



MICROPALEO
CONSULTANTS, INC.

USN/HUSKY - NPRA
EAST TESHEKPUK NO. 1

API #50-103-20006
SEC. 16, T14N/R4W UM
NORTH SLOPE, ALASKA

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BIOSTRATIGRAPHY REPORT

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INTEGRATED SUMMARY

533-1055'

Late Cretaceous
Santonian to Campanian

1055-1625'

Late Cretaceous
Turonian to Coniacian

1625-1945'

Late Cretaceous
Probable Cenomanian

1945-4620'

Early Cretaceous
Middle to Late Albian

4620-6925'

Early Cretaceous
Aptian to Early Albian

6925-7020'

Early Cretaceous
Barremian
KE_B

7020-7125'

Early Cretaceous
Hauterivian
KE_H

7125-7505'

Late Jurassic
Kimmeridgian
JL_K

7505-7680'

Middle Jurassic
Aalenian
JM_A

7680-8060'

Early Jurassic
Toarcian
JE_T

8060-8310'

Early Jurassic
Pliensbachian
JE_P

8310-8530'

Early Jurassic
Hettangian to Sinemurian
JE_H to JE_S

8530-8775'

Late Triassic
Norian
TL_N

8775-8890'

Late Triassic
Probable Carnian
TL_C

8890-9615'

Early Triassic
TE

Discussion. Sadlerochit Group. Ivishak Fm. tops at 8890 feet and Kavik Fm. tops at 9440 feet.

9615-9650'

Probable Late Permian
PL

Discussion. Echooka Fm.

9650-9950'

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

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

9950-10,310'

Early to Middle Pennsylvanian
Morrowan to Atokan
Zone M-21

10,310-10,460'

Early Pennsylvanian
Morrowan
Zone M-20

10,460-10,625'

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

Discussion. Alapah Fm.

10,625-10,664" T.D.

Indeterminate Age

Discussion. Quartzite. Could represent either Endicott Group, Kekiktuk Fm. or older Franklinian basement.

FORAMINIFERA REPORT

Interpreted by:

Michael B. Mickey

FORAMINIFERA SUMMARY

533-1060'

<u>Age.</u>	Late Cretaceous Santonian to Maestrichtian
<u>Zone.</u>	F-5
<u>Environment.</u>	Middle Neritic to Upper Bathyal (Middle Shelf to Upper Slope)

1060-1620'

<u>Age.</u>	Late Cretaceous Turonian to Coniacian
<u>Zones.</u>	F-6 to F-7
<u>Environment.</u>	Bathyal - Some Distal (Slope & Base of Slope - Some Starved Basin)

1620-1940'

<u>Age.</u>	Late Cretaceous Probable Cenomanian
<u>Zone.</u>	Probable F-8
<u>Environment.</u>	Marginal Marine to Middle Neritic (Transitional to Middle Shelf)

1940-4560'

Age. Early Cretaceous
Middle to Late Albian

Zones. F-9 to F-10

Environment. Inner to Outer Neritic
(Inner to Outer Shelf)

4560-6930'

Age. Early Cretaceous
Aptian to Early Albian

Zones. F-10 to F-11

Environment. Bathyal - Distal
(Slope to Base of Slope - Starved Basin)

6930-7020'

Age. Early Cretaceous
Barremian

Zone. F-12

Environment. Outer Neritic to Upper Bathyal - Some Distal
(Outer Shelf to Upper Slope - Some Starved Basin)

7020-7110'

<u>Age.</u>	Early Cretaceous Hauterivian
<u>Zone.</u>	F-13a
<u>Environment.</u>	Middle to Outer Neritic (Middle to Outer Shelf)

7110-7470'

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

7470-7650'

<u>Age.</u>	Middle Jurassic Aalenian
<u>Zone.</u>	F-17
<u>Environment.</u>	Middle to Lower Bathyal (Middle to Lower Slope & Base of Slope)

7650-8040'

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

8040-8310'

<u>Age.</u>	Early Jurassic Pliensbachian
<u>Zone.</u>	F-18b
<u>Environment.</u>	Middle Bathyal (Middle Slope)

8310-8520'

<u>Age.</u>	Early Jurassic Hettangian to Sinemurian
<u>Zone.</u>	F-18c
<u>Environment.</u>	Upper to Middle Bathyal (Upper to Middle Slope)

8520-8790'

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

8790-8880'

<u>Age.</u>	Late Triassic Probable Carnian
<u>Zone.</u>	Probable F-19c
<u>Environment.</u>	Middle Neritic (Middle Shelf)

8880-9600'

<u>Age.</u>	Early Triassic
<u>Zone.</u>	F-20a
<u>Environment.</u>	Nonmarine to Inner Neritic (Alluvial Plain to Inner Shelf)
<u>Discussion.</u>	Sadlerochit Group. Ivishak Fm. tops at 8880 feet and Kavik Fm. tops at 9450 feet.

