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**USGS/HUSKY - NPRA
EAST SIMPSON NO. 2**

API #50-279-20007

SEC. 23, T19N/R11W UM

NORTH SLOPE, ALASKA

Prepared by:

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BIOSTRATIGRAPHY REPORT

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INTEGRATED SUMMARY

90-990'

Late Cretaceous
Possible Santonian to Campanian

990-1040'

Late Cretaceous
Possible Turonian to Coniacian

1040-2430'

Early Cretaceous
Middle to Late Albian

2430-6340'

Early Cretaceous
Aptian to Early Albian

6340-6530'

Early Cretaceous
Barremian
KE_B

6530-6600'

Early Cretaceous
Hauterivian
KE_H

6600-6825'

Early Jurassic
Pliensbachian
JE_P

6825-7150'

Late Triassic
Norian
TL_N

7150-7360'

Early Mississippian
Undifferentiated

Discussion. Endicott Group. Kekiktuk Fm.

7360-7504'T.D.

Indeterminate Age

Discussion. Dark gray argillite and red shale.

FORAMINIFERA REPORT

Interpreted by

Michael B. Mickey

FORAMINIFERA SUMMARY

90-150'

<u>Age.</u>	Indeterminate
<u>Environment.</u>	Nonmarine (Alluvial Plain)

150-1050'

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

1050-2430'

<u>Age.</u>	Early Cretaceous Middle to Late Albian
<u>Zone.</u>	F-9
<u>Environment.</u>	Inner to Middle Neritic (Inner to Middle Shelf)

2430-6340'C

<u>Age.</u>	Early Cretaceous Aptian to Early Albian	
<u>Zones</u>	F-10 to F-11	
<u>Environment.</u>	2430-4350':	Outer Neritic to Upper Bathyal (Outer Shelf to Upper Slope)
	4350-6340'C:	Bathyal (Slope)

6340C-6540'

<u>Age.</u>	Early Cretaceous Barremian
<u>Zone.</u>	F-12
<u>Environment.</u>	Outer Neritic to Upper Bathyal (Outer Shelf to Upper Slope)

6540-6600'

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

6600-6810'

<u>Age.</u>	Early Jurassic Pliensbachian
<u>Zone.</u>	F-18b
<u>Environment.</u>	6600-6705'C: Outer Neritic to Upper Bathyal (Outer Shelf to Upper Slope) 6705C-6810': Marginal Marine? to Inner Neritic? (Transitional? To Inner Shelf?)

6810-7160'

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

7160-7370'

<u>Age.</u>	Probable Early Mississippian Undifferentiated
<u>Environment.</u>	Nonmarine to Marginal Marine (Alluvial Plain to Transitional)
<u>Discussion.</u>	Light gray to white quartzitic sandstones and siltstones, interbedded with coal seams, characterize this section. These strata are suggestive of the Kekiktuk Fm.

7370-7504"T.D.

<u>Age.</u>	Indeterminate
<u>Environment.</u>	Indeterminate
<u>Discussion.</u>	Dark gray argillite and red shale.

INTRODUCTION

Scope

Data from 324 Foraminifera samples from the USGS/Husky East Simpson No. 2 well were incorporated into this report. These samples consisted of 247 ditch, 55 conventional core and 22 sidewall core samples covering the interval 90 to 7504 feet total depth. Thin sections were also prepared on 24 ditch and 51 conventional core samples from 6810 to 7504 feet total depth. This work was done as part of M.C.I. Job Number 21-106.

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, 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

90-150'

<u>Age.</u>	Indeterminate
<u>Environment.</u>	Nonmarine (Alluvial Plain)
<u>Fauna.</u>	Barren of Foraminifera or other marine indicators.

150-1050'

<u>Age.</u>	Probable Late Cretaceous Undifferentiated
<u>Environment.</u>	Nonmarine to Marginal Marine (Alluvial Plain to Transitional)
<u>Fauna.</u>	Barren of Foraminifera. <i>Inoceramus</i> prisms rare at 150 to 210 feet.

