INDIANA UNIVERSITY

DEPARTMENT OF GEOLOGY
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January 4, 1983

Dr. H.M. Simpson
Arco Exploration Company
Exploration Operations--Alaska
Post Office Box 360
Anchorage, Alaska 99510

Dear Bud,

Enclosed is the report of the core samples you sent me. You asked me specifically two questions on the phone which I will deal with here. 1) How young could the samples be? -- They could range as young as Middle Miocene but may be older as I discuss in the report. Early to Middle Miocene is a reasonable upper limit from the nature of the fossil assamblage. 2) Could sample #1 and #2 be from the same assemblage and/or environment? -- They both contain the same fossils but sample #2 is from a different environment of deposition. It has much more organic material in relation to sediment and seems to have had more wear before final burial.

The samples will be returned to you as you have requested. You might want to take the time to look especially at sample #1 for there are some nice examples of leaves there. It would be a great bed to collect fossils in if they were ever accessible.

Hope this report helps your work on this section. I've never heard anything from Arco about payment for the first cores I looked at last fall so I have combined the fees for the work on both sets of cores and enclosed it with this letter.

Best regards,

Sincerely yours,

David Dilcher
Professor of Paleobotany
Department of Biology
Department of Geology

Report for Arco Oil and Gas Company

January 4, 1983

In late November 1982 I received two core samples from H. M. Simpson to analyze for megafossils. I broke each of these samples along the bedding surfaces in order to expose as many plant megafossils as possible. The following is a report of what was found and a statement of its bearing on the stratigraphy of the sample. I was not given any location of where the well core was taken; but, from the megafossils it is obvious they are from the far north in tertiary age sediments. Details of this are discussed below.

Analysis

Sample #1. (12,630.6') The following is a tally of the branch and leaf fragments identified.