9600-9655'SW

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

9655SW-9930'

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

9930-10,286'SW

<u>Age.</u>	Early to Middle Pennsylvanian Morrowan to Atokan
<u>Zone.</u>	M-21
<u>Environment.</u>	Shoaling Shelf (Bank)

10,286SW-10,440'

Age. Early Pennsylvanian
Morrowan

Zone. M-20

Environment. Shoaling Shelf
(Bank)

10,440-10,650'

Age. Late Mississippian
Chesterian

Zones. M-18 to M-19

Environment. Shoaling Shelf
(Outer Lagoonal to Bank)

Discussion. Alapah Fm.

10,650-10,664" T.D.

Age. Indeterminate

Environment. Indeterminate

Discussion. Quartzite. Could represent either Endicott Group, Kekiktuk Fm. or older Franklinian basement.

INTRODUCTION

Scope

Data from 357 Foraminifera samples from the USN/HUSKY East Teshekpuk No. 1 well were incorporated into this report. These samples consisted of 312 ditch and 45 sidewall core samples covering the interval 533 to 10,664 feet total depth. Thin sections were also prepared on 40 ditch samples and eight (8) sidewall core samples from 9600 to 10,664 feet total depth. 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, prepared thin sections and residues are repositied 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. Foraminifera Distribution Charts

(Figures F-1 and 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

533-1060'

<u>Age.</u>	Late Cretaceous Santonian to Maestrichtian
<u>Zone.</u>	F-5
<u>Environment.</u>	Middle Neritic to Upper Bathyal (Middle Shelf to Upper Slope)
<u>Fauna.</u>	<i>Haplophragmoides rota</i> , <i>Trochammina albertensis</i> , <i>Saccammina lathrami</i> , <i>Vaginulina schraderensis</i> , <i>Quinqueloculina sphaera</i> , <i>Cenosphaera</i> spp., <i>Spongodiscus</i> spp., coal and pyrite.

1060-1620'

<u>Age.</u>	Late Cretaceous Turonian to Coniacian
<u>Zones.</u>	F-6 to F-7
<u>Environment.</u>	Bathyal - Some Distal (Slope & Base of Slope - Some Starved Basin)
<u>Fauna.</u>	<i>Haplophragmoides</i> spp., <i>H. rota</i> , <i>Saccammina lathrami</i> , <i>Spongodiscus</i> spp., <i>Cenosphaera</i> spp., <i>Theocorys</i> spp., <i>Rhopalodictyum</i> spp., <i>Dictyomitra</i> spp., <i>Crucella</i> spp., <i>Inoceramus</i> prisms, sponge spicules, megaspores, fish debris, rare to common coal, and abundant paper shale below 1540 feet.

1620-1940'

<u>Age.</u>	Late Cretaceous Probable Cenomanian
<u>Zone.</u>	Probable F-8
<u>Environment.</u>	Marginal Marine to Middle Neritic (Transitional to Middle Shelf)
<u>Fauna.</u>	<i>Textularia</i> cf. <i>gravenori</i> , <i>Haplophragmoides rota</i> , <i>Trochammina rutherfordi</i> , <i>T. whittingtoni</i> , <i>Proteonina</i> sp., <i>Inoceramus</i> prisms, pyrite and frequent to abundant coal.

1940-4560'

<u>Age.</u>	Early Cretaceous Middle to Late Albian
<u>Zones.</u>	F-9 to F-10
<u>Environment.</u>	Inner to Outer Neritic (Inner to Outer Shelf)
<u>Fauna.</u>	<i>Haplophragmoides topagorukensis</i> , <i>H. kirki</i> , <i>H. excavatus</i> , <i>Trochammina mcmurrayensis</i> , <i>T. rainwateri</i> , <i>Verneulinoides borealis</i> , <i>Lenticulina macrodisca</i> , <i>L. topagorukensis</i> , <i>Ammobaculites wenonahae</i> , <i>Miliammina manitobensis</i> , <i>Globorotalites alaskensis</i> , <i>Valvulineria loetterlei</i> , <i>Eurycheilostoma grandstandensis</i> , <i>E. robinsonae</i> , <i>Conorboides umiatensis</i> , <i>Gavelinella stictata</i> , <i>G. awunensis</i> , <i>Gaudryina nanushukensis</i> , <i>Psamminopelta bowsheri</i> , <i>Saracenaria projectura</i> , <i>Inoceramus</i> prisms, <i>Ditrupea cornu</i> , frequent to abundant pyrite, frequent to abundant coal and rare to common radiolaria.

4560-6930'

<u>Age.</u>	Early Cretaceous Aptian to Early Albian
<u>Zones.</u>	F-10 to F-11
<u>Environment.</u>	Bathyal - Distal (Slope to Base of Slope - Starved Basin)
<u>Fauna.</u>	<i>Verneuilinoides borealis</i> , <i>Bathysiphon vitta</i> , <i>B. brosgei</i> , <i>Haplophragmoides topagorukensis</i> , <i>H. excavatus</i> , <i>Gaudryina nanushukensis</i> , <i>Psamminopelta subcircularis</i> , <i>P. bowsheri</i> , <i>Eponides morani</i> , <i>Miliammina manitobensis</i> , <i>Gavelinella stictata</i> , <i>Textularia topagorukensis</i> , <i>Saracenaria projectura</i> , <i>Conorboides umiatensis</i> , <i>Inoceramus</i> prisms, <i>Ditrupa cornu</i> , megaspores, frequent to abundant coal, and common to abundant radiolaria below 5790 feet.

