAGLUKIK A-75

K.B.: _____ m. G.L.: _____ m. CSG: _____ m. T.D.: _____ m. BHT: _____ °C

Data Category	Avail Type	Indicates		Reliable		Reason	Picks ¹
		IBPF	Trans	Hi	Lo		
RES Acoustic Long Acoustic SP GR Caliper Neutron Density Mud Gas Sample Open H.Temp GSC Temp. ² Crystal SRS Velocity Other						WELL NOT LOGGED	

¹ X = Preferred ² Depth Adjusted to
S = Supportive KB Datum

CONSIDER GAS HYDRATES AT _____ INTERVALS
AS INDICATED FROM PETROPHYSICAL LOGS _____
AS INDICATED FROM MUD GAS LOGS _____

COMMENTS: IBPF/PERMAFROST

ORIGINAL PICK _____

CHECKED & AGREED _____

IBPF/PERMAFROST/GAS HYDRATE

TABLE 2 RESULTS

WELL		DEPTHS			
No.	Name	Preferred Log Pick IBPF Base of Trans.	Type Log	GSC Temp Data IBPF 0°C	Likely Hydrate Intervals
1	Aklavik F-17	<161	R		
2	Aklavik F-38	<841	R		
3	Aklavik A-37	67 103	R		
4	Crossley Lake SK60	<215	R		
5	Wolverine H-34	<471	R		
6	Scurry Inuvik D-54	<384	R		
7	Napoiak F-31	92 97	R		
8	Beaverhouse Creek	112 135	R	98.4 E204	650-655
9	Kuglauk N-02	98	O	E104	
10	East Reindeer P-60	158	R		186-229
11	Napartok M-01	71	R		
12	Fish River B-60	<232	R		
13	East Reindeer C-38	<490	R		
14	Ogeoqeoq J-06	<164	R		
15	East Reindeer A-01	214	A		360-365.8, 472.7-478.5 489.2-495.3
16	Ikhil I-37	351	R	348+8 E354	328-351
17	Kipnik O-20	76	R		253-261

1 Type Log

R - Resistivity
A - Acoustic

C - Caliper
S - SP

O - O.H. Temp
G - Crystal

IBPF/PERMAFROST/GAS HYDRATE

TABLE 2 RESULTS

WELL		DEPTHS			
No.	Name	Preferred Log Pick IBPF Base of Trans.	Type Log	GSC Temp Data IBPF 0°C	Likely Hydrate Intervals
18	Unak B-11	<158	R		
19	Ulu A-35	<227	R	E99	
20	Sadene D-02	307	A	318+8 313+	
21	Blow River YT E-47	<238	R		
22	Kamik F-38	<536	R		
23	Kamik D-48	390	R	Ex375	
24	Kamik D-58	317 332	R		
25	Kamik L-60	402	G		
26	Parsons F-09	384	G		244
27	Parsons N-10	332	R	E347+15 E360	
28	Parsons N-17	286	G	326+15 E361	
29	Parsons D-20	<1050	R	358+8 E370	
30	Parsons O-27	348	R		
31	Parsons L-37	<1016		320+8 x308+	
32	Parsons P-41	220	G		
33	Parsons L-43	247	R	268+15 E302	

1 Type Log R - Resistivity C - Caliper O - O.H. Temp
A - Acoustic S - SP G - Crystal

IBPF/PERMAFROST/GAS HYDRATE

TABLE 2 RESULTS

WELL		DEPTHS			
No.	Name	Preferred Log Pick IBPF Base of Trans.	Type Log	GSC Temp Data IBPF 0°C	Likely Hydrate Intervals
34	Parsons A-44	352	R		
35	Parsons P-53	307	R		
36	East Reindeer G-04	320	R		
37	Atigi O-48	509	G	570 ₊ 15 Ex 594	
38	Ogruknang M-31	539	A		
39	Tununuk K-10	96 137	R		
40	Tununuk F-30	<166	R		
41	Tulugak K-31	73 102	R		
42	Kugpik O-13	<171	R	E103	
43	Kugpik L-24	88 107	R		
44	Dome Imp Imnak J-29	533	R		
45	Imp Nuna A-32	390	R		
46	Siku C-11	357	R	365 ₊ 8 E385	
47	Siku A-12	358	O	348 ₊ 8 E365	
48	Siku E-21	326	G	398 ₊ 8 E403	
49	Siku C-55	463	R		
50	Reindeer D-27	<464	R	343 ₊ 15 E375	

