MICROPALEO CONSULTANTS, INC.

U. S. NAVY - NPRA

IKO BAY NO. 1

API #50-023-20007

SEC. 16, T21N/R16W UM

NORTH SLOPE, ALASKA

Prepared by:

Michael B. Mickey - Foraminifera

Hideyo Haga - Palynomorphs

BIOSTRATIGRAPHY REPORT

Job No. 22-113 **March, 2003**

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TL_{N}

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Indeterminate Age

Discussion. Black basement argillite based on lithologic examination of core and e-log.

FORAMINIFERA REPORT

Interpreted by

Michael B. Mickey

FORAMINIFERA SUMMARY

180-1510'

Age.	Early Cretaceous Probable Middle to Late Albian	
Zones.	Probable F-9 to F-11	
Environment.	180-540':	Inner to Middle Neritic (Inner to Middle Shelf)
	540-1310':	Outer Neritic to Upper Bathyal (Outer Shelf to Upper Slope)
	1310-1510':	Middle Bathyal - Some Distal (Middle Slope - Some Starved Basin)

1510-1520'

Age.	Early Cretaceous Aptian to Early Albian
Zone.	F-11
Environment.	Middle Bathyal - Distal (Middle Slope - Starved Basin)

1520-1760'

Age.	Early Cretaceous Probable Barremian
Zone.	Probable F-12
Environment.	Outer Neritic to Upper Bathyal (Outer Shelf to Upper Slope)

1760-1890'SW

Age.	Early Cretaceous Hauterivian
Zone.	F-13a
Environment.	Outer Neritic to Upper Bathyal (Outer Shelf to Upper Slope)

1890SW-1930'

Age.	Early Cretaceous Possible Valanginian
Zone.	F-13b?
Environment.	Middle to Outer Neritic (Middle to Outer Shelf)

1930-2090'

Age.	Early Jurassic Toarcian	
Zone.	F-18a	
Environment.	Outer Neritic to Upper Bathyal (Outer Shelf to Upper Slope)	

2090-2571'SW

Age.	Early Jurassic Pliensbachian	
Zone.	F-18b	
Environment.	2090-2387'C:	Upper to Middle Bathyal (Upper to Middle Slope)
	2387C-2571'SW:	Marginal Marine to Middle Neritic (Transitional to Middle Shelf)

2571SW-2623'SW SAMPLE GAP

2623SW-2683'SW (Base of Submitted Samples)

Age.	Late Triassic Norian
Zone.	F-19b
Environment.	Marginal Marine to Inner Neritic (Transitional to Inner Shelf)

INTRODUCTION

Scope

Data from 150 Foraminifera samples from the U. S. Navy Iko Bay No. 1 well were incorporated into this report. These consisted of 122 ditch, 9 conventional core and 19 sidewall core samples covering the interval 180 to 2683SW feet. This work was done as part of M.C.I. Job Number 22-113.

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 reposited 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. A Foraminifera Distribution Chart (Figure F-1) 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

180-1510'

Age. Early Cretaceous
Probable Middle to Late Albian

Zones. Probable F-9 to F-11

Environment.

180-540':	Inner to Middle Neritic (Inner to Middle Shelf)
540-1310':	Outer Neritic to Upper Bathyal (Outer Shelf to Upper Slope)
1310-1510':	Middle Bathyal - Some Distal (Middle Slope - Some Starved Basin)

Fauna. *Trochammina mcmurrayensis, T. rainwateri, Gavelinella stictata, G. awunensis, Bathysiphon brosgei, B. vitta, Haplophragmoides topagorukensis, H. excavatus, Eurycheilostoma robinsonae, Valvulineria loetterlei, Ammodiscus rotalarius, Miliammina awunensis, M. manitobensis, Lenticulina macrodisca, Hippocrepina barksdalei, Verneuilinoides borealis, Gaudryina nanushukensis, Textularia topagorukensis, Reophax minuta, Arenobulimina paynei, Saracenaria grandstandensis, Inoceramus* prisms, *Ditrupa cornu,* fish debris, coal, pyrite, paper shale, frequent to common radiolaria below 1220 feet, and frequent tar below 1440 feet.

1510-1520'

Age. Early Cretaceous
Aptian to Early Albian

Zone. F-11

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

Fauna. Barren of Foraminifera. Frequent to common pyritized radiolaria and common paper shale.