6930-7020'

<u>Age.</u>	Early Cretaceous Barremian
<u>Zone.</u>	F-12
<u>Environment.</u>	Outer Neritic to Upper Bathyal - Some Distal (Outer Shelf to Upper Slope - Some Starved Basin)
<u>Fauna.</u>	<i>Bathysiphon vitta</i> , arenaceous spp. (large-coarse), <i>Trochamminoides</i> spp., <i>Inoceramus</i> prisms, fish debris, abundant <i>Lithocampe</i> sp. N var. and common to abundant rounded frosted quartz floating sand grains.

7020-7110'

<u>Age.</u>	Early Cretaceous Hauterivian
<u>Zone.</u>	F-13a
<u>Environment.</u>	Middle to Outer Neritic (Middle to Outer Shelf)
<u>Fauna.</u>	Arenaceous spp. (large-coarse), <i>Trochamminoides</i> spp., <i>Saracenaria trollopei</i> , <i>S. dutroi</i> , <i>Gaudryina tailleuri</i> , <i>Praebulimina nannina</i> , <i>Pseudobolivina</i> sp., <i>Inoceramus</i> prisms and common rounded frosted quartz floating sand grains.

7110-7470'

<u>Age.</u>	Late Jurassic Kimmeridgian
<u>Zone.</u>	F-16a
<u>Environment.</u>	Middle to Outer Neritic (Middle to Outer Shelf)
<u>Fauna.</u>	<i>Ammobaculites alaskensis</i> , <i>A. barrowensis</i> , <i>Trochammina topagorukensis</i> , <i>T. canningensis</i> , <i>Gaudryina tailleuri</i> , arenaceous spp. (large-coarse), <i>Lenticulina toarcense</i> , <i>L. varians</i> , <i>Glomospira pattoni</i> , <i>Haplophragmoides canui</i> , <i>H.</i> spp., <i>Marginulinopsis phragmites</i> , <i>Vaginulina curva</i> , <i>Trochamminoides</i> spp., <i>Ammodiscus asperus</i> , <i>Saracenaria topagorukensis</i> , <i>Conorboides hofkeri</i> , <i>Recurvoides turbinatus</i> , <i>Bathysiphon anomalocoelia</i> , <i>Eoguttulina liasica</i> , <i>Astacolus pediacus</i> , <i>Inoceramus</i> prisms, pyrite, frequent to common radiolaria and rare to common scattered glauconite.

7470-7650'

<u>Age.</u>	Middle Jurassic Aalenian
<u>Zone.</u>	F-17
<u>Environment.</u>	Middle to Lower Bathyal (Middle to Lower Slope & Base of Slope)
<u>Fauna.</u>	<i>Gaudryina tailleuri</i> , <i>G. dyscrita</i> , <i>Haplophragmoides barrowensis</i> , <i>H. spp.</i> , <i>H. canui</i> , <i>Glomospirella</i> sp. B, <i>Bathysiphon anomalocoelia</i> , <i>Trochammina sablei</i> , <i>Reophax suevica</i> , arenaceous spp. (large-coarse), <i>Ammodiscus cheradospirus</i> , <i>A. asperus</i> , <i>Trochamminoides</i> spp., <i>T. vertens</i> , <i>Ammobaculites alaskensis</i> , <i>Dorothia squamosa</i> , <i>Inoceramus</i> prisms, pyrite, common to abundant pyritized radiolaria, and <i>Tasmanites</i> spp. in the sidewall core at 7500 feet.

7650-8040'

<u>Age.</u>	Early Jurassic Toarcian
<u>Zone.</u>	F-18a
<u>Environment.</u>	Middle Bathyal (Middle Slope)
<u>Fauna.</u>	<i>Gaudryina dyscrita</i> , <i>G. kelleri</i> , arenaceous spp. (large-coarse), <i>Trochamminoides</i> spp., <i>T. vertens</i> , <i>Trochammina sablei</i> , <i>Fronicularia squamosa</i> , <i>Marginulina utricula</i> , <i>Astacolus dubius</i> , <i>Bathysiphon anomalocoelia</i> , <i>Ammobaculites vetusta</i> , <i>Ammodiscus cheradospirus</i> , <i>Haplophragmoides canui</i> , <i>Gumbelitria?</i> sp., <i>Conorboides hofkeri</i> , <i>Lenticulina</i> cf. <i>bicostata</i> , <i>Triplasia</i> sp., pelecypods (pyrite casts), <i>Inoceramus</i> prisms, gastropods (pyrite casts), <i>Tasmanites</i> spp., common to abundant pyritized radiolaria and abundant to flood of pyrite.