1 Type Log R - Resistivity C - Caliper O - O.H. Temp
 A - Acoustic S - SP G - Crystal

IBPF/PERMAFROST/GAS HYDRATE

TABLE 2 RESULTS

WELL		DEPTHS			
No.	Name	Preferred Log Pick IBPF Base of Trans.	Type Log	GSC Temp Data IBPF 0°C	Likely Hydrate Intervals
51	Reindeer F-36	342	R	344+8 E363	625-640 727-732
52	Reindeer A-41	335 420	R		
53	Kikoralok N-46	<161	R		760
54	Titalik 0-15	97 107	R		
55	Titalik K-26	<55	G	72+	
56	Kurk M-39	61	G		
57	Ellice 0-14	38	G		
58	Spring River YT N-58	46	O		
59	Eskimo J-07	155 201	R		
60	Tuktu 0-19	335	G		
61	Tuk F-18	<575	R		
62	Wagnark G-12	387	R		
63	Wagnark C-23	518	G		
64	Red Fox P-21	610 640	R		
65	Ya Ya I-17	685 721	R		
66	Ya Ya A-28	674 728	R	Ex 674	
67	Ya Ya M-33	470 548	R		

1 Type Log R - Resistivity C - Caliper O - O.H. Temp
 A - Acoustic S - SP G - Crystal

IBPF/PERMAFROST/GAS HYDRATE

TABLE 2 RESULTS

WELL		DEPTHS			
No.	Name	Preferred Log Pick IBPF Base of Trans.	Type Log	GSC Temp Data IBPF 0°C	Likely Hydrate Intervals
68	Ya Ya P-53	402 438	R	407 + 15 E 438	670-701
69	Torpolok H-24	335 357	R		
70	Torpolok O-54	207 216	R		
71	Kumak J-06	243 291	R		664-710
72	Kumak K-16	241 311	R		
73	Kumak C-58	247 283	R		
74	Kumak E-58	217 288	R	E283	
75	Niglintgak B-19	181 198	R	176+15 E181	872-998
76	Niglintgak M-19	58 213	R	57 >148	806-851
77	Unipkat I-22	58 88	R	E94	
78	Niglintgak H-30	89 189	R	69 E152	762-787, 902-924 954-994, 1058-1073
79	Langley E-29	67 82	R		
80	North Ellice J-23	<158	R	62+8 E84	

1 Type Log R - Resistivity C - Caliper O - O.H. Temp
 A - Acoustic S - SP G - Crystal

IBPF/PERMAFROST/GAS HYDRATE

TABLE 2 RESULTS

WELL		DEPTHS			
No.	Name	Preferred Log Pick IBPF Base of Trans.	Type Log	GSC Temp Data IBPF 0°C	Likely Hydrate Intervals
81	Ikattok J-17	<170	R		
82	Smoking Hills A-23	No logs run			
83	Kiligvak I-29	<159	R		
84	Akku F-14	229	R		
85	Pikiolik M-26	340	R	368+	
86	Pikiolik E-54	425	R	439+	
87	Mayogiak M-16	411	R		
88	Mayogiak J-17	433	O		
89	Mayogiak L-39	636	R		
90	Kilagmiotak M-16	740 790	R		
91	Kilagmiotak F-48	716 747	R	x 607	
92	Umiak N-10	701 768	R		
93	Umiak J-37	669 733	R		
94	Mallik A-06	640	R	>258	
95	Mallik J-37	622 652	R		
96	Mallik L-38	613 637	R		820-1113
97	Mallik P-59	645 707	R		
98	Taglu G-33	543	G		

