



**MICROPALEO**  
CONSULTANTS, INC.

**PHILLIPS ALASKA (ARCO)**

**ITKILLIK RIVER NO. 1**

**API #50-103-20003**

**SEC. 10, T8N/R5E UM**

**NORTH SLOPE, ALASKA**

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**BIOSTRATIGRAPHY REPORT**

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## INTEGRATED SUMMARY

80-340'

Tertiary  
Undifferentiated

340-1060'

Late Cretaceous  
Maestrichtian

1060-2320'

Late Cretaceous  
Campanian

2320-4050'?

Late Cretaceous  
Coniacian to Santonian

4050?-4480'

Late Cretaceous  
Turonian to Coniacian

4480-5330'

Late Cretaceous  
Cenomanian

5330-7765'

Early Cretaceous  
Middle to Late Albian

7765-7900'?

Early Cretaceous  
Hauterivian  
KE<sub>H</sub>

7900?-8615'

Early Cretaceous  
Valanginian  
KE<sub>V</sub>

8615-9170'

Late Jurassic  
Kimmeridgian  
JL<sub>K</sub>

9170-9750'

Late Jurassic  
Oxfordian  
JL<sub>O</sub>

9750-9895'

Early Jurassic  
Toarcian  
JE<sub>T</sub>

9895-10,060'

Early Jurassic  
Pliensbachian  
JE<sub>P</sub>

10,060-10,150'

Late Triassic  
Norian  
TL<sub>N</sub>

10,150-10,265'

Late Triassic  
Probable Carnian  
TL<sub>C</sub>

10,265-11,360'

Early Triassic  
TE

Discussion. Ivishak Fm. tops at 10,265 feet and Kavik Fm.  
tops at 11,070 feet.

11,360-11,515'

Probable Late Permian  
PL

Discussion. Ehooka Fm.

11,515-12,060'

Middle to Late Pennsylvanian  
Atokan to Kawvian  
Zone M-22 to Zone M-24

Discussion. Lisburne Group. Wahoo Fm.; Upper  
Limestone Unit.

12,060-12,390'

Middle Pennsylvanian  
Morrowan to Atokan  
Zone M-21

12,390-12,840'

Early Pennsylvanian  
Morrowan  
Zone M-20

12,840-13,230'

Late Mississippian  
Chesterian  
Zone M-18 to Zone M-19

Discussion. Alapah Limestone

13,230-13,440'

Late Mississippian  
Chesterian  
Zone M-17

Discussion. Dolomite Unit

13,440-13,980'

Late Mississippian  
Meramecian to Chesterian  
Zone M-14 to Zone M-16

Discussion. Lower Limy Unit

13,980-14,716C

Late Mississippian  
Meramecian  
Zone M-12 to Zone M-14?

Discussion. Kayak Fm. - Itkilyariak Fm., Zone M-12/13  
between 14,430 and 14,716C feet. Paly zone P-  
T21a.

14,716C-14,950'

Probable Early Mississippian  
Probable Osagean

Discussion. Probable Kekiktuk Fm. Paly zone P-T21b.

14,950-15,321'C T.D.

Indeterminate Age

Discussion. Argillite

# **FORAMINIFERA REPORT**

**Interpreted by:**

**Michael B. Mickey**

## FORAMINIFERA SUMMARY

80-790'

<u>Age.</u>	Latest Cretaceous to Tertiary Undifferentiated
<u>Environment.</u>	Nonmarine to Marginal Marine (Alluvial Plain to Transitional)

790-2320'

<u>Age.</u>	Late Cretaceous Campanian to Maestrichtian
<u>Zone.</u>	F-5
<u>Environment.</u>	Middle to Outer Neritic (Middle to Outer Shelf)

2320-4030'

<u>Age.</u>	Late Cretaceous Coniacian to Santonian
<u>Zones.</u>	F-5 to F-6
<u>Environment.</u>	Bathyal - Some Distal (Slope - Some Starved Basin)

4030-4480'

<u>Age.</u>	Late Cretaceous Turonian to Coniacian
<u>Zone.</u>	F-6
<u>Environment.</u>	Probable Middle to Lower Bathyal (Probable Lower Slope to Base of Slope)

4480-4660'

<u>Age.</u>	Late Cretaceous Probable Cenomanian
<u>Zones.</u>	Probable F-7 to F-8
<u>Environment.</u>	Middle to Lower Bathyal - Distal (Base of Slope - Starved Basin)

4660-5820'

<u>Age.</u>	Early to Late Cretaceous Latest Albian to Cenomanian
<u>Zone.</u>	F-8
<u>Environment.</u>	Possible Bathyal (Possible Slope)

5820-7760'

Age. Early Cretaceous  
Probable Albian

Zones. Probable F-9 to F-11

Environment. Bathyal - Some Distal  
(Slope - Some Starved Basin)

7760-7910'

Age. Early Cretaceous  
Hauterivian

Zone. F-13a

Environment. Middle Neritic  
(Middle Shelf)

7910-8630'

Age. Early Cretaceous  
Valanginian

Zone. F-13b

Environment. Middle to Outer? Neritic  
(Middle to Outer? Shelf)

8630-9140'

<u>Age.</u>	Late Jurassic Kimmeridgian
<u>Zone.</u>	F-16a
<u>Environment.</u>	Middle? Neritic to Upper Bathyal (Middle? Shelf to Upper Slope)

9140-9740'

<u>Age.</u>	Late Jurassic Oxfordian
<u>Zone.</u>	F-16b
<u>Environment.</u>	Upper Bathyal (Upper Slope)

9740-9890'

<u>Age.</u>	Early Jurassic Toarcian
<u>Zone.</u>	F-18a
<u>Environment.</u>	Upper to Lower Bathyal (Upper to Lower Slope)