8040-8310'

<u>Age.</u>	Early Jurassic Pliensbachian
<u>Zone.</u>	F-18b
<u>Environment.</u>	Middle Bathyal (Middle Slope)
<u>Fauna.</u>	<i>Trochamminoides vertens</i> , <i>T. spp.</i> , <i>Ammobaculites vetusta</i> , <i>A. alaskensis</i> , <i>Triplasia sp.</i> , <i>Conorboides hofkeri</i> , <i>Trochammina sablei</i> , <i>Bathysiphon anomalocoelia</i> , <i>Haplophragmoides barrowensis</i> , <i>H. canui</i> , <i>Textularia areoplecta</i> , <i>Ammodiscus cheradospirus</i> , arenaceous spp. (large-coarse), <i>Reophax liasica</i> , <i>R. densa</i> , <i>R. metensis</i> , <i>Lenticulina cf. bicostata</i> , <i>L. dilecta</i> , <i>Gaudryina topagorukensis</i> , <i>G. dyscrita</i> , <i>Lituotuba irregularis</i> , <i>Flabellamina instowensis</i> , <i>Nodosaria radiata</i> , <i>Tasmanites spp.</i> , gastropods (pyrite casts), <i>Inoceramus</i> prisms, pelecypods (pyrite casts), pyrite and common to abundant pyritized radiolaria.

8310-8520'

<u>Age.</u>	Early Jurassic Hettangian to Sinemurian
<u>Zone.</u>	F-18c
<u>Environment.</u>	Upper to Middle Bathyal (Upper to Middle Slope)
<u>Fauna.</u>	<i>Ammobaculites alaskensis</i> , <i>A. vetusta</i> , <i>Reophax liasica</i> , <i>Triplasia sp.</i> , arenaceous spp. (large-coarse), <i>Textularia areoplecta</i> , <i>Gaudryina dyscrita</i> , <i>Bathysiphon anomalocoelia</i> , <i>Trochamminoides spp.</i> , <i>Ammodiscus asperus</i> , <i>A. cheradospirus</i> , <i>Trochammina sablei</i> , <i>T. contornata</i> , <i>T. sp.</i> (small-thin), <i>Thuramminoides sp.</i> , <i>Inoceramus</i> prisms, pyrite and frequent to abundant pyritized radiolaria.

8520-8790'

<u>Age.</u>	Late Triassic Norian
<u>Zone.</u>	F-19b
<u>Environment.</u>	Inner to Outer Neritic (Inner to Outer Shelf)
<u>Fauna.</u>	<i>Frondicularia acmaea</i> , <i>F. lustrata</i> , <i>Astacolus connudatus</i> , <i>Tolypammina glareosa</i> , <i>Trochammina contornata</i> , <i>T. helicta</i> , <i>Nodosaria larina</i> , <i>N. liratella</i> , <i>N. shublikensis</i> , <i>Lingulina borealis</i> , <i>Pseudoglandulina simpsonensis</i> , <i>P. lata</i> , <i>Vaginulinopsis acrolus</i> , <i>Marginulina prisca</i> , <i>Citharina fallax</i> , <i>Hemigordius</i> sp., echinoid spines, rare to abundant <i>Monotis</i> / <i>Halobia</i> shell fragments, and rare to frequent medium to large size, smooth ostracods.

8790-8880'

<u>Age.</u>	Late Triassic Probable Carnian
<u>Zone.</u>	Probable F-19c
<u>Environment.</u>	Middle Neritic (Middle Shelf)
<u>Fauna.</u>	<i>Trochammina contornata</i> , <i>T. sp.</i> (small-thin), arenaceous spp., <i>Bathysiphon anomalocoelia</i> , <i>Ammobaculites vetusta</i> , ostracods (medium-large, smooth), pelecypods (pyrite casts), gastropods (pyrite casts), echinoid spines, <i>Monotis</i> / <i>Halobia</i> fragments, and abundant rounded black chert? or phosphate? sand-size pebbles.

8880-9600'

<u>Age.</u>	Early Triassic
<u>Zone.</u>	F-20a
<u>Environment.</u>	Nonmarine to Inner Neritic (Alluvial Plain to Inner Shelf)
<u>Fauna.</u>	<i>Gaudryina dyscrita</i> , <i>G. adoxa</i> , <i>Ammobaculites vetusta</i> , <i>Ammodiscus</i> sp. P, arenaceous spp., <i>Bathysiphon</i> <i>anomalocoelia</i> , <i>Textularia areoplecta</i> , <i>Tolypammia glareosa</i> , <i>Gaudryinella?</i> sp., <i>Reophax liasica</i> , echinoid spines and pyrite.
<u>Discussion.</u>	Sadlerochit Group. Ivishak Fm. tops at 8880 feet and Kavik Fm. tops at 9450 feet.

9600-9655'SW

<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, <i>Endothyra?</i> sp., arenaceous spp., conodonts, ostracods and frequent to abundant glauconite.
<u>Discussion.</u>	Echooka Fm.

9655SW-9930'

<u>Age.</u>	Middle to Late Pennsylvanian Atokan to Kawvian
<u>Zones.</u>	M-22 to M-24
<u>Environment.</u>	Shoaling Shelf (Outer Lagoonal to Bank)
<u>Fauna.</u>	<i>Porcellaneous</i> spp., <i>Paleotextularia</i> ss., <i>Monotaxinoides</i> sp., <i>Pseudoglomospira</i> sp., <i>Trepeilopsis</i> sp., <i>Earlandia</i> spp., <i>Eoschubertella</i> sp., <i>E. yukonensis</i> , <i>Climmacammina</i> of the group <i>C. moelleri</i> , <i>Biseriella parva</i> , <i>Endothyra</i> spp., <i>Stacheoides meandriformis</i> , <i>Asphaltina</i> sp., <i>Stylocodium</i> sp., <i>Calcisphaera laevis</i> and <i>Cuneiphycus</i> sp.
<u>Discussion.</u>	Lisburne Group. Wahoo Fm.; Upper Limestone Unit.