Metasequoia - 5

Cercidiphyllum - 3

large Betuloid leaf form (Alnus - Carpinus - Corylus) - 3

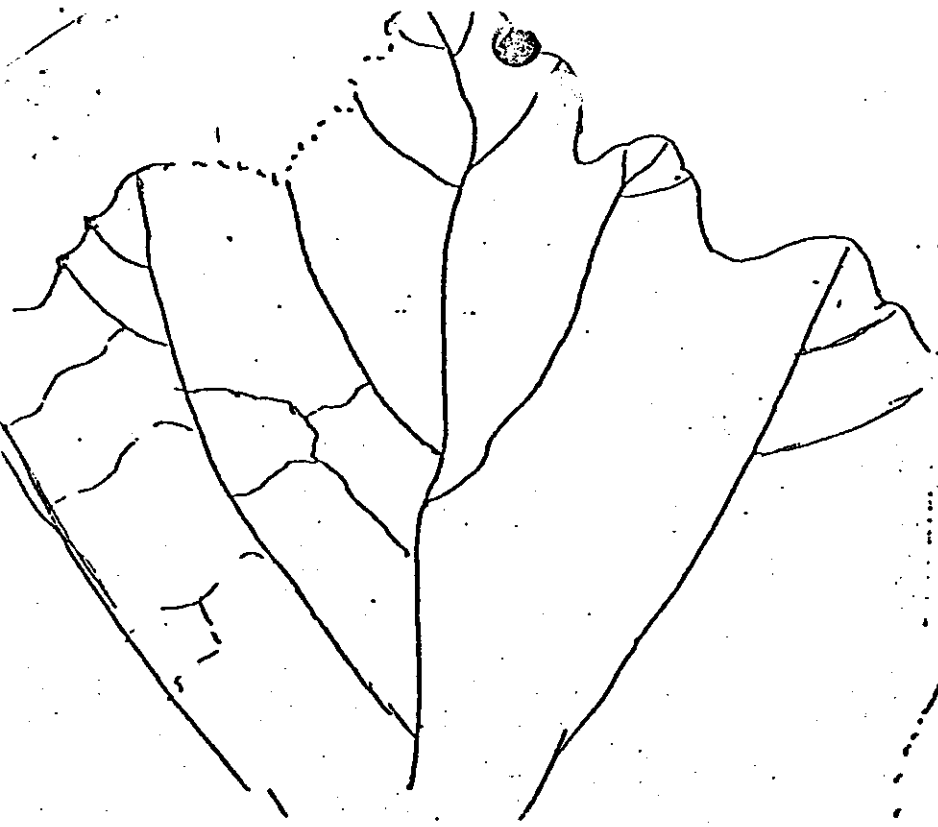
small Betuloid leaf form - 1

fragments of possible Metasequoia cone - 2

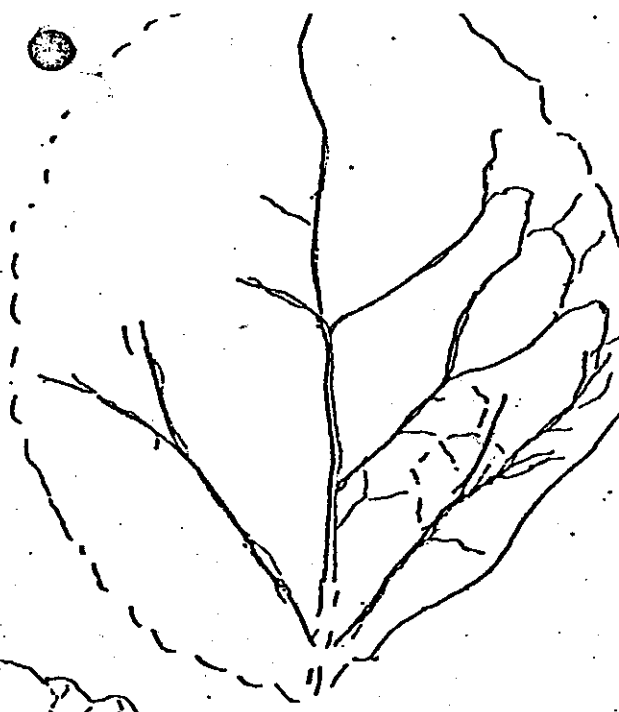
possible fine roots

Illustrations:

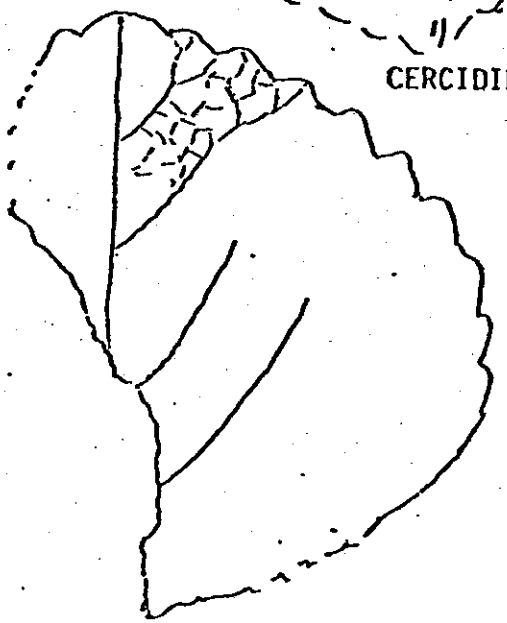
SEE FOLLOWING PAGE.



LARGE BETULOID LEAF
ALNUS-CARPINUS-CORYLUS



CERCIDIPHYLLUM LEAF



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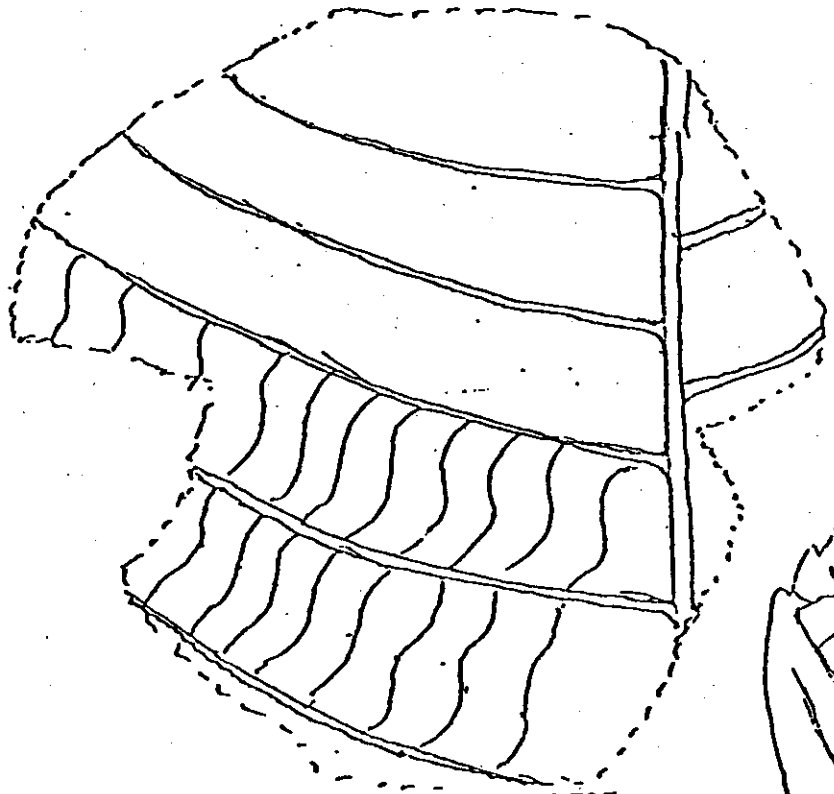
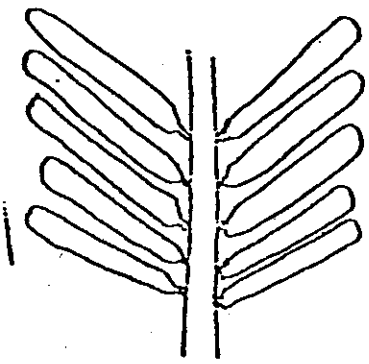
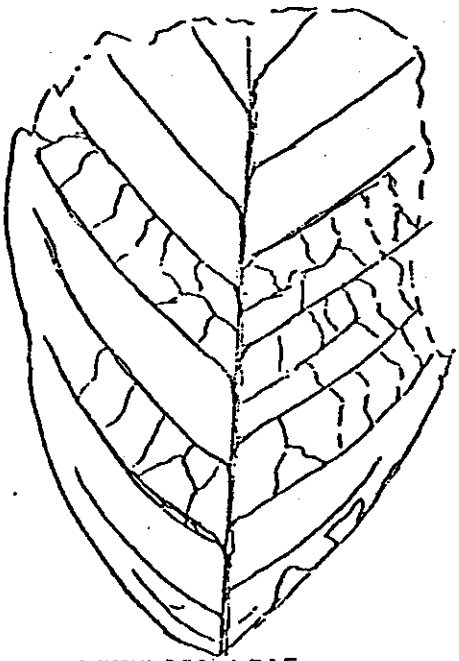