1520-1760'

Age. Early Cretaceous
Probable Barremian

Zone. Probable F-12

Environment. Outer Neritic to Upper Bathyal
(Outer Shelf to Upper Slope)

Fauna. *Ammobaculites reophacoides, A. fragmentarius, Haplophragmoides topagorukensis, H. duoflatis, H. coronis,* arenaceous spp. (large, coarse), *Gaudryina subcretacea, G. tailleuri, G. tappanae, Thuramminoides* spp., *T. septagonalis, Pseudobolivina* sp., *P. rayi, Reophax tundraensis, Ammodiscus* sp. (small, thin), *Bathysiphon scintillata, Miliammina* cf. *ischnia, Saracenaria projectura, Gaudryinella irregularis, Trochamminoides* sp. (small, thin), megaspores, paper shale, pyrite and frequent to abundant rounded frosted quartz floating sand grains.

1760-1890'SW

Age. Early Cretaceous
Hauterivian

Zone. F-13a

Environment. Outer Neritic to Upper Bathyal
(Outer Shelf to Upper Slope)

Fauna. *Haplophragmoides duoflatis, H. coronis, Gaudryina tailleuri*, arenaceous spp. (large, coarse), *Thuramminoides* spp., *Pseudobolivina rayi, Bathysiphon scintillata, Ammobaculites reophacoides, Saracenaria projectura*, pyrite, common to abundant rounded frosted quartz floating sand grains, and frequent oil staining? and tar between 1870 to 1890 feet.

1890SW-1930'

Age. Early Cretaceous
Possible Valanginian

Zone. F-13b?

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

Fauna. *Lenticulina muensteri, Glomospira subarctica, Haplophragmoides inflatigrandis, H. duoflatis, H. coronis, Gaudryina milleri, G. tailleuri, Glomospirella arctica*, arenaceous spp. (large, coarse), *Trochamminoides* sp. (small, thin), *Ammobaculites reophacoides, Thuramminoides septagonalis, T.* spp., *Pseudobolivina rayi*, pyrite, common to abundant rounded frosted quartz floating sand grains and frequent tar.

1930-2090'

Age.	Early Jurassic Toarcian
Zone.	F-18a
Environment.	Outer Neritic to Upper Bathyal (Outer Shelf to Upper Slope)
Fauna.	*Marginulinopsis bergquisti, Trochammina sablei, T. canningensis, T. topagorukensis, Haplophragmoides barrowensis, H. canui, Ammodiscus siliceus, A. asperus, Ammobaculites alaskensis, A. barrowensis, A. vetusta, Bathysiphon anomalocoelia, Astacolus dubius, Reophax densa, R. liasica, Textularia areoplecta,* pyrite, frequent to common radiolaria, and frequent tar down to 2000 feet.

2090-2571'SW

Age.	Early Jurassic Pliensbachian	
Zone.	F-18b	
Environment.	2090-2387'C:	Upper to Middle Bathyal (Upper to Middle Slope)
	2387C-2571'SW:	Marginal Marine to Middle Neritic (Transitional to Middle Shelf)
Fauna.	*Trochammina canningensis, T. sablei, T. gryci, Lenticulina toarcense, L. varians, Haplophragmoides barrowensis, H. canui, Ammobaculites alaskensis, A. barrowensis, A. fontinensis, Astacolus calliopsis, Ammodiscus asperus, A. siliceus, Nodosaria radiata, N. pachistika, Textularia areoplecta, Vaginulina sherborni, Paleopolymorphina vagina, Marginulina psila, Triplasia kingakensis, Tolypammina glareosa, Frondicularia baueri, Planularia striata*, pyrite, and rare *Pentacrinus subangularis alaska* in core samples from 2410 to 2444 feet.	

2571SW-2623'SW SAMPLE GAP

2623SW-2683'SW (Base of Submitted Samples)

Age.	Late Triassic Norian
Zone.	F-19b
Environment.	Marginal Marine to Inner Neritic (Transitional to Inner Shelf)
Fauna.	Rare *Vaginulinopsis acrulus* and rare to frequent *Monotis/Halobia* shell fragments.

CONCLUSIONS

The U. S. Navy Iko Bay No. 1 well penetrated the following biostratigraphic sequence based on foraminiferal analysis:

- 1710+ feet (180-1890'SW) of Hauterivian to probable Albian age (Early Brookian & Beaufortian - Rift Sequence) inner shelf to middle slope Hauterivian deposits.

- 681+ feet (1890SW-2571'SW) of Pliensbachian to possible Valanginian age (Beaufortian - Incipient Rift Sequence) marginal marine to middle slope sedimentation.