9930-10,286'SW

<u>Age.</u>	Early to Middle Pennsylvanian Morrowan to Atokan
<u>Zone.</u>	M-21
<u>Environment.</u>	Shoaling Shelf (Bank)
<u>Fauna.</u>	<i>Earlandia elegans</i> , <i>Trepeilopsis</i> sp., <i>Planoendothyra rotayi</i> , <i>Monotaxinoides multivolutus</i> , <i>Archaeodiscus krestovnikovi</i> , <i>A. chernoussovensis</i> , <i>Neoarchaeodiscus incertus</i> , <i>Eoschubertella yukonensis</i> , <i>Pseudoglomospira</i> sp., <i>Endothyra</i> spp., <i>Asteroarchaeodiscus baschkiricus</i> , <i>Millerella carbonica</i> , <i>Globivalvulina bulloides</i> , <i>Pseudostaffella</i> sp., <i>Biseriella parva</i> , <i>Zellerina designata</i> , <i>Eostaffella radiata</i> , <i>Calcisphaera laevis</i> and rare to common <i>Stylocodium</i> sp.

10,286SW-10,440'

<u>Age.</u>	Early Pennsylvanian Morrowan
<u>Zone.</u>	M-20
<u>Environment.</u>	Shoaling Shelf (Bank)
<u>Fauna.</u>	<i>Eostaffella radiata</i> , <i>Globivalvulina bulloides</i> , <i>Pseudoendothyra</i> sp., <i>Endothyra</i> spp., <i>E. cf. paramosquensis</i> , <i>Biseriella parva</i> , <i>Neoarchaediscus incertus</i> , <i>Pseudoglomospira</i> sp., <i>Globoendothyra?</i> sp., <i>Priscella prisca</i> , <i>Asphaltina</i> sp., <i>Stylocodium</i> sp. and frequent <i>Calcisphaera laevis</i> .

10,440-10,650'

<u>Age.</u>	Late Mississippian Chesterian
<u>Zones.</u>	M-18 to M-19
<u>Environment.</u>	Shoaling Shelf (Outer Lagoonal to Bank)
<u>Fauna.</u>	<i>Eosigmoilina rugosus?</i> , <i>Asteroarchaediscus</i> spp., <i>Globivalvulina bulloides</i> , <i>Neoarchaediscus incertus</i> , <i>N. parvus</i> , <i>Pseudoglomospira</i> sp., <i>Biseriella parva</i> , <i>Archaediscus krestovnikovi</i> , <i>Zellerina</i> sp., <i>Paleotextularia</i> ss., <i>Consoibrinella?</i> sp., <i>Brunsia pulchra?</i> , <i>Asphaltina</i> sp., <i>Calcisphaera laevis</i> , <i>C. pachysphaerica</i> and rare to frequent <i>Stylocodium</i> sp.
<u>Discussion.</u>	Alapah Fm.

10,650-10,664" T.D.

Age.

Indeterminate

Environment.

Indeterminate

Fauna.

Barren of Foraminifera.

Discussion.

Quartzite. Could represent either Endicott Group, Kekiktuk Fm. or older Franklinian basement.

CONCLUSIONS

The USN/HUSKY East Teshekpuk No. 1 well penetrated the following biostratigraphic sequence based on foraminiferal analysis:

- 1087+ feet (533-1620') of Turonian to Maestrichtian age (Early Brookian) upward shallowing base of slope bottomsets, slope foresets and marginal marine to outer shelf topsets.
- 5490 feet (1620-7110') of Hauterivian to probable Cenomanian age (Early Brookian & Beaufortian - Rift Sequence) generally upward shallowing base of slope bottomsets, slope foresets and inner to outer shelf topsets.
- 1410 feet (7110-8520') of Hettangian and/or Sinemurian to Kimmeridgian age (Beaufortian - Incipient Rift Sequence) middle to outer shelf and slope to base of slope sedimentation.
- 1135 feet (8520-9655') of Late Permian to Late Triassic age (Late Ellesmerian) nonmarine, marginal marine and shelf deposition.
- 995 feet (9655-10,650') of Late Mississippian (Chesterian) to Middle or Late Pennsylvanian (Atokan or Kawvian) age (Early Ellesmerian) shoaling shelf carbonates.
- 14+ feet (10,650-10,664'T.D.) of indeterminate age quartzite that could represent either Endicott Group, Kekiktuk Fm. or older Franklinian basement.

