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PALYNEX INTERNATIONAL

June 20, 1987

John Decker
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794 University Ave.
Fairbanks, Alaska 99709

Dear John,

Enclosed is a draft of the palynological analyses for the 35 samples submitted to us. I will be able to finalize the conclusions when you can submit some locality information on the initial 30 samples submitted. In the mean time, these results should prove of interest to you. Lacking are the plates which I will send to you with the final draft.

These samples were rather difficult to work with due to preservation and the sparse assemblages, but the processing was done by an excellent processor. He has an MS in palynology and is good in the lab. I spent alot of time on the examination and I don't think that much was overlooked. I keep microscope coordinates for most all specimens and this information can be available to you as well. We will send you the residues and remaining sample material when everything is completed.

The foram samples are not yielding. Four samples are productive, and I should be getting that information to you shortly. They took longer to process.

Thanks for using our services.

Sincerely,

Fred May, PhD

Biostratigraphy,
Basin Analysis,
Geohistory, Burial History,
Laboratory Processing, Micropaleo/Palynology

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Palynex International

Technical Report

Report Title: Palynological analysis of thirty-five Arctic Alaska outcrop samples from near the Arctic National Wildlife Refuge.

Report Prepared By: Fred E. May
Date: May 15, 1987
Samples Submitted By: John Decker, Alaska Dept. Natural Resources

INTRODUCTORY COMMENTS

This report is considered tentative until sample locality and formation information can be provided. Age information included herein is based solely on palynomorph forms present, and reworking potential has not been evaluated totally. Locality information accompanied the final five (5) samples examined for this report. Otherwise, no submittal sheet accompanied the previous thirty (30) samples. The thirty outcrop samples are from the general area of the Arctic National Wildlife Refuge (ANWR).

Sample Processing: Samples were processed by Palynex International Laboratories by an MS palynologist with excellent background and training to assure optimum palynomorph recovery. This is especially important in processing Arctic Alaska outcrop or near surface samples where recovery is generally difficult.

Magnification of Examination: All samples were scanned at 100X magnification for initial examination; individual specimens were examined at 400X to 1,000X. Each sample was also scanned through two transects at 200X to determine if small palynomorphs are present. Fossil residues were mounted under 22 X 44mm coverslips.

Age Terminology Used: Previously reported occurrences for palynomorphs are stated as ranging "from" one age "to" another age; these ages are inclusive.

Age Determinations: Age determinations for sparse and poorly-preserved assemblages are less conclusive than for other assemblages. In most cases, for these samples examined, the age determinations could be more conclusive through the examination of additional material or samples. Generally, it is best to have two or three outcrop, or subsurface, samples from the same interval. Certainly, the samples submitted indicate that good palynostratigraphic information exists within the stratigraphic intervals of interest. Considering the generally difficult nature of Arctic outcrop samples, these samples worked out quite well.

Barren Samples: Each fossil residue was examined at length. Strew mounts are placed on a 22 X 44mm glass cover slip for examination, and each field of view is examined. This is a considerable amount of field area to cover, but it allows for the extraction of more information than might otherwise be found. Thus, samples pronounced barren are done so only after considerable examination.

Paleoecology: samples containing dinoflagellates and/or acritarchs can be considered marine. Samples containing only pollen and spores could be either marine or nonmarine. Detailed examinations, using count data and environmental marker taxa, were not done. This can work in palynology, if the right forms are present.

Confidentiality of Some Information Provided: Palynex will discuss and/or state with clients its views on applicable palynomorph ranges. This information, however, should not be distributed to, or discussed with, competetor companies. It would be appropriate for a client to crosscheck age information with competetors without divulging proprietary Palynex data.

TAI Information: TAI preparations were made after the sample had been processed with HCl and HF, and prior to oxidaton; each residue was put through heavy liquid. The Pollen and Spore Color Standard, using 10 Munsell color standards, is used. This system was developed in 1981, and updated in 1984, by D.A. Pearson of Phillips Petroleum Company, Bartlesville, OK. The following values and corresponding Organic Thermal Maturity terms are used: Immature (1, 1+, 2-, 2); Mature Main Phase of Liquid Petroleum Generation (2+, 3-, 3, 3+), Dry Gas or Barren (3+, 4-, 4, 5). Although vitrinite reflectance was not done, the following VR values correspond to TAI values: VR 0.5% = 2 to 2+ TAI; VR 1.3% = 3+. The measurement of thermal maturity (TAI) of the visual kerogen is based primarily upon coloration of the plant cuticle and secondarily upon the coloration of the spore-pollen. When curticle and spore are absent, a value for maturity can be obtained from the coloration of the amorphous-sapropel but this is difficult to do with any great degree of confidence. In the case of these samples examined, TAI's were determined from either spores or amorphous sapropel (as) (alginite). The "as" was examined under high power to isolate clusters of "as" that could be evaluated for coloration.

RESULTS OF PALYNOLOGICAL ANALYSES:

SAMPLE 86JD1A

Age: Indeterminate.