9890-10,070'

<u>Age.</u>	Early Jurassic Pliensbachian
<u>Zone.</u>	F-18b
<u>Environment.</u>	Upper Bathyal - Distal (Upper Slope - Starved Basin)

10,070-10,160'

<u>Age.</u>	Late Triassic Norian
<u>Zone.</u>	F-19b
<u>Environment.</u>	Inner to Middle Neritic (Inner to Middle Shelf)

10,160-10,280'

<u>Age.</u>	Late Triassic Probable Carnian
<u>Zone.</u>	Probable F-19c
<u>Environment.</u>	Marginal Marine to Inner Neritic (Transitional to Inner Shelf)

10,280-11,340'

<u>Age.</u>	Early Triassic
<u>Zone.</u>	F-20a
<u>Environment.</u>	Marginal Marine to Inner Neritic (Transitional to Inner Shelf)
<u>Discussion.</u>	Ivishak Fm. tops at 10,280 feet and Kavik Fm. tops at 11,070 feet.

11,340-11,520'

<u>Age.</u>	Probable Late Permian
<u>Zone.</u>	Probable F-20b
<u>Environment.</u>	Marginal Marine (Transitional)
<u>Discussion.</u>	Echooka Fm.

11,520-12,060'

<u>Age.</u>	Middle to Late Pennsylvanian Atokan to Kawvian
<u>Zones.</u>	M-22 to M-24
<u>Environment.</u>	Shoaling Shelf (Lagoonal to Inner Bank)
<u>Discussion.</u>	Lisburne Group. Wahoo Fm.; Upper Limestone Unit.

12,060-12,390'

Age. Middle Pennsylvanian  
Morrowan to Atokan

Zone. M-21

Environment. Shoaling Shelf  
(Outer Lagoonal to Bank)

12,390-12,840'

Age. Early Pennsylvanian  
Morrowan

Zone. M-20

Environment. Shoaling Shelf  
(Outer Lagoonal to Bank)

12,840-13,230'

Age. Late Mississippian  
Chesterian

Zones. M-18 to M-19

Environment. Shoaling Shelf  
(Outer Lagoonal to Inner Bank)

Discussion. Alapah Limestone

13,230-13,440'

Age. Late Mississippian  
Chesterian

Zone. M-17

Environment. Shoaling Shelf  
(Supratidal to Inner Lagoonal)

Discussion. Dolomite Unit equivalent.

13,440-14,430'

Age. Late Mississippian  
Meramecian to Chesterian

Zones. M-14 to M-16

Environment. 13,440-13,980': Shoaling Shelf  
(Lagoonal)  
13,980-14,430': Nonmarine to Inner Shelf  
(Alluvial Plain to Inner Lagoonal)

Discussion. Lower Limy Unit. Endicott Group tops at 13,980 feet. Kayak  
Fm. - Itkilyariak Fm.

14,430-14,610'

Age. Late Mississippian  
Meramecian

Zones. M-12 to M-13

Environment. Shoaling Shelf  
(Lagoonal)

14,610-14,940'

<u>Age.</u>	Probable Early Mississippian Probable Osagean
<u>Environment.</u>	Nonmarine to Shoaling Shelf (Alluvial Plain to Lagoonal)
<u>Discussion.</u>	Probable Kekiktuk Fm./Wachsmuth Limestone.

14,940-15,310'

<u>Age.</u>	Indeterminate
<u>Environment.</u>	Indeterminate
<u>Discussion.</u>	Argillite

## **INTRODUCTION**

### **Scope**

Micropaleo Consultants, Inc. processed, picked and analyzed for Foraminifera 188 ditch samples from the Phillips Alaska (ARCO) Itkillik River No. 1 well. Thin sections for Foraminifera were prepared on 123 ditch and two (2) conventional core samples from 11,520 to 15,310 feet. This work was done as part of M.C.I. Job Number 99-111.

### **Procedures**

Standard techniques were used to process the material. All samples were boiled in Quaternary-O and washed over 20 and 200 mesh screens. Frequency symbols correspond to the following numerical values: very rare (1), rare (2 - 4), frequent (5 -25), common (26 - 100), abundant (101 - 999) and prolific (1000+). The picked foram slides and residues are repositated at the State of Alaska Geological Materials Center in Eagle River, Alaska.

Certain factors such as shelf widths, basin configuration and overall basin depths associated with Arctic Mesozoic basins are not completely understood at present. The paleoenvironments presented in this report reflect relative basinal position only and should not be tied to specific water depths. Generally, neritic corresponds to shelf or deltaic environments, while bathyal corresponds to slope or prodelta environments and bathyal (starved basin) corresponds to distal (far from the source) deposition. As an example, prodelta deposits could represent deposition as shallow as middle neritic or as deep as bathyal (slope) depending on the delta type and shelf width. With a narrow shelf, a river-dominated deltaic system could build across the shelf and the prodelta deposits would be in a bathyal (slope) depth. A tide-dominated deltaic system associated with a wide shelf could result in middle neritic prodelta deposition.

### **Format**

A listing of the age, environment, fauna and occasional lithology comments for each biostratigraphic interval follows. A generalized summary of the well is presented in the Conclusions section at the end of the Foraminifera Report. Two Foraminifera Distribution Charts (Figures F-1 & F-2) and a High Resolution Biostratigraphy Plot (Figure B-1) containing foram diversity/abundance plots, a cumulative faunal plot and paleoenvironmental plot(s) are in pockets at the back of this report.

## RESULTS

80-790'

<u>Age.</u>	Latest Cretaceous to Tertiary Undifferentiated
<u>Environment.</u>	Nonmarine to Marginal Marine (Alluvial Plain to Transitional)
<u>Fauna.</u>	Barren of Foraminifera. Rare scattered radiolaria and frequent to abundant coal.