PALYNOLOGY REPORT

Interpreted by:

Hideyo Haga

PALYNOLOGY SUMMARY

533-1540'

<u>Age.</u>	Late Cretaceous Probable Santonian - Campanian
<u>Zone.</u>	Probable P-M14
<u>Environment.</u>	Marine

1540-2180'

<u>Age.</u>	Late Cretaceous Turonian - Coniacian
<u>Zone.</u>	P-M15
<u>Environment.</u>	Marine

2180-4680'

<u>Age.</u>	Early Cretaceous Middle - Late Albian
<u>Zone.</u>	P-M17
<u>Environment.</u>	Marine

4680-6900'

<u>Age.</u>	Early Cretaceous Aptian - Early Albian
<u>Zone.</u>	P-M18
<u>Environment.</u>	Marine
<u>Remarks.</u>	This separation is based on negative evidence.

6900-7020'

<u>Age.</u>	Early Cretaceous Barremian - Aptian
<u>Zone.</u>	P-M18a
<u>Environment.</u>	Marine
<u>Remarks.</u>	The top of this interval is marked by abundant sapropelic material.

7020-7320'

<u>Age.</u>	Early Cretaceous Hauterivian
<u>Zone.</u>	P-M19
<u>Environment.</u>	Marine

7320-7470'

<u>Age.</u>	Late Jurassic Probable Kimmeridgian
<u>Zone.</u>	Probable P-M21
<u>Environment.</u>	Marine
<u>Remarks.</u>	No positive evidence of Oxfordian age strata was recorded.

7470-8190'

<u>Age.</u>	Early - Middle Jurassic Undifferentiated
<u>Zones.</u>	P-M24? to P-M23
<u>Environment.</u>	Marine
<u>Remarks.</u>	The top of the P-M24 zonule possibly tops between the sidewall core samples at 7920 feet and 8080 feet.

8190-9052'SW

<u>Age.</u>	Late Triassic - Early Jurassic Undifferentiated
<u>Zones.</u>	P-T15? to P-M24?
<u>Environment.</u>	Marginal Marine?

9052SW-9510'

Age. Triassic (Possible Early)
Undifferentiated

Zone. P-T16?

Environment. Nonmarine

9510-9655'SW

Age. Early Triassic
Undifferentiated

Zone. P-T17

Environment. Nonmarine

Remarks. The spore-pollen assemblage is characteristic of the Kavik Formation.

No palynomorph evidence for the presence of Permian age, Echooka Formation, was observed.

9655SW-9780'

Age. Indeterminate

Environment. Indeterminate

Remarks. Barren of indigenous palynomorphs.

9780-10,590'

<u>Age.</u>	Carboniferous Probable Pennsylvanian
<u>Zone.</u>	Probable P-T19
<u>Environment.</u>	Nonmarine
<u>Remarks.</u>	Based on negative evidence, the palynomorph assemblage is suggestive of a post-Mississippian age.

10,590-10,664'T.D.

<u>Age.</u>	Indeterminate
<u>Environment.</u>	Indeterminate
<u>Remarks.</u>	Barren of indigenous palynomorphs.

INTRODUCTION

Purpose and Scope

Data from 170 palynology samples of the USN/HUSKY East Teshekpuk No. 1 well are incorporated in this study. The samples consist of 135 ditch-cutting composites and 35 sidewall core samples taken between 533 feet and the total depth of 10,664 feet.

The initial analysis was completed in May, 1976, as part of the U. S. Government's evaluation program of the NPRA. At that time, 117 ditch samples and 36 sidewall core samples were analyzed. (One sidewall core sample consisted of mudcake and has been omitted from the current distribution chart.) The species occurrences were hand-plotted in a distribution chart.

In the years following the drilling of the well, some palynological samples have been reprocessed. Most of the newer preparations were examined and the occurrences of selected taxa from these samples are included.

This report, therefore, provides new data and an updated format for the original data. Some of the earlier taxa designations are modified to reflect the newer taxonomic assignments that have evolved over the years since the well was first analyzed.

Procedures

The original samples were processed in San Diego, California, using techniques standard for the time. The chemical treatments involved the use of hydrochloric, hydrofluoric and nitric acids. The resulting kerogen residues were further concentrated by physical separation with heavy liquids and a sieving/panning technique. Permanent slide mounts were made of the residue concentrates. The coverslip mounting medium was a synthetic resin sold under the brand name of "CoverBond".

Data from the species distribution charts and the more recent palynological preparations were entered in a microcomputer to compile newly formatted charts. These charts are located in the pocket.

The Palynomorph Distribution Chart (Figure P-1) lists the occurrence and abundance of recorded taxa in each sample. Included on this chart are the diversity and abundance curves for the spore-pollen and the microplankton cysts.

High Resolution Biostratigraphy Plots - Foraminifera/Palynomorphs (Figure B-1) are also provided. This chart includes additional palynology parameters in the form of a cumulative plot that illustrates the relative abundance of the nonmarine, marine and miscellaneous palynomorph components.

RESULTS

533-1540'

<u>Age.</u>	Late Cretaceous Probable Santonian - Campanian
<u>Zone.</u>	Probable P-M14
<u>Environment.</u>	Marine
<u>Palynomorphs.</u>	The uppermost part of the well has an interval marked by a marine palynomorph assemblage. The assemblage is rather sparse and the species occur sporadically. The more numerous species include <i>Chatangiella ditissima</i> , <i>Hystrichodinium pulchrum</i> , <i>Hystrichosphaeridium difficile</i> and <i>Isabelidinium cooksoniae</i> .
<u>Discussion.</u>	The relatively spotty recoveries lead to a tentative Santonian - Campanian age assignment.