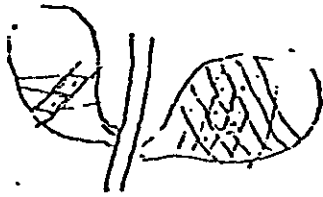
LARGE BETULOID LEAF
ALNUS-CARPINUS-CORYLUS



METASEQUOIA SHOOT



SMALL BETULOID LEAF



METASEQUOIA CONES

ILLUSTRATIONS:

All drawings are about times one and are taken from sample #1. Same leaf types found in both samples.

Sample #2. (12,631.0') The following is a tally of the branch and leaf fragments identified.

Metasequoia - 13

Cercidiphyllum - 3

large Betuloid leaf form - 1

small Betuloid leaf form - 1

Discussion

Cores:

Sample #2 was about 1/2 the size fo sample #1. In spite of this, fragmentary remains of eighteen (18) plant megafossils could be identified. This is an indication of how much more organically rich sample #2 is although the leaf fragments are smaller. There was much more "chewed - up" plant debris in sample #2 than #1. The plant fossils were more regularly dispersed in sample #1,and some very large fragments nearly covered the whole surface of the 4" core.

Biostratigraphy of plant megafossils:

Plant megafossil floras are known from the Gulf of Alaska area (56°) north to about 65° north latitude (Wolfe 1966, Wolfe et al 1966, Wolfe 1972) and from the Ellesmere Island area at about 80° north latitude (Dilcher, field work with Geological Survey of Canada 1982). I do not know from where the core samples were collected. Therefore, I can discuss this unknown only in relation to the knowns mentioned and hope that the reader who may know more details can find this useful to assess an age for the sample.

The very common occurrence of Metasequoia, Cercidiphyllum and Alnus - Carpinus - Corylus Betuloid leaves is typical of the Seldovian flora listed by Wolfe (1966), and he places this flora as Early to Middle Miocene (1972). This flora comes from about 58 - 60° north latitude. Also, this Metasequoia - Alnus - Carpinus - Cercidiphyllum association first becomes dominant in the Middle and Late Oligocene in Asia and Northwestern United States.

A similar assemblage was collected by me from the Fosheim penisula on Ellesmere Island in coal-bearing strata at 80 north latitude from sediments thought to be Paleocene - Eocene age. We also found very large Betuloid leaves which I found in both samples #1 and #2. There were no invertebrates to secure the age of these terrestrial deposits on Ellesmere as Wolfe had in Alaska.

I would suggest the sediments in the core you sent me might be as young as Early to Middle Miocene but no younger. After that time at about 60 north latitude in Alaska conifer forests begin to dominate. However, they could range somewhat earlier because such an assemblage of plants becomes dominant in Oligocene age sediments elsewhere (Asia and northwestern United States) and in the Paleocene - Eocene sediments on Ellesmere Island. The tectonics of the Arctic Ocean and the migration of the north pole may also be factors worth considering in relation to the location of the core. We know as the Arctic sea opened that a plate moved west and south pushing into the top of Alaska forming the Brooks Mountain range. Also we know the north pole moved from mid-Siberia in Cretaceous times to its present position at about Oligocene time. I am uncertain about the importance of this in regards to paleoclimates of that time.