1050-2430'

Age. Early Cretaceous
Middle to Late Albian

Zone. F-9

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

Fauna. *Haplophragmoides kirki*, *H. excavatus*, *H. topagorukensis*, *H. gigas*, *Miliammina manitobensis*, *M. bisobscura*, *Hippocrepina barksdalei*, *Quadrिमorphina ruckerae*, *Lenticulina macrodisca*, *L. erecta*, *Trochammina mcmurrayensis*, *Verneuilioides borealis*, *Eurycheilostoma grandstandensis*, *Ammobaculites wenonahae*, *Marginulinopsis collinsi*, *M. jonesi*, *Gavelinella stictata*, pelmatozoan fragments, shell fragments, *Inoceramus* prisms, coal, pyrite and rare to common scattered *Ditrupa cornu*.

2430-6340'C

<u>Age.</u>	Early Cretaceous Aptian to Early Albian	
<u>Zones</u>	F-10 to F-11	
<u>Environment.</u>	2430-4350':	Outer Neritic to Upper Bathyal (Outer Shelf to Upper Slope)
	4350-6340'C:	Bathyal (Slope)
<u>Fauna.</u>	<i>Haplophragmoides gigas</i> , <i>H. topagorukensis</i> , <i>H. excavatus</i> , <i>H. kirki</i> , <i>Saccammmina lathrami</i> , <i>Lenticulina macrodisca</i> , <i>L. erecta</i> , <i>Bathysiphon vitta</i> , <i>Gaudryinella irregularis</i> , <i>Ammodiscus</i> sp. (small), <i>A. rotalarius</i> , <i>Verneuilinoides borealis</i> , <i>Miliammmina manitobensis</i> , <i>M. awunensis</i> , <i>Psamminopelta bowsheri</i> , <i>P. subcircularis</i> , <i>Ammobaculites wenonahae</i> , <i>A. fragmentarius</i> , <i>Gavelinella stictata</i> , <i>G. awunensis</i> , <i>Gaudryina nanushukensis</i> , <i>G. subcretacea</i> , <i>Valvulineria loetterlei</i> , <i>Glomospirella gaultina</i> , <i>Textularia topagorukensis</i> , <i>Eurycheilostoma grandstandensis</i> , <i>E. robinsonae</i> , <i>Hippocrepina barksdalei</i> , <i>Vaginulina exilis</i> , <i>Saracenaria dutroi</i> , <i>Ditrupa cornu</i> , pelmatozoan fragments, <i>Inoceramus</i> prisms, megaspores, echinoid spines, coal, pyrite, pyrite sticks, and frequent to abundant pyritized radiolaria below 3510-3540 feet.	

6340C-6540'

<u>Age.</u>	Early Cretaceous Barremian
<u>Zone.</u>	F-12
<u>Environment.</u>	Outer Neritic to Upper Bathyal (Outer Shelf to Upper Slope)
<u>Fauna.</u>	<i>Bathysiphon scintillata</i> , arenaceous spp. (large, coarse), <i>Haplophragmoides coronis</i> , <i>Trochamminoides</i> spp., fish debris, fecal pellets, pyrite, paper shale, frequent to abundant pyritized radiolaria and common to flood of rounded frosted quartz floating sand grains.

6540-6600'

<u>Age.</u>	Early Cretaceous Hauterivian
<u>Zone.</u>	F-13a
<u>Environment.</u>	Middle Neritic? to Upper Bathyal (Middle Shelf? to Upper Slope)
<u>Fauna.</u>	Arenaceous spp., <i>Glomospira corona</i> , <i>Haplophragmoides coronis</i> , <i>Trochamminoides</i> spp., pyrite and frequent rounded frosted quartz floating sand grains.

6600-6810'

<u>Age.</u>	Early Jurassic Pliensbachian
<u>Zone.</u>	F-18b
<u>Environment.</u>	6600-6705'C: Outer Neritic to Upper Bathyal (Outer Shelf to Upper Slope) 6705C-6810': Marginal Marine? to Inner Neritic? (Transitional? To Inner Shelf?)
<u>Fauna.</u>	<i>Ammobaculites barrowensis</i> , <i>Trochamminoides</i> spp., arenaceous spp. (large, coarse), arenaceous spp., <i>Halobia?</i> shell fragments and rare to frequent glauconite.