1540-2180'

<u>Age.</u>	Late Cretaceous Turonian - Coniacian
<u>Zone.</u>	P-M15
<u>Environment.</u>	Marine
<u>Palynomorphs.</u>	This interval reflects an increase in dinocyst diversity. Most of the forms seen above continue into this section. The marker species for the Turonian - Coniacian interval is <i>Isabelidinium globosum</i> .
<u>Discussion.</u>	No palynological evidence of Cenomanian age strata was recovered in the well.

2180-4680'

<u>Age.</u>	Early Cretaceous Middle - Late Albian
<u>Zone.</u>	P-M17
<u>Environment.</u>	Marine
<u>Palynomorphs.</u>	This Albian interval is identified by the occurrences of the dinocysts <i>Luxadinium propatum</i> , <i>Ovoidinium verrucosum</i> , <i>Pseudoceratium expositum</i> , <i>Spinidinium vestitum</i> and <i>Wigginsella grandstandica</i> .
<u>Discussion.</u>	The Aptian - Albian section contains numerous rare occurrences of reworked palynomorphs. The reworked forms consist of marine and nonmarine species that range in age from the Mississippian through the Neocomian.

4680-6900'

<u>Age.</u>	Early Cretaceous Aptian - Early Albian
<u>Zone.</u>	P-M18
<u>Environment.</u>	Marine
<u>Palynomorphs.</u>	The Aptian - Early Albian interval contains most of the same species as the interval above. The distinguishing aspect of this assemblage is the absence of the age restrictive Middle - Late Albian dinocyst markers.
<u>Discussion.</u>	The reworked palynomorphs continue through this interval with abundances similar to those seen above.

6900-7020'

<u>Age.</u>	Early Cretaceous Barremian - Aptian
<u>Zone.</u>	P-M18a
<u>Environment.</u>	Marine
<u>Palynomorphs.</u>	The Barremian - Aptian section is a thin unit in which a significant increase in the number of dinocysts usually occurs. In this interval, an increase in the abundance of <i>Odontochitina operculata</i> is apparent.
<u>Discussion.</u>	The abundance of amorphous (sapropelic) material is important and generally accompanies the dinocyst blooms. The high percentage of amorphous material denotes the top of the section in this well.

7020-7320'

<u>Age.</u>	Early Cretaceous Hauterivian
<u>Zone.</u>	P-M19
<u>Environment.</u>	Marine
<u>Palynomorphs.</u>	<p>The Hauterivian interval is characterized by the appearance of several dinocyst species. This assemblage includes <i>Dimidiadinium uncinatum</i>, <i>Gardodinium trabeculosum</i>, <i>Muderongia</i> cf. <i>M. simplex</i>, <i>Oligosphaeridium complex</i> (thick-wall) and <i>Pseudoceratium nudum</i>.</p> <p>The assemblage is not as rich as usually seen in the Hauterivian. The sidewall core sample at 7112 feet recovered mainly one species of Early Cretaceous dinocyst.</p> <p>There appears to be a large amount of sloughing in this hole and the Jurassic/Cretaceous boundary is somewhat tentative. The base of the Early Cretaceous, or Hauterivian in this well, is placed at the approximate top occurrence of <i>Gonyaulacysta cladophora</i>, a Jurassic dinocyst.</p>

7320-7470'

<u>Age.</u>	Late Jurassic Probable Kimmeridgian
<u>Zone.</u>	Probable P-M21
<u>Environment.</u>	Marine
<u>Palynomorphs.</u>	<p>The Kimmeridgian section is marked by the occurrences of <i>Ctenidodinium ornatum</i>, <i>Gonyaulacysta cladophora</i>, <i>G. jurassica</i>, <i>Pareodinia ceratophora</i> and <i>Sirmiodinium grossi</i>.</p>
<u>Discussion.</u>	<p>The absence of <i>Nannoceratopsis pellucida</i> suggests a post-Oxfordian age for this interval.</p>

7470-8190'

<u>Age.</u>	Early - Middle Jurassic Undifferentiated
<u>Zones.</u>	P-M24? to P-M23
<u>Environment.</u>	Marine
<u>Palynomorphs.</u>	<p>The Early - Middle Jurassic strata contain a very different dinocyst assemblage compared to the Late Jurassic strata. As seen in core samples, very few form cross the stratal boundary. The assemblage in this well consists of <i>Fromea elongata</i>, <i>Nannoceratopsis</i> cf. <i>N. ambonis</i>, <i>N. gracilis</i>, <i>N. senex</i>, <i>Parvocysta cracens</i>, <i>P. nasuta</i> and <i>Phallocysta subconica</i>.</p>
<u>Discussion.</u>	<p>The dinocyst assemblage suggests that the Early - Middle Jurassic interval, to about 7920 feet, is probably of Toarcian to Aalenian age.</p> <p>The sidewall core data indicate that the dinocyst occurrences decrease below 7920 feet. The top of zonule P-M24 is questionably proposed to lie between the sidewall core samples at 7920 feet and 8080 feet.</p>

8190-9052'SW

<u>Age.</u>	Late Triassic - Early Jurassic Undifferentiated
<u>Zones.</u>	P-T15? to P-M24?
<u>Environment.</u>	Marginal Marine?
<u>Palynomorphs.</u>	The palynomorph recoveries are generally very sparse in this interval. Very rare occurrences of <i>Taeniaesporites</i> were recorded. The only marine indications were the rare occurrences of acritarchs in two samples.
<u>Discussion.</u>	The meager palynomorph assemblage supports only a very broad age assignment of Late Triassic to Early Jurassic.