TAI: No palynomorphs available for examination; clusters of fluffy alginite (amorphous sapropel) are in the 3+ to 4 range.

SAMPLE 86JD108B

Age: Assemblage suggests an age of Middle Albian.

TAI: Only dinoflagellates were observed; these are in the 3- to 3+ range.

SAMPLE 86JD116A

Age: Indeterminate.

TAI: No spores or pollen were observed. Amorphous sapropel ranges from 3 to 4-.

SAMPLE 86JD117A

Age: Concurrent ranges tend to restrict the age to Barremian to Middle Albian. The range for Microdinium opacum restricts the age perhaps further to Aptian to Middle Albian. The lack of the Middle to Late Albian markers (e.g., Genus W, Spinidinium vestitum, Luxadinium propatulum, and Ovoidinium verrucosum) suggests an age older than Middle to Late Albian. Based on the assemblage from this single sample, an Aptian to Early Albian age is favored. The presence of Millioudodinium spinoreticulatum suggests Valanginian, but its range is likely not well known, having been reported only once in the literature from the northern Richardson Mountains in the District of MacKenzie, Canada.

TAI: Only dinoflagellates were observed; these are in the 3 to 3+.

SAMPLE 86JD156A

Age: Indeterminate.

TAI: 3- to 4-; one palynomorph fragment observed; amorphous sapropel (alginite) organic debris examined as well.

SAMPLE 86JD157A

Age: Indeterminate.

TAI: A few palynomorph fragments and fine amorphous sapropel indicate a TAI range of 3- to 3+.

SAMPLE 86JD157B

Sample is barren of palynomorphs. Organic debris consists of fine inertinite
Age: Indeterminate.

TAI: No palynomorphs were observed. Amorphous sapropel is in the 3- to 3+ range.

86JD167A

Age: Indeterminate.

TAI: Amorphous sapropel is in the 3+ to 4- range.

SAMPLE 86JD170B

Age: Indeterminate.

TAI: No palynomorphs observed; amorphous sapropel is in the 3 to 3+ range; clumps of sapropel may be as high as 4-.

SAMPLE 86JD194A

Age: Indeterminate.

TAI: No palynomorphs available; clusters of fluffy alginite (amorphous sapropel)are about 4.

SAMPLE 86JD194A-1

Age: Hautervian or younger.

TAI: Difficult to determine. Two acritarchs (Cymatiosphaera) are about 2+; amorphous sapropel is generally in the 2- to 2+ range.

SAMPLE 86JD195B

Age: Possibly Albian or younger.

TAI: No palynomorphs were observed. Amorphous sapropel examined ranges from 3 to 3+.

SAMPLE 86JD196B

Age: Indeterminate.

TAI: Rare spore fragments appear to ie in the 3 to 3+ range. Amorphous sapropel is lighter in color, being nearly clear, but sometimes being darker, 3 to 3+.

SAMPLE 86JD197A

Age: A strict concurrent-age-interpretation of the above-stated ranges would suggest a Barremian to Aptian age, but the assemblage is sparse and poorly preserved, and the age depends heavily on the single Tanyosphaeridium and on the Tenua. This is not an ideal situation for developing an age determination.

TAI: No palynomorphs were observed. Amorphous sapropel lacks brown color, typically being clear to black. This suggests a fairly high TAI, perhaps in the 3+ to 4- range.

SAMPLE 86JD197B

Age: Latest Triassic or younger.

TAI: No palynomorphs were observed. Amorphous sapropel is in the 3+ to 4- range.

SAMPLE 86JD199A

Age: Indeterminate.

TAI: No palynomorphs were observed. Amorphous sapropel is generall dark, in the 3+ to 4- range.

SAMPLE 86NH9D-12M

Age: Likely Permian to Triassic.

TAI: Pollen grains appear to be in the 3+ to 4- range. Amorphous sapropel generall lacks a brownish color, with more dark brown to blacl color.

SAMPLE 86NH9-6.5M

Age: Perhaps Pennsylvanian.

TAI: Spores observed are in the 3+ to 4- range. Amorphous sapropel is primarily lacking in brown, having more black.

SAMPLE 86NH17-8M

Age: Devonian to probable Mississippian.

TAI: The few palynomorphs encountered in the unoxidized fraction have a TAI of about 3 to 4-. This is significant because this sample was the oldest dated. If these specimens are indicative of the thermal maturity, then oil has been generated in these older strata without going far into gas phase.

SAMPLE 86NH17-26M

Age: Probably Early Triassic; however, the assemblage is sparse, containing only a few forms that appear diagnostic; they are not well preserved. More samples from this interval would be helpful.

TAI: A few fragments of palynomorphs were observed, being in the 3 to 3+ range. Amorphous sapropel has a brownish tint, also being in the 3 to 3+ range.

SAMPLE 86AM2(F1)

Age: Aptian to Albian

TAI: Spores and amorphous sapropel are in the 3 to 3+ range.

SAMPLE 86AM2(F2)

Age: Indeterminate.

TAI: No palynomorphs were observed. The abundant amorphous sapropel has a brownish color, ranging from 3 to 3+.