6810-7160'

<u>Age.</u>	Late Triassic Probable Norian
<u>Zone.</u>	Probable F-19b
<u>Environment.</u>	Marginal Marine to Middle Neritic (Transitional to Middle Shelf)
<u>Fauna.</u>	<i>Astacolus connudatus</i> , <i>Nodosaria</i> spp., <i>Citharinella</i> sp., ostracods (medium-large, smooth), glauconite, pyrite and rare to frequent scattered <i>Monotis</i> / <i>Halobia</i> shells fragments.

7160-7370'

<u>Age.</u>	Probable Early Mississippian Undifferentiated
<u>Environment.</u>	Nonmarine to Marginal Marine (Alluvial Plain to Transitional)
<u>Fauna.</u>	Rare <i>Endothyra?</i> sp., common to abundant scattered megaspores, pyrite and frequent to flood of coal.
<u>Discussion.</u>	Light gray to white quartzitic sandstones and siltstones, interbedded with coal seams, characterize this section. These strata are suggestive of the Kekiktuk Fm.

7370-7504" T.D.

<u>Age.</u>	Indeterminate
<u>Environment.</u>	Indeterminate
<u>Fauna.</u>	Barren of Foraminifera.
<u>Discussion.</u>	Dark gray argillite and red shale.

CONCLUSIONS

The USGS/Husky East Simpson No. 2 well penetrated the following biostratigraphic sequence based on foraminiferal analysis:

- 6510+ feet (90-6600') of Hauterivian to indeterminate (Late Cretaceous?) age (Early Brookian & Beaufortian - Rift Sequence) alluvial plain to outer shelf topsets, slope foresets and base of slope bottomsets.
- 210 feet (6600-6810') of Pliensbachian age (Beaufortian - Incipient Rift Sequence) outer shelf to upper slope sedimentation with a basal transitional? to inner shelf? transgressive sandstone.
- 350 feet (6810-7160') of Late Triassic (probable Norian) age (Late Ellesmerian) transitional to middle shelf deposition.
- 210 feet (7160-7370') of undifferentiated probable Early Mississippian age (Early Ellesmerian) alluvial plain to transitional light gray to white quartzitic sandstones and siltstones.
- 134+ feet (7370-7504'T.D.) of indeterminate age (Franklinian) dark gray argillite and red shale.

PALYNOLOGY REPORT

Interpreted by:

Hideyo Haga

PALYNOLOGY SUMMARY

90-990'

Age. Late Cretaceous
Possible Santonian - Campanian

Zone. P-M14?

Environment. Marine

990-1088'SW

Age. Late Cretaceous
Possible Turonian - Coniacian

Zone. P-M15?

Environment. Marine

1088SW-2430'SW

Age. Early Cretaceous
Middle - Late Albian

Zone. P-M17

Environment. Marine

2430SW-6340'C

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

6340C-6570'

<u>Age.</u>	Early Cretaceous Barremian - Aptian
<u>Zone.</u>	P-M18a
<u>Environment.</u>	Marine

6570-6660'

<u>Age.</u>	Early Cretaceous Possible Hauterivian
<u>Zone.</u>	P-M19?
<u>Environment.</u>	Marine
<u>Remarks.</u>	Very weak palynomorph evidence for the identification of this interval.

6660-6705'C

<u>Age.</u>	Possible Early Jurassic Undifferentiated
<u>Zone.</u>	P-M24?
<u>Environment.</u>	Marine

6705C-6750'

<u>Age.</u>	Late Triassic Norian
<u>Zone.</u>	P-M26
<u>Environment.</u>	Marine

6750-7167'C

<u>Age.</u>	Indeterminate
<u>Zone.</u>	Indeterminate
<u>Environment.</u>	Indeterminate
<u>Remarks.</u>	Very sparse recoveries.

7167C-7504T.D.

Age. Mississippi

Zone. P-T21b

Environment. Nonmarine

INTRODUCTION

Purpose and Scope

The USGS/Husky East Simpson No. 2 well completed drilling in March 1980. During the drilling process, a palynological study of the well was conducted from selected sample material. In the course of this investigation, 200 palynology samples were examined. The total consisted of 83 ditch-cutting composites, 95 conventional core fragments, and 22 sidewall core samples taken between 90 feet and the total depth of 7504 feet.