790-2320'

<u>Age.</u>	Late Cretaceous Campanian to Maestrichtian
<u>Zone.</u>	F-5
<u>Environment.</u>	Middle to Outer Neritic (Middle to Outer Shelf)
<u>Fauna.</u>	<i>Valvulineria</i> sp., <i>Anomalinoides solis</i> , <i>A. talaria</i> , <i>A. pinguis</i> , <i>Dentalina basiplanata</i> , <i>Caucasina vitrea</i> , <i>Praebulimina venusae</i> , <i>Eoeponidella strombodes</i> , <i>E. linki</i> , <i>Trochammina stefanssoni</i> , <i>Haplophragmoides bonanzaensis</i> and rare to frequent radiolaria.

2320-4030'

<u>Age.</u>	Late Cretaceous Coniacian to Santonian
<u>Zones.</u>	F-5 to F-6
<u>Environment.</u>	Bathyal - Some Distal (Slope - Some Starved Basin)
<u>Fauna.</u>	Generally barren of Foraminifera with rare to frequent scattered occurrences of <i>Nonionella taylorensis</i> , <i>Haplophragmium?</i> sp., <i>Saccamina lathrami</i> , <i>Trochammina</i> cf. <i>ribstonensis</i> , <i>Spongodiscus</i> spp., <i>Cenosphaera</i> spp., <i>Archicorys</i> sp., <i>Dictyomitra</i> spp., diatoms, pyrite and rare to abundant tar.

4030-4480'

<u>Age.</u>	Late Cretaceous Turonian to Coniacian
<u>Zone.</u>	F-6
<u>Environment.</u>	Probable Middle to Lower Bathyal (Probable Lower Slope to Base of Slope)
<u>Fauna.</u>	Rare to frequent scattered occurrences of <i>Trochammina ribstonensis</i> , <i>T. whittingtoni</i> , <i>Saccamina lathrami</i> , <i>Cenosphaera</i> spp., <i>Inoceramus</i> prisms and pyrite oblates.

4480-4660'

<u>Age.</u>	Late Cretaceous Probable Cenomanian
<u>Zones.</u>	Probable F-7 to F-8
<u>Environment.</u>	Middle to Lower Bathyal - Distal (Base of Slope - Starved Basin)
<u>Fauna.</u>	Rare to frequent occurrences of <i>Saccamina lathrami</i> , <i>Trochamina whittingtoni</i> , <i>Verneuilinoides?</i> sp., <i>Cenosphaera</i> spp., <i>Inoceramus</i> prisms, tar, and rare paper shale below 4570 feet.

4660-5820'

<u>Age.</u>	Early to Late Cretaceous Latest Albian to Cenomanian
<u>Zone.</u>	F-8
<u>Environment.</u>	Possible Bathyal (Possible Slope)
<u>Fauna.</u>	<i>Trochamina stefanssoni</i> , <i>T. ribstonensis</i> , <i>T. rutherfordi</i> , <i>Saccamina lathrami</i> , <i>Trochamminoides</i> sp., <i>Pseudobolivina?</i> sp., <i>Verneuilinoides fischeri</i> , <i>Hyperamminoides</i> cf. <i>barksdalei</i> , <i>Archicorys</i> sp., <i>Cenosphaera</i> spp., <i>Lithocampe?</i> sp., <i>Inoceramus</i> prisms, frequent to common tar, and common pyrite oblates between 5320 and 5420 feet.

5820-7760'

<u>Age.</u>	Early Cretaceous Probable Albian
<u>Zones.</u>	Probable F-9 to F-11
<u>Environment.</u>	Bathyal - Some Distal (Slope - Some Starved Basin)
<u>Fauna.</u>	<i>Trochammina umiatensis</i> , <i>T. mcmurrayensis</i> , <i>Cenosphaera</i> spp., <i>C. spp.</i> (pyritized), <i>Lithocampe</i> sp. N, <i>Inoceramus</i> prisms, tar and rare to abundant scattered paper shale.

7760-7910'

<u>Age.</u>	Early Cretaceous Hauterivian
<u>Zone.</u>	F-13a
<u>Environment.</u>	Middle Neritic (Middle Shelf)
<u>Fauna.</u>	Arenaceous spp. (large, coarse), <i>Ammobaculites erectus</i> , pyrite, frequent rounded frosted quartz floating sand grains and frequent to common paper shale.

7910-8630'

<u>Age.</u>	Early Cretaceous Valanginian
<u>Zone.</u>	F-13b
<u>Environment.</u>	Middle to Outer? Neritic (Middle to Outer? Shelf)
<u>Fauna.</u>	Arenaceous spp. (large, coarse), <i>Ammobaculites erectus</i> , <i>A. reophacoides</i> , <i>Haplophragmoides coronis</i> , <i>H. duoflatis</i> , <i>H. inflatigrandis</i> , <i>H. goodenoughensis</i> , <i>Rectoglandulina netrona</i> , <i>Trochammina conicominita</i> , <i>T. squamata</i> , <i>Globulina canadensis</i> , <i>Oolina apiculata</i> , <i>Lenticulina muensteri</i> , <i>Gaudryina milleri</i> , <i>G. leffingwelli</i> , <i>Saracenaria projectura</i> , ostracods, pyrite and rare to frequent rounded frosted quartz floating sand grains.