1 Type Log R - Resistivity C - Caliper O - O.H. Temp
 A - Acoustic S - SP G - Crystal

IBPF/PERMAFROST/GAS HYDRATE

TABLE 2 RESULTS

WELL		DEPTHS			
No.	Name	Preferred Log Pick IBPF Base of Trans.	Type Log	GSC Temp Data IBPF 0°C	Likely Hydrate Intervals
99	Taglu C-42	564 670	R	x 610+	
100	Taglu F-43	548 618	R	x 633	
101	Taglu H-54	515	R	513+15 542	
102	Taglu D-55	>533, <884	R	510+	
103	Taglu West P-03	482	G		
104	Upluk C-21	233	R		
105	Upluk M-38	409 433	R		
106	Upluk A-42	348 378	R		
107	Garry P-04	486	A	509+	
108	Garry G-07	422	R		
109	Adgo C-15	<38	R		300
110	Adgo P-25	<170	R		701-793
111	Adgo J-27	<195	R		900-950
112	Adgo F-28	<151	R		490
113	Sarpik B-35	< 38	R		450
114	Roland Bay YT L-41	<142	R		
115	Amaguk H-16	210	R		
116	Maguk A-32	236	R		
117	Kimik D-29	631	G	X672	

1 Type Log R - Resistivity C - Caliper O - O.H. Temp
 A - Acoustic S - SP G - Crystal

IBPF/PERMAFROST/GAS HYDRATE

TABLE 2 RESULTS

WELL		DEPTHS			
No.	Name	Preferred Log Pick IBPF Base of Trans.	Type Log	GSC Temp Data IBPF 0°C	Likely Hydrate Intervals
118	Atertak E-41	527 543	R	542	
119	Kugmallit H-59	690	R		
120	Ivik N-17	672 697	R		
121	Uvik J-26	646 678	R	x507	980-1021
122	Ivik C-52	649	R		
123	Ivik K-54	668 726	R		
124	Unark L-24	649	A		
125	Imerk B-48	542	R		
126	Pelly B-35	451	R		759-768, 795-799 838-841
127	Netserk F-40	518	R		
128	Netserk B-44	378	R		
129	Natagnak K-23	535	R		
130	Natagnak H-50	538 546	R		
131	Natagnak K-53	561 576	R		
132	Atkinson H-25	533	C		
133	Atkinson M-33	490 512	R		
134	Atkinson A-55	619	G		
135	Arnak L-30	662	R		
136	Pullen E-17	604	R		

1 Type Log R - Resistivity C - Caliper O - O.H. Temp
 A - Acoustic S - SP G - Crystal

IBPF/PERMAFROST/GAS HYDRATE

TABLE 2 RESULTS

WELL		DEPTHS			
No.	Name	Preferred Log Pick IBPF Base of Trans.	Type Log	GSC Temp Data IBPF 0°C	Likely Hydrate Intervals
137	Nuktak C-22	701	R	E146	
138	Natsek E-56	0	G		
139	Horton River G-02	<371	R		
140	Nicholson N-45	198	R		
141	Nicholson G-56	378	R		
142	Kapik J-39	509 527	R		
143	Nuvorak O-09	360	R		
144	Amorok N-44	350	R		
145	Kanguk I-24	421	G		
146	Kanguk F-42	473 479	R		
147	Louth K-45	564 598	R		
148	Isserk E-27	674	R		
149	Tarsiut H-25	0	G		580-605, 710-812
150	Rusell H-23	455 506	R		
151	Kannerk G-42	601 665	R		
152	Ukalerk C-50	689	R	1150-1250	
153	Ukalerk 2C-50	677 690	R		
154	Issungnak O-61	<900	R	1067-1073	

1 Type Log R - Resistivity C - Caliper O - O.H. Temp
 A - Acoustic S - SP G - Crystal

IBPF/PERMAFROST/GAS HYDRATE

TABLE 2 RESULTS

WELL		DEPTHS			
No.	Name	Preferred Log Pick IBPF Base of Trans.	Type Log	GSC Temp Data IBPF 0°C	Likely Hydrate Intervals
155	Tingmiark K-91	552	O		
156	Nerlerk M-98	668	R		550-700
157	Kopanoar M-13	402	G		700-730
158	Kopanoar I-14	No logs available			
159	Kopanoar I-44	408	R		
160	Nektoralik K-59	<232	G		
161	Kaglulik A-75	WELL NOT LOGGED			