The cores were originally sampled and examined at very close intervals. For this report, some of the core data are composited into larger intervals where the contained assemblages are similar and no biostratigraphic boundaries are straddled.

This report provides an updated format from the original data. Some of the taxon designations have been revised to reflect the newer taxonomic assignments that have evolved over the decades since the initial study.

Procedures

For the original analysis, palynological samples were processed in San Diego, California, using techniques that were 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 used was a synthetic resin sold under the brand name of "Coverbond".

The original palynomorph distribution chart data were entered into a desktop PC using proprietary software to compile new format charts. The 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

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

The samples begin at 90 feet and the youngest units encountered at that depth are of Late Cretaceous age. The well bottomed in Mississippian age strata.

90-990'

<u>Age.</u>	Late Cretaceous Possible Santonian to Campanian
<u>Zone.</u>	P-M14?
<u>Environment.</u>	Marine
<u>Palynomorphs.</u>	<p>The questionable Santonian - Campanian interval is marked by a rather sparse dinocyst assemblage. The assemblage includes the forms <i>Chatangiella ditissima</i>, <i>C. granulifera</i>, <i>Gonyaulacysta tenuiceras</i>, <i>Nelsoniella aceras</i> and <i>Odontochitina operculata</i>.</p> <p>The spore-pollen assemblage consists of long ranging Mesozoic forms.</p>

990-1088'SW

<u>Age.</u>	Late Cretaceous Possible Turonian to Coniacian
<u>Zone.</u>	P-M15?
<u>Environment.</u>	Marine
<u>Palynomorphs.</u>	This interval carries some of the same species recorded above and has an increase in occurrences of <i>Oligosphaeridium complex</i> and <i>Palaeoperidinium cretaceum</i> .
<u>Discussion.</u>	The age assignment is based mainly on the decrease in dinocyst occurrences. The usual marker species <i>Isabelidium globosum</i> was not found.

1088SW-2430'SW

<u>Age.</u>	Early Cretaceous Middle to Late Albian
<u>Zone.</u>	P-M17
<u>Environment.</u>	Marine
<u>Palynomorphs.</u>	<p>The Middle to Late Albian spore assemblage is rather sparse. The recorded forms include <i>Appendicidites</i>, <i>Contignisporites glebulentus</i> and <i>Foraminisporis wonthaggiensis</i>.</p> <p>The dinocyst assemblage includes the important markers <i>Luxadinium propatum</i>, <i>Pseudoceratium polymorphum</i> and <i>Wigginsella grandstandica</i>.</p>

2430SW-6340'C

<u>Age.</u>	Early Cretaceous Aptian to Early Albian
<u>Zone.</u>	P-M18
<u>Environment.</u>	Marine
<u>Palynomorphs.</u>	<p>This interval carries a generalized Aptian - Albian palynomorph assemblage and many of the forms seen above are present here.</p> <p>The spore-pollen assemblage shows some increase in diversity. Recorded are scattered occurrences of <i>Foveosporites</i>, <i>Klukisporites</i>, <i>Polycingulatisporites reduncus</i> and <i>Rogalskaisporites cicatricosus</i>.</p> <p>The dinocyst forms include <i>Cribroperidinium edwardsi</i>, <i>Cyclonephelium distinctum</i>, <i>Imbatodinium jaegeri</i>, <i>Odontochitina operculata</i>, <i>Oligosphaeridium complex</i>, <i>Palaeoperidinium cretaceum</i>, <i>Pseudoceratium polymorphum</i> and <i>P. retusum</i>.</p> <p>Common to this interval are numerous scattered occurrences of reworked Carboniferous, Triassic, Jurassic and Neocomian palynomorphs.</p>
<u>Discussion.</u>	Although the assemblage is similar to the Middle - Late Albian, an absence of Albian-restrictive species is significant. Based on this absence, an Aptian - Early Albian age is assigned.