8630-9140'

<u>Age.</u>	Late Jurassic Kimmeridgian
<u>Zone.</u>	F-16a
<u>Environment.</u>	Middle? Neritic to Upper Bathyal (Middle? Shelf to Upper Slope)
<u>Fauna.</u>	<i>Trochammina kosyrevae</i> , <i>Globulina topagorukensis</i> , <i>Ammobaculites alaskensis</i> , <i>A. vetusta</i> , <i>A. barrowensis</i> , <i>Haplophragmoides canui</i> , <i>H. spp.</i> , <i>Gaudryina milleri</i> , <i>G. leffingwelli</i> , arenaceous spp. (large, coarse), <i>Lenticulina audax</i> , <i>Marginulinopsis phragmites</i> , <i>Eoguttulina metensis</i> , <i>Nodosaria phobytica</i> , <i>Reophax suevica</i> , <i>Ammodiscus orbis</i> , pyrite sticks, pyrite, rare to frequent rounded frosted quartz floating sand grains and rare to frequent scattered pyritized radiolaria.

9140-9740'

<u>Age.</u>	Late Jurassic Oxfordian
<u>Zone.</u>	F-16b
<u>Environment.</u>	Upper Bathyal (Upper Slope)
<u>Fauna.</u>	<i>Ammobaculites vetusta</i> , <i>A. alaskensis</i> , <i>A. barrowensis</i> , <i>Haplophragmoides canui</i> , <i>H. spp.</i> , <i>Lenticulina audax</i> , <i>Dentalina ectadia</i> , arenaceous spp. (large, coarse), <i>Gaudryina milleri</i> , <i>G. leffingwelli</i> , <i>G. topagorukensis</i> , <i>Globulina topagorukensis</i> , <i>Ammodiscus cheradospirus</i> , <i>Recurvoides turbinatus</i> , <i>Saracenaria topagorukensis</i> , <i>Trochammina instowensis</i> , <i>Inoceramus</i> prisms, pelecypods, pyrite, pyrite sticks, rare to frequent rounded frosted quartz floating sand grains and rare scattered pyritized radiolaria.

9740-9890'

<u>Age.</u>	Early Jurassic Toarcian
<u>Zone.</u>	F-18a
<u>Environment.</u>	Upper to Lower Bathyal (Upper to Lower Slope)
<u>Fauna.</u>	<i>Haplophragmoides</i> spp., arenaceous spp. (large, coarse), <i>Trochammina canningensis</i> , <i>Ammobaculites vetusta</i> , <i>Globulina topagorukensis</i> , <i>Ammodiscus siliceus</i> , <i>Bathysiphon anomalocoelia</i> , <i>Inoceramus</i> prisms, pyrite and frequent to abundant paper shale.

9890-10,070'

<u>Age.</u>	Early Jurassic Pliensbachian
<u>Zone.</u>	F-18b
<u>Environment.</u>	Upper Bathyal - Distal (Upper Slope - Starved Basin)
<u>Fauna.</u>	Arenaceous spp. (large, coarse), <i>Ammobaculites alaskensis</i> , <i>A. vetusta</i> , <i>Haplophragmoides</i> spp., <i>Ammodiscus siliceus</i> , <i>Quinqueloculina</i> sp. (small), <i>Trochammina instowensis</i> , <i>Inoceramus</i> prisms and abundant paper shale.

10,070-10,160'

<u>Age.</u>	Late Triassic Norian
<u>Zone.</u>	F-19b
<u>Environment.</u>	Inner to Middle Neritic (Inner to Middle Shelf)
<u>Fauna.</u>	<i>Nodosaria shublikensis</i> , <i>N. larina</i> , <i>Trochammina helicta</i> , <i>Haplophragmoides</i> spp., <i>Lingulina alaskensis</i> , <i>Astacolus connudatus</i> , arenaceous spp. (large, coarse), ostracods (medium-large, smooth), <i>Pinna?</i> prisms and rare to frequent <i>Monotis/Halobia</i> shell fragments.

10,160-10,280'

<u>Age.</u>	Late Triassic Probable Carnian
<u>Zone.</u>	Probable F-19c
<u>Environment.</u>	Marginal Marine to Inner Neritic (Transitional to Inner Shelf)
<u>Fauna.</u>	<i>Haplophragmoides</i> spp., arenaceous spp. (large, coarse), <i>Marginulina prisca</i> , <i>Monotis/Halobia</i> fragments, echinoid spines and frequent to common shiny dark gray to black sand- size chert pebbles.

10,280-11,340'

<u>Age.</u>	Early Triassic
<u>Zone.</u>	F-20a
<u>Environment.</u>	Marginal Marine to Inner Neritic (Transitional to Inner Shelf)
<u>Fauna.</u>	Arenaceous spp. (large, coarse), <i>Haplophragmoides</i> spp., <i>Bathysiphon anomalocoelia</i> , <i>Pseudobolivina</i> sp., <i>Ammobaculites</i> cf. <i>vetusta</i> , frequent to abundant tar between 10,310 to 10,450 feet, and frequent sloughed Foraminifera.
<u>Discussion.</u>	Ivishak Fm. tops at 10,280 feet and Kavik Fm. tops at 11,070 feet.

11,340-11,520'

<u>Age.</u>	Probable Late Permian
<u>Zone.</u>	Probable F-20b
<u>Environment.</u>	Marginal Marine (Transitional)
<u>Fauna.</u>	<i>Ammodiscus</i> sp. P, frequent glauconite and rare to frequent sloughed Foraminifera.
<u>Discussion.</u>	Echooka Fm.