SAMPLE 86AM2(F3)

Age: Indeterminate.

TAI: No palynomorphs were observed. Amorphous sapropel is in the 3 to 3+ range, having a pervasive brown color.

SAMPLE 86AM2(F4)

Age: Indeterminate.

TAI: No palynomorphs observed; alginite bodies (amorphous sapropel) clusters in the 3 to 4- range.

SAMPLE 86AM3(F)

TAI: A few small spores and acritarchs are in the 3 to 3+ range. Overall amorphous sapropel is also 3 to 3+.

SAMPLE 86AM4F

Age: Indeterminate

TAI: Both the rare pollen and amorphous sapropel have a brownish coloration in the 3 to 3+ range.

SAMPLE 86AM75F

Age: Based on the possible Muderongia simplex, the age would be Aptian to Albian.

TAI: No palynomorphs were observed. Amorphous sapropel has a pervasive brown color in the 3 to 3+ range.

SAMPLE 86AM77(F)

Age: Indeterminate.

TAI: No palynomorphs observed. Amorphous sapropel is in the 3 to 3+ range.

SAMPLE 86LR45-F

Age: Indeterminate.

TAI: No palynomorphs available; general coloration of most all organic debris is in the 4 range.

SAMPLE 86LR51F

Age: Indeterminate..

TAI: No palynomorphs were observed. Amorphous sapropel is black, being in the 4- to 4 range. No brownish coloration observed at all.

SAMPLE 86LR88F

Age: Indeterminate.

TAI: Rare fragments observed are in the 3+ to 4- range. Amorphous

sapropel is also in the 3+ to 4- range.

Western Bathtub Ridge
Kongakut Clayshale Member
69 7 27 145 45 10

SAMPLE 86AMU42-8

Age: Possibly Hauterivian to Albian.

TAI: No palynomorphs were observed. Amorphous sapropel observed under high power suggests a 3- to 3+ range.

SAMPLE 86AMU42-13

Age: Indeterminate.

TAI: No palynomorphs were observed. Amorphous sapropel suggest a 3- to 3+ range.

SAMPLE 86AMU42-16

Age: Indeterminate.

TAI: No palynomorphs were observed. Scanning under high power several pieces of amorphous sapropel were found that had a coloration in the 3- to 3+ range.

SAMPLE 86WC012C 69 7 14 142 43 53

Age: Albian

TAI: One pollen grain was observed, plus small clumps of amorphous sapropel were examined. These range in color from 3- to 3+.

SAMPLE 86WC013 69 7 7 142 43 50

Age: ?Albian.

TAI: No palynomorphs were observed. Clumps of amorphous sapropel often have a brownish color in the 3- to 3+ range.

SUMMARY OF TAI AND AGE ANALYSES:

	SAMPLE	TAI RANGE	AGE
1.	86JD1A	3+ to 4	Indeterminate
2.	86JD108B	3- to 3+	Middle Albian
3.	86JD116A	3 to 4-	Indeterminate
4.	86JD117A	3 to 3+	Aptian-Early Albian
5.	86JD156A	3- to 4-	Indeterminate
6.	86JD157A	3- to 3+	Indeterminate
7.	86JD157B	3- to 3+	Indeterminate
8.	86JD167A	3+ to 4-	Indeterminate
9.	86JD170B	3 to 4-	Indeterminate
10.	86JD194A	3- to 4	Indeterminate
11.	86JD194A-1	2- to 2+	Hauterivian or younger
12.	86JD195B	3 to 3+	Albian or younger
13.	86JD196B	3 to 3+	Indeterminate
14.	86JD197A	3+ to 4-	Barremian to Aptian
15.	86JD199A	3+ to 4-	Indeterminate
16.	86NH9-6.5M	3+ to 4-	?Pennsylvanian
17.	86NH9D-12M	3+ to 4-	Permian to Triassic
18.	86NH17-8M	3 to 4-	Devonian to Mississippian
19.	86NH17-26M	3 to 3+	Early Triassic
20.	86AM2(F1)	3 to 3+—	Aptian to Albian
21.	86AM2(F2)	3 to 3+	Indeterminate
22.	86AM2(F3)	3 to 3+	Indeterminate
23.	86AM2(F4)	3 to 4-	Indeterminate
24.	86AM3(F)	3 to 3+—	Toarcian to Early Bathonian
25.	86AM4F	3 to 3+	Indeterminate
26.	86AM75F	3 to 3+—	Aptian to Albian
27.	86AM77(F)	3 to 3+	Indeterminate
28.	86LR45-F	4- to 4	Indeterminate
29.	86LR51F	4- to 4	Indeterminate
30.	86LR88F	3+ to 4-	Indeterminate
31.	86AMU42-8	3- to 3+	Hauterivian to Albian
32.	86AMU42-13	3- to 3+	Indeterminate
33.	86AMU42-16	3- to 3+	Indeterminate
34.	86WC012C	3- to 3+	Albian
35.	86WC013	3- to 3+	?Albian

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