6340C-6570'

<u>Age.</u>	Early Cretaceous Barremian to Aptian
<u>Zone.</u>	P-M18a
<u>Environment.</u>	Marine
<u>Palynomorphs.</u>	<p>The interval of Barremian - Aptian strata is marked by an increase in dinocyst abundance. The assemblage includes <i>Cyclonephelium distinctum</i>, <i>Gardodinium trabeculosum</i>, <i>Odontochitina operculata</i>, <i>Oligosphaeridium complex</i>, <i>Palaeoperidinium cretaceum</i> and <i>Senoniasphaera microreticulata</i>.</p> <p>The spore-pollen assemblage is very sparse.</p>
<u>Discussion.</u>	A depositional site with low detrital input is indicated by the paucity of land-derived palynomorphs. The organics are thus amorphous-rich.

6570-6660'

<u>Age.</u>	Early Cretaceous Possible Hauterivian
<u>Zone.</u>	P-M19?
<u>Environment.</u>	Marine
<u>Palynomorphs.</u>	<p>The very thin interval of possible Hauterivian strata represents one ditch sample. The age assignment is based mainly on the appearance of <i>Oligosphaeridium complex</i> (thick-wall) and the presence of <i>Gardodinium trabeculosum</i>.</p>

6660-6705'C

<u>Age.</u>	Possible Early Jurassic Undifferentiated
<u>Zone.</u>	P-M24?
<u>Environment.</u>	Marine
<u>Palynomorphs.</u>	This questionable interval is also very thin. The bases for the age assignment are the occurrences of <i>Lycopodiumsporites semimurus</i> , and an increase in <i>Micrhystridium</i> and <i>Veryhachium</i> species.

6705C-6750'

<u>Age.</u>	Late Triassic Norian
<u>Zone.</u>	P-M26
<u>Environment.</u>	Marine
<u>Palynomorphs.</u>	The appearance of the pollen <i>Ricciisporites tuberculatus</i> , and the dinocysts <i>Sverdrupiella spinosa</i> and <i>S. usitata</i> , mark the Norian section.

6750-7167'C

<u>Age.</u>	Indeterminate
<u>Environment.</u>	Indeterminate
<u>Palynomorphs.</u>	A palynomorph assemblage of low diversity is seen in this interval. The marine forms are essentially absent, and the spore-pollen forms consist mainly of bisaccates and densosporites. The latter are deemed to be reworked.

7167C-7504'T.D.

<u>Age.</u>	Mississippian Undifferentiated
<u>Zone.</u>	P-T21b
<u>Environment.</u>	Nonmarine
<u>Palynomorphs.</u>	Only spore-pollen were recovered through this interval. The assemblage includes <i>Alatisporites tessellatus</i> , <i>Densosporites</i> , <i>Endosporites</i> , <i>Knoxisporites hederatus</i> , <i>Lycospora</i> , <i>Murospora varia</i> and <i>Tripartites incisorilobus</i> .
<u>Discussion.</u>	This high diversity assemblage is equated to the P-M21b zonule.

CONCLUSIONS

Palynological analysis of the USGS/Husky East Simpson No. 2 well provides the following generalized palynostratigraphic succession:

- Marine Late Cretaceous strata occur between 90 feet and 1088SW feet. The subdivision of this interval is highly tentative. Possible Santonian - Campanian age is assigned to the section down to 990 feet. Possible Turonian - Coniacian age is assigned to the section below 990 feet.
- Marine Middle - Late Albian strata are seen between 1088SW feet and 2430SW feet.
- Marine Aptian - Early Albian strata are identified between 2430SW feet and 6340C feet. This age assignment is based on negative evidence.
- Marine Barremian - Aptian strata is designated from 6340C feet to 6570 feet. This interval represents a time of low detrital input.
- A single sample of marine Hauterivian? strata is recorded. The sample depth is 6570 feet to 6660 feet.
- A thin interval of marine Early Jurassic? strata is placed at 6660 feet to 6705C feet. This section appears to be in the P-M24 zonule.
- Marine Late Triassic, Norian, strata are identified between 6705C feet and 6750 feet.

- An interval of indeterminate age is seen between 6750 feet and 7167C feet. A sparse nondescript assemblage was recorded.
- The bottom interval from 7167C feet to the total depth of 7504 feet consists of nonmarine Mississippian strata. This represents the P-M21b zonule.