11,520-12,060'

<u>Age.</u>	Middle to Late Pennsylvanian Atokan to Kawvian
<u>Zones.</u>	M-22 to M-24
<u>Environment.</u>	Shoaling Shelf (Lagoonal to Inner Bank)
<u>Fauna.</u>	<i>Zellerina designata</i> , <i>Earlandia clavatula</i> , <i>E. elegans</i> , <i>Globivalvulina bulloides</i> , <i>Pseudostaffella</i> spp., <i>Eoschubertella yukonensis</i> , <i>Trepeilopsis</i> spp., <i>Endothyra</i> spp., <i>E. paramosquensis</i> , <i>Pseudoglomospira</i> spp., glomospirids (large, thick-walled), <i>Priscella prisca</i> , <i>Bradyina</i> sp., <i>Volvotextularia mississippiana</i> , <i>Monotaxinoides multivolutus</i> , <i>Biseriella parva</i> , <i>Millerella carbonica</i> , <i>Neoarchaediscus incertus</i> , <i>Archaediscus</i> spp., <i>Girvanella ducii</i> , <i>Stylocodium</i> sp., <i>Asphaltina</i> sp., frequent to common ooids, and rare to frequent birdseyes between 11,970 to 12,030 feet.
<u>Discussion.</u>	Lisburne Group. Wahoo Fm.; Upper Limestone Unit.

12,060-12,390'

<u>Age.</u>	Middle Pennsylvanian Morrowan to Atokan
<u>Zone.</u>	M-21
<u>Environment.</u>	Shoaling Shelf (Outer Lagoonal to Bank)
<u>Fauna.</u>	<i>Pseudoendothyra ornata</i> , <i>P. britishensis</i> , <i>Millerella carbonica</i> , <i>Globivalvulina bulloides</i> , <i>Earlandia elegans</i> , <i>E. clavatula</i> , <i>Endothyra</i> spp., <i>Eoschubertella yukonensis</i> , <i>Trepeilopsis</i> spp., <i>Pseudostaffella</i> spp., <i>Pseudoglomospira</i> spp., <i>Priscella prisca</i> , <i>Biseriella parva</i> , <i>Zellerina designata</i> , <i>Neoarchaediscus incertus</i> , <i>Monotaxinoides multivolutus</i> , <i>Calcisphaera pachysphaerica</i> , <i>C. laevis</i> , <i>Stylocodium</i> sp., <i>Asphaltina</i> sp., <i>Stacheoides meandriiformis</i> , <i>Girvanella ducii</i> , and frequent to abundant ooids and oolites.

12,390-12,840'

<u>Age.</u>	Early Pennsylvanian Morrowan
<u>Zone.</u>	M-20
<u>Environment.</u>	Shoaling Shelf (Outer Lagoonal to Bank)
<u>Fauna.</u>	<i>Endothyra</i> spp., <i>Trepeilopsis</i> spp., <i>Earlandia elegans</i> , <i>E. clavatula</i> , <i>Pseudoglomospira</i> spp., <i>Biseriella parva</i> , <i>Priscella prisca</i> , <i>Zellerina discoidea</i> , <i>Z. designata</i> , archaeodiscids, <i>Pseudoendothyra britishensis</i> , <i>Planoendothyra rotayi</i> , <i>Girvanella ducii</i> , <i>Calcisphaera laevis</i> , <i>C. pachysphaerica</i> , <i>Asphaltina</i> sp., and frequent to common ooids and oolites.

12,840-13,230'

<u>Age.</u>	Late Mississippian Chesterian
<u>Zones.</u>	M-18 to M-19
<u>Environment.</u>	Shoaling Shelf (Outer Lagoonal to Inner Bank)
<u>Fauna.</u>	<i>Paleotextularia</i> ss., <i>Endothyra</i> spp., <i>Biseriella parva</i> , <i>Earlandia elegans</i> , <i>Trepeilopsis</i> spp., <i>Pseudoglomospira</i> spp., <i>Priscella prisca</i> , archaediscids, <i>Archaediscus chernousovensis</i> and rare to frequent <i>Girvanella ducii</i> .
<u>Discussion.</u>	Alapah Limestone

13,230-13,440'

<u>Age.</u>	Late Mississippian Chesterian
<u>Zone.</u>	M-17
<u>Environment.</u>	Shoaling Shelf (Supratidal to Inner Lagoonal)
<u>Fauna.</u>	Barren of Foraminifera. Gray microdolomite.
<u>Discussion.</u>	Dolomite Unit equivalent.

13,440-14,430'

<u>Age.</u>	Late Mississippian Meramecian to Chesterian
<u>Zones.</u>	M-14 to M-16
<u>Environment.</u>	13,440-13,980': Shoaling Shelf (Lagoonal) 13,980-14,430': Nonmarine to Inner Shelf (Alluvial Plain to Inner Lagoonal)
<u>Fauna.</u>	<i>Endothyra</i> spp., <i>E. bowmani</i> , <i>Trepeilopsis</i> spp., <i>Pseudoglomospira</i> spp., <i>Earlandia elegans</i> , <i>E. moderata</i> , <i>Brunsia lenensis</i> , archaediscids, <i>Pseudoammodiscus volgensis</i> , <i>Archaediscus krestovnikovi</i> , <i>Calcisphaera pachysphaerica</i> , <i>C.</i> <i>laevis</i> , ostracods, rare to common coral wall debris, rare scattered glauconite, and frequent to common red shale below 13,980 feet.
<u>Discussion.</u>	Lower Limy Unit. Endicott Group tops at 13,980 feet. Kayak Fm. - Itkilyariak Fm.

14,430-14,610'

<u>Age.</u>	Late Mississippian Meramecian
<u>Zones.</u>	M-12 to M-13
<u>Environment.</u>	Shoaling Shelf (Lagoonal)
<u>Fauna.</u>	<i>Globoendothyra tomiliensis</i> , <i>Pseudoglomospira</i> spp., <i>Trepeilopsis</i> spp., <i>Brunsia lenensis</i> , <i>Earlandia moderata</i> , <i>Endothyra</i> spp., <i>Archaediscus krestovnikovi</i> , ostracods and frequent to common coral wall debris.