1 Type Log

R - Resistivity
A - Acoustic

C - Caliper
S - SP

O - O.H. Temp
G - Crystal

IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS SUMMARY

TABLE 3

WELL		IBPF Depth Indicated / Base of Transition									
No.	Name	Res	Acoustic	SP	Caliper	OH Temp	Crystal	SRS	GSC/IBPF GSC 0°C	Hydrate Considered	Hydrate Likely
1	Aklavik F-17	<u><161</u>	<161	<161							
2	Aklavik F-38	<u><841</u>									
3	Aklavik A-37	<u>67</u> <u>103</u>		118	103						
4	Crossley Lake S K-60	<u><215</u>									
5	Wolverine H-34	<u><471</u>									
6	Scurry Inuvik D-54	<u><384</u>									
7	Napoiak F-31	<u>92</u> <u>97</u>									
8	BeaverHouse Creek H-13	<u>112</u> <u>135</u>	112 135	135		98.4			E204	Yes	Yes
9	Kugaluk N-02	<u><246</u>				98			E104		
10	East Reindeer P-60	<u>158</u>		160	151					Yes	Yes
11	Napartok M-01	<u>71</u>		71							
12	Fish River B-60	<u><232</u>									
13	East Reindeer C-38	<u><490</u>					>85				

1 Preferred Value Underlined

IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS SUMMARY

WELL		IBPF Depth Indicated / Base of Transition										
No.	Name	Res	Acoustic	SP	Caliper	OH Temp	Crystal	SRS	GSC/IBPF GSC 0°C	Hydrate Considered	Hydrate Likely	
14	Ogeoqeq J-06	<u><164</u>		344							Yes	No
15	East Reindeer A-01		214		214						Yes	Yes
16	Ikhil I-37	<u>351</u>	351	351	351				348+8 E354		Yes	Yes
17	Kipnik O-20	<u>76</u>									Yes	Yes or gas
18	Unak B-11	<u><158</u>										
19	Ulu A-35	<u><227</u>							E99			
20	Sadene D-02		<u>307</u>		271				318+8 313+			
21	Blow River YT E-47	<u><238</u>	<238									
22	Kamik F-38	<u><536</u>	<536	<536								
23	Kamik D-48	<u>390</u>	387					>365	Ex375			
24	Kamik D-58	<u>317</u> <u>332</u>						293				
25	Kamik L-60	<1148						<u>402</u>				
26	Parsons F-09	<457 >292						<u>384</u>			Yes	Yes

1 Preferred Value Underlined

IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS SUMMARY

WELL		IBPF Depth Indicated / Base of Transition									
No.	Name	Res	Acoustic	SP	Caliper	OH Temp	Crystal	SRS	GSC/IBPF GSC 0°C	Hydrate Considered	Hydrate Likely
27	Parsons N-10	<u>332</u>			332				E347+15 E360		
28	Parsons N-17	<996					286		326+15 E361		
29	Parsons D-20	< <u>1050</u>							358+8 E370		
30	Parsons O-27	<u>348</u>		348							
31	Parsons L-37	< <u>1016</u>							320+8 X308+		
32	Parsons P-41	<308					<u>220</u>				
33	Parsons L-43	<u>247</u>	247		247				268+15 E302		
34	Parsons A-44	<u>352</u>	359	332							
35	Parsons P-53	<u>307</u>	304 320	320			317				
36	East Reindeer G-04	<u>320</u>	323		365		152				
37	Atigi O-48	<761	<761				<u>509</u>		570+15 Ex594		