- 52 feet (2571SW-2623'SW) Sample Gap

- 60+ feet (2623SW-2683'SW Basal Sample) of Late Triassic (Norian) age (Late Ellesmerian) marginal marine to inner shelf deposition.

- 19 feet (2683SW-2702'C) Sample Gap

- 37+ feet (2702C-2739'T.D.) of indeterminate age (Franklinian) black basement argillite. Based on lithologic examination of core only.

PALYNOLOGY REPORT

Interpreted by:

Hideyo Haga

PALYNOLOGY SUMMARY

180-1440'

Age.	Early Cretaceous Aptian - Early Albian
Zone.	P-M18
Environment.	Marine
Remarks.	No species distribution chart is available for this part of the well. The age assignment is made from data in a summary report written May, 1975.

1440-1530'

Age.	Early Cretaceous Aptian - Early Albian
Zone.	P-M18
Environment.	Marine

1530-1860'

Age.	Early Cretaceous Barremian - Aptian
Zone.	P-M18a
Environment.	Marine

1860-1900'

Age.	Early Cretaceous Hauterivian
Zone.	P-M19
Environment.	Marine
Remarks.	Possible Hauterivian as high as 1820 feet.

1900-1930'

Age.	Early Cretaceous Possible Valanginian
Zone.	P-M20?
Environment.	Marginal? Marine

1930-2000'

Age.	Probable Early Jurassic Undifferentiated
Zone.	P-M24?
Environment.	Marginal? Marine

2000-2337'C

Age. Indeterminate

Environment. Indeterminate

Remarks. No species distribution chart is available for this part of the well. A list of species is given in a summary report written January, 1977.

2337C-2571'SW

Age. Triassic - Early Jurassic Undifferentiated

Zones. P-T15 to P-M24

Environment. Marginal Marine

Remarks. No species distribution chart is available for this part of the well. The age assignment is made from data in a summary report written January, 1977.

2571SW-2683'SW SAMPLE GAP

2683'SW

Age.	Probable Late Triassic Probable Carnian - Norian
Zones.	Probable P-M27 to P-M26
Environment.	Marine
Remarks.	Deepest sample examined.

INTRODUCTION

Purpose and Scope

The U. S. Navy Iko Bay No. 1 well was initially prepared and analyzed for palynological study in May, 1975. The report of that date studied the interval from 180 feet to 2683 feet, but did not have a palynomorph species distribution chart. In a later study, part of the well was resampled and processed. This later study, conducted in the early 1980's, had a distribution chart that covered the interval from 1440 feet to 2000 feet.

This report provides an updated format for all the available data. Some of the taxa have been revised to reflect newer taxonomic assignments that have evolved over the decades since the initial study.

Procedures

The 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 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 available for examination begin at 180 feet and the youngest units encountered at that depth were of Early Cretaceous age. The oldest dateable assemblage is of Late Triassic age.

180-1440'

Age. Early Cretaceous
Aptian to Early Albian

Zone. P-M18

Environment. Marine

Palynomorphs. The species noted in the summary report are the following:

- Undifferentiated bisaccates (F-A)
- *Cyclonephelium distinctum* (R)
- *Imbatodinium jaegeri* (R)
- *Nannoceratopsis gracilis* (V) reworked
- *Odontochitina operculata* (R)
- *Oligosphaeridium complex* (R)
- *Muderongia* sp. (R)
- *Palaeoperidinium cretaceum* (R-F)
- *Sirmiodinium grossi* (R) reworked
- *Tubotuberella apatela* (R) reworked

Discussion. No species distribution chart is available for this part of the well. The age assignment is made from data in a summary report written May, 1975.

1440-1530'

Age. Early Cretaceous
Aptian to Early Albian

Zone. P-M18

Environment. Marine

Palynomorphs. The palynomorph assemblage contains most of the forms listed above. Additional forms noted in the reprocessed slides include *Deltoidospora*, *Gleicheniidites senonicus*, *Lycopodiumsporites* and *Osmundacidites*.

Within this interval, an earlier summary report dated January, 1977, noted presence of the reworked forms, striated bisaccates, *Gonyaulacysta cladophora*, *G. jurassica*, *Nannoceratopsis gracilis*, *N. pellucida*, *Pareodinia osmingtonensis*, *Sirmiodinium grossi*, *Sverdrupiella usitata* and *Tubotuberella apatela*.

1530-1860'

Age. Early Cretaceous
Barremian to Aptian

Zone. P-M18a

Environment. Marine

Palynomorphs. The spore-pollen assemblage remains similar to the above interval.