14,610-14,940'

<u>Age.</u>	Probable Early Mississippian Probable Osagean
<u>Environment.</u>	Nonmarine to Shoaling Shelf (Alluvial Plain to Lagoonal)
<u>Fauna.</u>	Mixture of scattered long ranging forms such as: <i>Pseudoglomospira</i> spp., <i>Glomospiranella</i> sp., <i>Trepeilopsis</i> spp., <i>Earlandia elegans</i> , <i>Girvanella ducii</i> , coral wall debris, some rare probably sloughed younger forms, coal, and rare to frequent glauconite between 14,880 and 14,940 feet.
<u>Discussion.</u>	Probable Kekiktuk Fm./Wachsmuth Limestone.

14,940-15,310'

<u>Age.</u>	Indeterminate
<u>Environment.</u>	Indeterminate
<u>Fauna.</u>	Barren of indigenous Foraminifera.
<u>Discussion.</u>	Argillite

## CONCLUSIONS

The Phillips Alaska (ARCO) Itkillik River No. 1 well penetrated the following biostratigraphic sequence based on foraminiferal analysis:

- 710+ feet (80-790') of undifferentiated Latest Cretaceous to Tertiary age (Early to Middle Brookian) nonmarine (alluvial plain) to marginal marine (transitional) clastic deposition.
- 3870 feet (790-4660') of Cenomanian to Maestrichtian age (Early Brookian) middle to outer shelf topsets, slope foresets and base of slope bottomsets.
- 3250 feet (4660-7910') of Hauterivian to Albian or Early Cenomanian? age (Early Brookian & Beaufortian - Rift Sequence) middle shelf topsets, slope foresets and base of slope bottomsets.
- 2160 feet (7910-10,070') of Pliensbachian to Valanginian age (Beaufortian - Incipient Rift Sequence) middle shelf to slope (some distal) deposition.
- 1450 feet (10,070-11,520') of Late Permian to Norian age (Late Ellesmerian) marginal marine and inner to middle shelf clastic deposition.
- 3420 feet (11,520-14,940') of probable Early Mississippian to Late Pennsylvanian age (Early Ellesmerian) shoaling shelf supratidal to bank carbonates and nonmarine to marginal marine clastics.
- 370+ feet (14,940-15,310') of indeterminate age (Franklinian) argillite.

# **PALYNOLOGY REPORT**

**Interpreted by:**

**Hideyo Haga**

## PALYNOLOGY SUMMARY

### 80-340'

Age. Tertiary  
Undifferentiated

Environment. Nonmarine

### 340-1240'?

Age. Late Cretaceous  
Maestrichtian

Zone. P-T11

Environment. Nonmarine

### 1240?-2140'

Age. Late Cretaceous  
Campanian

Zone. P-T12

Environment. Nonmarine

### 2140-3040'?

Age. Late Cretaceous  
Santonian - Campanian

Zone. P-M14

Environment. Marine

3040?-4570'

Age. Late Cretaceous  
Possible Turonian - Santonian

Zones. P-M15? to P-M14?

Environment. Marginal Marine to Marine

Remarks. Poor recoveries.

4570-5320'

Age. Late Cretaceous  
Cenomanian

Zone. P-M16

Environment. Marine

5320-7740'

Age. Early Cretaceous  
Middle - Late Albian

Zone. P-M17

Environment. Marine

7740-8190'

Age. Early Cretaceous  
Hauterivian

Zone. P-M19

Environment. Marine

8190-8640'

Age. Early Cretaceous  
Valanginian

Zone. P-M20

Environment. Marginal Marine

8640-8910'

Age. Late Jurassic  
Kimmeridgian

Zone. P-M21

Environment. Marginal Marine

8910-9720'

Age. Late Jurassic  
Oxfordian

Zone. P-M22

Environment. Marine

9720-10,980'

Age. Triassic - Early Jurassic  
Undifferentiated

Zones. P-T16 to P-M24?

Environment. Nonmarine to Marginal Marine

10,980-11,340'

<u>Age.</u>	Early Triassic Undifferentiated
<u>Zone.</u>	P-T17
<u>Environment.</u>	Nonmarine?

11,340-11,520'

<u>Age.</u>	Permian Undifferentiated
<u>Zone.</u>	P-T18
<u>Environment.</u>	Marginal Marine

11,520-14,160'

<u>Age.</u>	Carboniferous Undifferentiated
<u>Zones.</u>	P-T20 to P-T19
<u>Environment.</u>	Marginal Marine

14,160-15,311'C

<u>Age.</u>	Mississippian Undifferentiated
<u>Zone.</u>	P-T21
<u>Environment.</u>	Marginal Marine
<u>Remarks.</u>	14,160-14,716': P-T21a 14,716-15,311'C: P-T21b

15,311C-15,321'C T.D.

<u>Age.</u>	Indeterminate
<u>Environment.</u>	Indeterminate
<u>Remarks.</u>	Kerogen recoveries indicate presence of argillite.

## **INTRODUCTION**

### **Purpose and Scope**

Micropaleo Consultants, Inc. conducted palynological analysis of 169 samples from the Phillips Alaska (ARCO) Itkillik River No. 1 well. The samples consisted of 167 ditch samples that were composited at intervals of 90 feet and two cores. One of the cores is a bottom-hole sample that was examined in four intervals, but reported in a total interval from 15,311C feet to 15,321C feet total depth.

The sample preparations are currently on deposit at the Geological Materials Center in Eagle River, Alaska.