The youngest possible age would be Middle Miocene for the samples, and I would leave open the suggestion that they could be slightly

older. Both samples #1 and #2 represent the same type of vegetation in a slightly different depositional setting and are probably the same age.

References cited:

Wolfe, J.A., 1966. Tertiary plants from the Cook Inlet region, Alaska, U.S. Geological Survey, Professional Papers 398-B:B1-B32.

----------, Hopkins, D. M. and Leopold, E.B., 1966. Tertiary stratigraphy and paleobotany of the Cook Inlet region, Alaska, U.S. Geological Survey, Professional Papers, 398-A: A1-A29.

----------, 1972. An Interpretation of Alaskan Tertiary Floras, Floristics and Paleofloristics of Asia and Eastern North America, Amsterdam, pp. 201-233.

Report prepared by

D. Dilcher

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February 6, 1983

Dr. H. M. Simpson
ARCO Alaska, INc.
Post Office Box 360
Anchorage, Alaska 99510

CONFIDENTIAL

Dear Bud:

Enclosed with this letter please find the report of the latest samples (#3) that you sent to me last week. There was not much material that I could generate from this sample other than the leaf remains that could be observed on the surface.

I do hope that this helps with the final analysis of the whole project and the core material that I have looked at. With best regards, I am,

Sincerely yours,

David Dilcher
Professor of Paleobotany
Department of Biology
Department of Geology

Confidential

REPORT FOR ARCO OIL AND GAS COMPANY

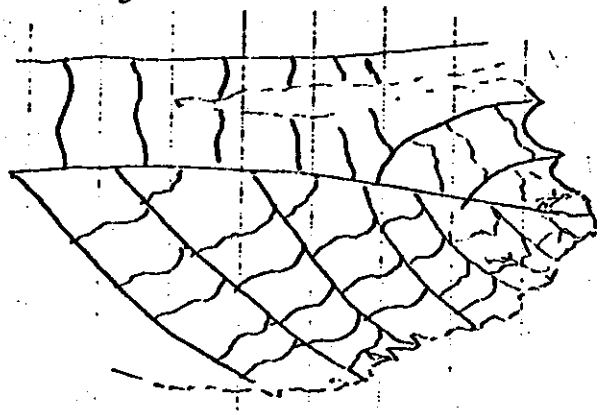
February 5, 1983

Re: North Aleutian No. 1 C.O.S.T.

On February 4, 1983 I received a small sample, designated sample # 3, (16,705.2') from H.M. Simpson. This sample measured about 3.5cm X 5cm and 0.5cm deep.

Analysis:

Sample # 3. (16,705.2') There was one leaf fragment and what appeared to be a branching root fragment obvious on one surface of this sample.



Part of a lobe of a Betuloid-type leaf
(3.5cm x 2.5cm)

I fractured the sample to expose other leaf remains or any organic fragments that might be preserved in the material. Only a very few small organic fragments could be found and none of them was large enough to be useful in the analysis.

Discussion: The single fragment of the Alnus-Carpinus-Corylus or Betuloid-type leaf is characteristic of the general assemblage of plants (also including Metasequoia and Cercidiphyllum) found in the Seldovian Flora from the Early to Middle Miocene of Alaska (Wolfe 1966, 1972).

This type assemblage is known to range from the Middle to Late Oligocene to the Early to Middle Miocene in Alaska. There should be an increase in the diversity of leaf types as this vegetation type first assumes dominance

and a decrease in the variety of elements making it up as well as the abundance of the dominant elements as the flora is "pushed" towards extinction in the northern landmass of North America.

This change in abundance and diversity should be more easily observed in the pollen diagrams of these sediments than the megafossil record, where the pollen is preserved. I have some very characteristic pollen data from the Paleocene-Eocene sediments of Ellesmere Island where coals and shales are quite abundant.

Based upon the presence of a single leaf preserved, I can say that the sample fits with the age determined already for samples # 1 and # 2, previously analyzed. Because of the small size of the sample it is impossible for me to comment upon the fact that no Metasequoia or Cercidiphyllum was found in Ranales sample # 3. The Betuloid leaf-type would be one of the elements in this flora that is known from earlier sediments dating as early as Late Paleocene and through the Eocene at high latitude areas. Also this leaf-type would be one that we might expect to carry through longer into a cooling period in the Miocene than either the Metasequoia or the Cercidiphyllum. With no further data to go on than the one leaf fragment found the age of this sample # 3 could range from Middle-Late Oligocene to Early-Middle Miocene.

References cited

Wolfe, J.A. 1966. Tertiary plants from the Cook Inlet region, Alaska, U.S. Geological Survey, Professional Papers 398-B:B1-B32.

Wolfe, J.A., 1972. An Interpretation of Alaskan Tertiary Floras, in A. Graham, Ed. Floristics and Paleofloristics of Asia and Eastern North America. Amsterdam, p.201-233.