The dinocyst assemblage becomes very abundant and diverse. The most abundant species include *Cyclonephelium distinctum*, *Gardodinium trabeculosum*, *Odontochitina operculata*, *O.* sp. 1, *Oligosphaeridium complex* and *Palaeoperidinium cretaceum*.

1860-1900'

Age. Early Cretaceous
Hauterivian

Zone. P-M19

Environment. Marine

Palynomorphs. The Hauterivian interval is marked by the abundance of *Oligosphaeridium complex* (thick-wall) and the presence of *Tubotuberella uncinata*.

Discussion. There is minor palynomorph evidence for placing the top of the Hauterivian as high as 1820 feet. This is based on the dinocyst form identified as *Gonyaulacysta confossa*. Although the species is identified in this well, it is not a commonly recognized dinocyst in the region and is of limited value.

1900-1930'

Age. Early Cretaceous
Possible Valanginian

Zone. P-M20?

Environment. Marginal? Marine

Palynomorphs. This interval is tentatively assigned a Valanginian age. The dinocyst species decrease in abundance. Possibly most of the specimens are present due to sloughing. No positive evidence of Valanginian was recorded.

1930-2000'

Age. Probable Early Jurassic
Undifferentiated

Zone. P-M24?

Environment. Marginal? Marine

Palynomorphs. The pollen *Classopollis classoides* occurs abundantly in this interval.

Many of the same forms seen above carry down into this section. The Early Jurassic evidence consists of the undescribed dinocyst JRD-6.

2000-2337'C

Age. Indeterminate

Environment. Indeterminate

Palynomorphs. No species distribution chart is available for this part of the well. The data are from a summary report dated January, 1977. The list of species is as follows:

Undifferentiated bisaccates (F-C)
Classopollis classoides (R-F)
Polycingulatisporites reduncus (V)
Rogalskaisporites cicatricosus (V)
Vitreisporites pallidus (R)
Gardodinium eisenacki (R-F)
Micrhystridium spp. (R)
Nannoceratopsis gracilis (R)
Nannoceratopsis pellucida (R)
Odontochitina operculata (R-F)
Oligosphaeridium complex (R-F)
Pareodinia ceratophora (R)

Discussion. The above assemblage is a mixture of Jurassic and Cretaceous species. These all appear to be derived from up-hole.

2337C-2571'SW

Age. Triassic - Early Jurassic
Undifferentiated

Zones. P-T15 to P-M24

Environment. Marginal Marine

Palynomorphs. No species distribution chart is available for this part of the well. The age assignment is made from data in a summary report written January, 1977. The list of palynomorphs is as follows:

Aequitriradites spp. (R)
Callialasporites dampieri (R)
Classopollis classoides (R-F)
Heliosporites altmarkensis (R)
?*Neoraistrickia elongata* (V)
Rogalskaisporites cicatricosus (R)
Vitreisporites pallidus (R-F)
Micrhystridium spp. (R-A)

2571SW-2683'SW SAMPLE GAP

2683'SW

Age.	Probable Late Triassic Probable Carnian - Norian
Zones.	Probable P-M27 to P-M26
Environment.	Marine
Palynomorphs.	This sidewall core yielded a limited palynomorph assemblage. It consisted of *Classopollis classoides*, *Vitreisporites pallidus*, *Micrhystridium* and ?*Shublikodinium*.
Discussion.	The *Shublikodinium* form was very abundant and is the basis for the Late Triassic age assignment. The well was drilled to a total depth of 2739 feet, but this sidewall core is the deepest sample examined.

CONCLUSIONS

Palynological analysis of the U. S. Navy Iko Bay No. 1 well provides the following generalized palynostratigraphic succession:

- Marine Aptian - Early Albian strata are identified between 180 feet and 1530 feet.

- Marine Barremian - Aptian age strata occur from 1530 feet to 1860 feet.

- Marine Hauterivian strata occur between 1860 feet and 1900 feet.

- Marginal? marine strata of possible Valanginian age are seen between 1900 feet and 1930 feet.

- Marginal marine strata of probable Early Jurassic age appear between 1930 feet and 2000 feet.

- The interval from 2000 feet to 2337C feet is of indeterminate age. The recovered palynomorphs do not appear to be indigenous.

- Marginal marine strata of Triassic to Early Jurassic age are identified between 2337C feet and 2571SW feet.

- The deepest sample examined is a sidewall core from 2683 feet. It carries a marine assemblage of probable Carnian - Norian age.