### **Procedures**

Upon examination an estimate of abundance of the identified palynomorph taxa for each sample was recorded in a microcomputer. These data form the basic elements of the species distribution chart (Figure P-1). The distribution chart gives the species abundances and, in addition, displays curves representing the diversity and abundance of the spore-pollen and microplankton assemblages in each sample

Based on the palynomorph assemblages, an age and generalized environment of deposition were interpreted for the palynostratigraphic subdivisions. The environments, are simply categorized as nonmarine, marginal marine or marine. These categories are based on the absence or presence and diversity of microplankton forms.

## RESULTS

### 80-340'

<u>Age.</u>	Tertiary Undifferentiated
<u>Environment.</u>	Nonmarine
<u>Palynomorphs.</u>	This uppermost interval recovered a limited spore-pollen assemblage. The assemblage included forms such as Betulaceae, <i>Laevigatosporites</i> , <i>Osmundacidites</i> , Taxodiaceae, <i>Tiliaepollenites</i> and <i>Ulmipollenites</i> .  No marine forms were present.

### 340-1240'?

<u>Age.</u>	Late Cretaceous Maestrichtian
<u>Zone.</u>	P-T11
<u>Environment.</u>	Nonmarine
<u>Palynomorphs.</u>	The Maestrichtian interval is marked by the appearance of the pollen species <i>Aquilapollenites magnus</i> and <i>Wodehouseia spinata</i> .  Marine forms remain absent in this interval except for a single dinocyst occurrence.

1240?-2140'

<u>Age.</u>	Late Cretaceous Campanian
<u>Zone.</u>	P-T12
<u>Environment.</u>	Nonmarine
<u>Palynomorphs.</u>	<p>The Campanian age assignment is based on the presence of the pollen <i>Aquilapollenites trialatus</i> and the absence of the Maestrichtian forms listed above.</p> <p>Dinocysts occurred in only one sample and was the form <i>Odontochitina operculata</i>.</p>
<u>Discussion.</u>	<p>The upper boundary of this interval is questioned because it is placed at the apparent base of Maestrichtian forms in ditch samples and not at the top occurrence of a Campanian marker.</p>

2140-3040'?

<u>Age.</u>	Late Cretaceous Santonian to Campanian
<u>Zone.</u>	P-M14
<u>Environment.</u>	Marine
<u>Palynomorphs.</u>	<p>The Santonian - Campanian is characterized by a large presence of dinocysts. This assemblage includes the forms <i>Chatangiella biapertura</i>, <i>C. ditissima</i>, <i>C. spectabilis</i>, <i>Hystrichosphaeridium difficile</i>, <i>Laciniadinium biconiculum</i> and <i>Trithyrodinium suspectum</i>.</p> <p>Some of the pollen species reported in the intervals above also occur in this interval, but the spore-pollen assemblage is relatively unimportant in the recognition of this section.</p>
<u>Discussion.</u>	The lower boundary of this interval is questioned because it is placed at the apparent base of <i>Chatangiella</i> assemblage in ditch samples.

3040?-4570'

<u>Age.</u>	Late Cretaceous Possible Turonian to Santonian
<u>Zones.</u>	P-M15? to P-M14?
<u>Environment.</u>	Marginal Marine to Marine
<u>Palynomorphs.</u>	The Turonian - Campanian section represents an interval with decreased palynomorph occurrences. Because of the poor assemblage, the age assignment has been questioned. The presence of <i>Isabelidinium globosum</i> in the bottom part of the interval is positive evidence for Turonian - Coniacian, but the age of the section above its occurrence is tentative.

4570-5320'

<u>Age.</u>	Late Cretaceous Cenomanian
<u>Zone.</u>	P-M16
<u>Environment.</u>	Marine
<u>Palynomorphs.</u>	The Cenomanian interval is marked by appearance of the dinocysts <i>Cribooperidinium edwardsi</i> , <i>Cyclonephelium membraniphorum</i> and <i>Pseudoceratium</i> sp.

5320-7740'

<u>Age.</u>	Early Cretaceous Middle to Late Albian
<u>Zone.</u>	P-M17
<u>Environment.</u>	Marine
<u>Palynomorphs.</u>	This interval is identified by the presence of a few marker dinocyst species. These include <i>Luxadinium propatulum</i> , <i>Ovoidinium verrucosum</i> and <i>Spinidinium vestitum</i> . The consistent occurrence of <i>Palaeoperidinium cretaceum</i> is also usual.

7740-8190'

<u>Age.</u>	Early Cretaceous Hauterivian
<u>Zone.</u>	P-M19
<u>Environment.</u>	Marine
<u>Palynomorphs.</u>	The Hauterivian section is characterized by a distinct dinocyst assemblage. This assemblage includes such species as <i>Dimidiadinium uncinatum</i> , <i>Gardodinium trabeculosum</i> , <i>Imbatodinium micropodum</i> , <i>Oligosphaeridium complex</i> (thick-wall) and <i>Pseudoceratium nudum</i> .

8190-8640'

<u>Age.</u>	Early Cretaceous Valanginian
<u>Zone.</u>	P-M20
<u>Environment.</u>	Marginal Marine
<u>Palynomorphs.</u>	The Valanginian interval is marked by a slight increase in spore-pollen abundance, but the key forms are the dinocysts <i>Gochteodinia villosa</i> , <i>Sirmiodinium grossi</i> and <i>Tubotuberella apatela</i> .

8640-8910'

<u>Age.</u>	Late Jurassic Kimmeridgian
<u>Zone.</u>	P-M21
<u>Environment.</u>	Marginal Marine
<u>Palynomorphs.</u>	The Kimmeridgian interval is represented by a thin interval in which the first Jurassic dinocyst <i>Gonyaulacysta jurassica</i> appears. The assemblage also includes the forms <i>Pareodinia ceratophora</i> , <i>Sirmiodinium grossi</i> and <i>Tubotuberella apatela</i> .