1 Preferred Value Underlined

IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS SUMMARY

WELL		IBPF Depth Indicated / Base of Transition									
No.	Name	Res	Acoustic	SP	Caliper	OH Temp	Crystal	SRS	GSC/IBPF GSC 0°C	Hydrate Considered	Hydrate Likely
38	Ogruknang M-31		<u>539</u>								
39	Tununuk K-10	<u>96</u> <u>137</u>		125	96	320					
40	Tununuk F-30	< <u>166</u>		190			<301				
41	Tulugak K-31	<u>73</u> <u>102</u>	<274	73							
42	Kugpik O-13	< <u>171</u>	<171						E103		
43	Kugpik L-24	<u>88</u> <u>107</u>									
44	Dome Imp Imnak J-29	<u>533</u>									
45	Imp Nuna A-32	<u>390</u>		387			378				
46	Siku C-11	<u>357</u>	357						365+8 E385		
47	Siku A-12	<1142	<1142			<u>358</u>			348+8 E365		
48	Siku E-21	<553	<553				<u>326</u>	365+	398+8 E403		

1 Preferred Value Underlined

IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS SUMMARY

WELL		IBPF Depth Indicated / Base of Transition									
No.	Name	Res	Acoustic	SP	Caliper	OH Temp	Crystal	SRS	GSC/IBPF GSC 0°C	Hydrate Considered	Hydrate Likely
49	Siku C-55	<u>463</u>		493				457			
50	Reindeer D-27	< <u>464</u>	<464						343+ <u>15</u> E375		
51	Reindeer F-36	<u>342</u>		335			347	304	344+ <u>8</u> Ex363	Yes	Yes
52	Reindeer A-41	<u>335</u> <u>420</u>	385							Yes	No
53	Kikoralok N-46	< <u>161</u>	<161							Yes	Yes
54	Titalik 0-15	<u>97</u> <u>107</u>									
55	Titalik K-26	<167					<u>55</u>		72+		
56	Kurk M-39	<167					<u>61</u>				
57	Ellice 0-14	<240					<u>38</u>				
58	Spring River YT N-58	<160		46		<u>46</u>					
59	Eskimo J-07	<u>155</u> <u>201</u>	155	201							
60	Tuktu 0-19	<620	<620				<u>335</u>				

1 Preferred Value Underlined

IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS SUMMARY

WELL		IBPF Depth Indicated / Base of Transition									
No.	Name	Res	Acoustic	SP	Caliper	OH Temp	Crystal	SRS	GSC/IBPF GSC 0°C	Hydrate Considered	Hydrate Likely
61	Tuk F-18	<u><575</u>						305			
62	Wagnark G-12	<u>387</u>	424				369				
63	Wagnark C-23	<864					<u>518</u>				
64	Red Fox P-21	<u>610</u> <u>640</u>	610	625					>583		
65	Ya Ya I-17	<u>685</u> <u>721</u>	591				573	610			
66	Ya Ya A-28	<u>673</u> <u>728</u>					573	762	Ex674		
67	Ya Ya M-33	<u>470</u> <u>548</u>	468		468		423				
68	Ya Ya P-53	<u>402</u> <u>438</u>	402		338		351	457	407+15 E438	Yes	Yes
69	Torpolok H-24	<u>335</u> <u>357</u>	320		320		330				
70	Torpolok O-54	<u>207</u> <u>216</u>	204				280			Yes	No
71	Kumak J-06	<u>243</u> <u>291</u>								Yes	Yes

1 Preferred Value Underlined

IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS SUMMARY

WELL		IBPF Depth Indicated / Base of Transition									
No.	Name	Res	Acoustic	SP	Caliper	OH Temp	Crystal	SRS	GSC/IBPF GSC 0°C	Hydrate Considered	Hydrate Likely
72	Kumak K-16	<u>241</u> <u>311</u>	256		264						
73	Kumak C-58	<u>247</u> <u>283</u>	228		220					Yes	No
74	Kumak E-58	<u>217</u> <u>288</u>	217		216				E283	Yes	No
75	Niglintgak B-19	<u>181</u> <u>198</u>							176+15 E181	Yes	Yes or gas
76	Niglintgak M-19	<u>58</u> <u>213</u>							57 148	Yes	Yes or gas
77	Unipkat I-22	<u>58</u> <u>88</u>							E94		
78	Niglintgak H-30	<u>89</u> <u>189</u>			239				69 E152	Yes	Yes or gas
79	Langley E-29	<u>67</u> <u>82</u>									
80	North Ellice J-23	< <u>158</u>							62+8 E84		
81	Ikattok J-17	< <u>170</u>		<170							
82	Smoking Hills A-23	NO LOGS RUN									