9052SW-9510'

<u>Age.</u>	Triassic (Possible Early) Undifferentiated
<u>Zone.</u>	P-T16?
<u>Environment.</u>	Nonmarine
<u>Palynomorphs.</u>	<p>This interval continues with relatively poor recoveries; however, there is an increase in frequencies of <i>Striatites</i> and <i>Taeniaesporites</i>.</p> <p>No marine forms were observed.</p>

9510-9655'SW

<u>Age.</u>	Early Triassic Undifferentiated
<u>Zone.</u>	P-T17
<u>Environment.</u>	Nonmarine
<u>Palynomorphs.</u>	This Early Triassic interval shows an increase in spore-pollen recoveries. The assemblage includes <i>Klausipollenites staplinii</i> , <i>Lueckisporites</i> , <i>Lundbladispora</i> , <i>Striatites</i> and <i>Taeniaesporites</i> .

9655SW-9780'

<u>Age.</u>	Indeterminate
<u>Environment.</u>	Indeterminate
<u>Palynomorphs.</u>	The three sidewall cores within this narrow interval recovered no palynomorphs. Therefore, the single ditch sample from this interval probably recovered only sloughed microfossils.

9780-10,590'

<u>Age.</u>	Carboniferous Probable Pennsylvanian
<u>Zone.</u>	Probable P-T19
<u>Environment.</u>	Nonmarine
<u>Palynomorphs.</u>	This interval shows an increase in Carboniferous spores. The assemblage includes frequent to common <i>Lycospora</i> . Other, rarer forms, include <i>Convolutispora</i> , <i>Densosporites</i> , <i>Kraeuselisporites</i> , <i>Raistrickia</i> and <i>Waltzispora</i> .
<u>Discussion.</u>	The absence of a more diverse spore assemblage is the basis for the tentative post-Mississippian age interpretation.

10,590-10,664'T.D.

<u>Age.</u>	Indeterminate
<u>Environment.</u>	Indeterminate
<u>Palynomorphs.</u>	Barren of indigenous palynomorphs.
<u>Discussion.</u>	The sidewall core sample at 10,624 feet was barren of palynomorphs. The few forms recovered in the ditch sample spanning this interval are deemed to be derived from up-hole.

CONCLUSIONS

Palynological analysis of the USN/HUSKY East Teshekpuk No. 1 well provides the following generalized palynostratigraphic succession:

- The uppermost interval, from 533 feet to 1540 feet, is assigned a tentative Santonian - Campanian age. The rare and sporadic marine dinocyst evidence is the basis for the qualified age.
- Marine strata of Turonian - Coniacian age occur from 1540 feet to 2180 feet.
- No evidence of Cenomanian age units was observed in this well.
- Early Cretaceous units top at 2180 feet and consist of marine Middle -Late Albian strata that extend down to 4680 feet.
- Marine Aptian - Early Albian strata are identified between 4680 feet and 6900 feet. This section is separated on the basis of negative evidence; absence of the Middle - Late Albian dinocyst markers seen above.
- The Barremian - Aptian interval is the thin unit present between 6900 feet and 7020 feet. This narrow interval is marked by an increase in dinocyst abundance and amorphous organics.
- Marine strata of Hauterivian age are recognized from 7020 feet to 7320 feet. This unit carries a diverse dinocyst assemblage, but somewhat less than commonly seen in the Hauterivian.
- Late Jurassic, probable Kimmeridgian, age marine strata occur from 7320 feet to 7470 feet.
- Early - Middle Jurassic age units are present from 7470 feet to 8190 feet. The dinocyst assemblage down to at least 7920 feet is suggestive of a Toarcian to Aalenian age. An interval that tops between 7920 feet and 8080 feet appears to be pre-Toarcian in age.
- The section from 8190 feet to 9052SW feet is of Late Triassic to Early Jurassic age. The entire interval appears to be essentially nonmarine.

- Nonmarine strata of Early? Triassic and unquestioned Early Triassic age occur between 9052SW feet and 9655SW feet. The definite Early Triassic begins at 9510 feet.
- The section from 9655SW feet to 9780 feet is of indeterminate age.
- Carboniferous strata of probable Pennsylvanian age are designated between 9780 feet and 10,590 feet. This age assignment is based largely on negative evidence.
- The bottom interval from 10,590 feet and the total depth of 10,664 feet is of indeterminate age. No indigenous palynomorphs were recovered.