8910-9720'

<u>Age.</u>	Late Jurassic Oxfordian
<u>Zone.</u>	P-M22
<u>Environment.</u>	Marine
<u>Palynomorphs.</u>	The Oxfordian interval is marked by the appearance of a distinct dinocyst assemblage. This assemblage includes <i>Endoscrinium galeritum</i> , <i>Gonyaulacysta cladophora</i> , <i>Nannoceratopsis pellucida</i> , <i>Pareodinia ceratophora</i> and <i>P. osmingtonensis</i> .

9720-10,980'

<u>Age.</u>	Triassic - Early Jurassic Undifferentiated
<u>Zones.</u>	P-T16 to P-M24?
<u>Environment.</u>	Nonmarine to Marginal Marine
<u>Palynomorphs.</u>	This interval contained a rather sporadic spore-pollen assemblage and almost no dinocysts.  The upper part of the interval had a single questionable specimen of an Early Jurassic dinocyst <i>Dapcodinium inornatum</i> . Triassic indicators were the pollen <i>Aratrisporites</i> sp., <i>Kraeuselisporites</i> spp. and <i>Taeniaesporites</i> spp. Indeterminate small spores and spore fragments were also recorded.

10,980-11,340'

<u>Age.</u>	Early Triassic Undifferentiated
<u>Zone.</u>	P-T17
<u>Environment.</u>	Nonmarine?
<u>Palynomorphs.</u>	The Early Triassic interval has a somewhat similar spore-pollen assemblage as above, however, the species occur more abundantly. The assemblage includes <i>Gnetaceaepollenites</i> sp., <i>Klausipollenites staplinii</i> , <i>Lundbladispora</i> sp. and <i>Striatites richteri</i> .
<u>Discussion.</u>	The base of this interval, below 11,160 feet, appears to have an assemblage generally attributed to the Kavik Formation.  No marine palynomorphs were observed.

11,340-11,520'

<u>Age.</u>	Permian Undifferentiated
<u>Zone.</u>	P-T18
<u>Environment.</u>	Marginal Marine
<u>Palynomorphs.</u>	The Permian interval is marked by the appearance of the pollen <i>Vittatina</i> .  The presence of <i>Micrhystridium</i> indicates some marine influences at the site of deposition.

11,520-14,160'

<u>Age.</u>	Carboniferous Undifferentiated
<u>Zones.</u>	P-T20 to P-T19
<u>Environment.</u>	Marginal Marine
<u>Palynomorphs.</u>	The most abundant palynomorph in this interval are the indeterminate spore and spore fragments. Sporadic occurrences of <i>Calamospora</i> , <i>Kraeuselisporites</i> and <i>Lycospora</i> were also recorded in the interval.  The occurrence of <i>Micrhystridium</i> indicates some marine influences, at least in the upper part of the interval.

14,160-15,311'C

<u>Age.</u>	Mississippian Undifferentiated
<u>Zone.</u>	P-T21
<u>Environment.</u>	Marginal Marine
<u>Palynomorphs.</u>	The Mississippian section is marked by the abundance of <i>Lycospora</i> and <i>Densosporites</i> . Also recorded were the spores <i>Diatomozonotriletes cervicornutus</i> and <i>Simonozonotriletes varia</i> .
<u>Discussion.</u>	The <i>Lycospora</i> -rich assemblage suggests that the P-M21a zonule is present from 14,160 feet to 14,716 feet. The lower half of the interval is Densospore-rich and suggests that the P-T21b zonule is present from 14,716 feet to 15,311C feet.

15,311C-15,321'C T.D.

<u>Age.</u>	Indeterminate
<u>Environment.</u>	Indeterminate
<u>Palynomorphs.</u>	Barren of palynomorphs.
<u>Discussion.</u>	The palynologic preparation of the bottom core recovered black organics and minerals. This indicates the presence of argillite.

## CONCLUSIONS

Palynological analysis of the Phillips Alaska (ARCO) Itkillik River No. 1 well provides the following generalized biostratigraphic succession:

- The uppermost interval is identified as undifferentiated Tertiary strata of nonmarine origin. This interval occurs between 80 feet and 340 feet.
- Late Cretaceous strata of Maestrichtian and Campanian ages occur from 340 feet to 2140 feet. These strata are predominantly of nonmarine origin.
- Marine Santonian - Campanian strata are present from 2140 feet to 3040? feet.
- Tentative assignment of Turonian - Santonian age is given to the section from 3040? feet to 4570 feet. This section appears to be of marginal marine to marine origin. The palynomorph recoveries were rather poor.
- Marine Cenomanian strata occur from 4570 feet to 5320 feet.
- Marine Middle to Late Albian strata are placed between 5320 feet and 7740 feet.
- The Neocomian section, consisting of Hauterivian and Valanginian strata, occurs between 7740 feet and 8640 feet. The depositional conditions for the Valanginian section were probably less marine than for the overlying Hauterivian section.
- Marine Late Jurassic strata of Kimmeridgian and Oxfordian ages occur between 8640 feet and 9720 feet.
- Undifferentiated Triassic - Early Jurassic strata of nonmarine to marginal marine origin are designated between 9720 feet and 10,980 feet.
- Early Triassic nonmarine? strata are seen between 10,980 feet and 11,340 feet. The section below 11,160 feet is probably equivalent to the Kavik Formation.
- Marginal marine Permian strata are seen from 11,340 feet to 11,520 feet.

- Undifferentiated Carboniferous strata occur from 11,520 feet to 14,160 feet. The spore recoveries are poor. The environment of deposition was probably marginal marine.
- Mississippian strata occur from 14,160 feet to 15,311C feet. Relatively rich spore assemblages are recovered from this clastic section.
- The bottom core sample, 15,311C feet to 15,321C feet, is in argillitic basement lithology.