1 Preferred Value Underlined

IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS SUMMARY

WELL		IBPF Depth Indicated / Base of Transition									
No.	Name	Res	Acoustic	SP	Caliper	OH Temp	Crystal	SRS	GSC/IBPF GSC 0°C	Hydrate Considered	Hydrate Likely
83	Kiligvak I-29	<u><159</u>									
84	Akku F-14	<u>229</u>	229		207			228			
85	Pikiolik M-26	<u>340</u>	340 356					305	369+		
86	Pikiolik E-54	<u>425</u>	427						439+	Yes	No
87	Mayogiak M-16	<u>411</u>									
88	Mayogiak J-17	<694				433					
89	Mayogiak L-39	<u>636</u>			549		>542	<914			
90	Kilagmiotak M-16	<u>740</u> <u>790</u>	723		724		707				
91	Kilagmiotak F-48	<u>716</u> <u>742</u>	707						x 607		
92	Umiak N-10	<u>701</u> <u>768</u>			701		>631				
93	Umiak J-37	<u>669</u> <u>733</u>	669		669						
94	Mallik A-06	<u>640</u>				640	>603	655	>258		

1 Preferred Value Underlined

IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS SUMMARY

WELL		IBPF Depth Indicated / Base of Transition									
No.	Name	Res	Acoustic	SP	Caliper	OH Temp	Crystal	SRS	GSC/IBPF GSC 0°C	Hydrate Considered	Hydrate Likely
95	Mallik J-37	<u>622</u> <u>652</u>					573			Yes	No
96	Mallik L-38	<u>613</u> <u>637</u>	575			>573				Yes	No
97	Mallik P-59	<u>645</u> <u>707</u>						640		Yes	No
98	Taglu G-33	<929					543	457			
99	Taglu C-42	<u>564</u> <u>670</u>	564		545				x610+		
100	Taglu F-43	<u>548</u> <u>618</u>	548				518	457+	x633		
101	Taglu H-54	<u>515</u>						609	513+15 542	Yes	No
102	Taglu D-55	>533 <u><884</u>							510+		
103	Taglu West P-03	<907					<u>482</u>	481			
104	Upluk C-21	<u>233</u>									
105	Upluk M-38	<u>409</u> <u>453</u>									

1 Preferred Value Underlined

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS SUMMARY**

WELL		IBPF Depth Indicated / Base of Transition									
No.	Name	Res	Acoustic	SP	Caliper	OH Temp	Crystal	SRS	GSC/IBPF GSC 0°C	Hydrate Considered	Hydrate Likely
106	Upluk A-42	<u>348</u> <u>378</u>									
107	Garry P-04	<911	<u>486</u>		>482 <512				509+		
108	Garry G-07	<u>422</u>									
109	Adgo C-15	< <u>38</u>								Yes	No
110	Adgo P-25	< <u>170</u>	<170						0	Yes	Yes or gas
111	Adgo J-27	< <u>195</u>								Yes	Yes or gas
112	Adgo F-28	< <u>151</u>								Yes	Yes
113	Sarpik B-35	< <u>38</u>								Yes	No
114	Roland Bay YT L-41	< <u>142</u>									
115	Amaguk H-16	<u>210</u>		213							
116	Maguk A-32	<u>236</u>				320	240	<304			
117	Kimik D-29	<759					<u>631</u>	610	x672		

1 Preferred Value Underlined

IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS SUMMARY

WELL		IBPF Depth Indicated / Base of Transition									
No.	Name	Res	Acoustic	SP	Caliper	OH Temp	Crystal	SRS	GSC/IBPF GSC 0°C	Hydrate Considered	Hydrate Likely
118	Atertak E-41	<u>527</u> <u>553</u>	527						542+		
119	Kugmallit H-59	<u>690</u>			690			793			
120	Ivik N-17	<u>672</u> <u>697</u>		655	674			588			
121	Ivik J-26	<u>646</u> <u>678</u>		646			>506	610	x507	Yes	Yes
122	Ivik C-52	<u>649</u>	646	649			649	610			
123	Ivik K-54	<u>668</u> <u>726</u>		668			625	610			
124	Unark L-24		<u>649</u>								
125	Imerk B-48	<u>542</u>		509	542		304	396			
126	Pelly B-35	<u>451</u>	451							Yes	Yes
127	Netserk F-40	<u>518</u>					366				
128	Netserk B-44	<u>378</u>					487				
129	Natagnak K-23	<u>535</u>									

1 Preferred Value Underlined

IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS SUMMARY

WELL		IBPF Depth Indicated / Base of Transition										
No.	Name	Res	Acoustic	SP	Caliper	OH Temp	Crystal	SRS	GSC/IBPF	GSC 0°C	Hydrate Considered	Hydrate Likely
130	Natagnak H-50	<u>538</u> <u>546</u>			540							
131	Natagnak K-53	<u>561</u> <u>576</u>	561				524					
132	Atkinson H-25	<612			533			457				
133	Atkinson M-33	<u>490</u> <u>512</u>										
134	Atkinson A-55	565					<u>619</u>	457				
135	Arnak L-30	<u>662</u>			660		>646	655				
136	Pullen E-17	<u>604</u>			604							
137	Nuktak C-22	<u>701</u>					>686					
138	Natsek E-56	<149					<u>0</u>					
139	Horton River G-02	< <u>371</u>							E146		Yes	No
140	Nicholson N-45	<u>198</u>										
141	Nicholson G-56	<u>378</u>										
142	Kapik J-39	<u>509</u> <u>527</u>					463					

1 Preferred Value Underlined

**IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS SUMMARY**

WELL		IBPF Depth Indicated / Base of Transition										
No.	Name	Res	Acoustic	SP	Caliper	OH Temp	Crystal	SRS	GSC/IBPF	GSC 0°C	Hydrate Considered	Hydrate Likely
143	Nuvorak 0-09	<u>360</u>			355			350				
144	Amorok N-44	<u>350</u>					348	457				
145	Kanguk F-42	<613					<u>421</u>	305+				
146	Kanguk F-42	<u>473</u> <u>479</u>					476					
147	Louth K-45	<u>564</u> <u>598</u>					561					
148	Isserk E-27	<u>674</u>			674							
149	Tarsiut H-25	<1521	<413				<u>0</u>				Yes	Yes
150	Russell H-23	<u>455</u> <u>506</u>										
151	Kannerk G-42	<u>601</u> <u>665</u>			601							
152	Ukalerk C-50	<u>689</u>			704	716					Yes	Yes
153	Ukalerk 2C-50	<u>677</u> <u>690</u>			677		607				Yes	No
154	Issungnak 0-61	< <u>900</u>									Yes	Yes

1 Preferred Value Underlined

IBPF/PERMAFROST/GAS HYDRATE
ANALYSIS SUMMARY

WELL		IBPF Depth Indicated / Base of Transition									
No.	Name	Res	Acoustic	SP	Caliper	OH Temp	Crystal	SRS	GSC/IBPF GSC 0°C	Hydrate Considered	Hydrate Likely
155	Tingmiark K-91	<1219				<u>552</u>					
156	Nerlerk M-98	<u>668*</u>			695					Yes	Yes
		*could be hydrates contiguous with IBPF									
157	Kopanoar M-13	<700				402	<u>402</u>			Yes	Yes
158	Kopanoar I-14	NO LOGS AVAILABLE									
159	Kopanoar I-44	<u>408</u>									
160	Nektoralik K-59	<320					<u><232</u>				
161	Kaglulik A-75	WELL NOT LOGGED									

1 Preferred Value Underlined