PLEISTOCENE BERINGIA
A SYNTHESIS OF PALEOENVIRONMENTAL AND ARCHAEOLOGICAL STUDIES

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Anthropology 403
December 18, 1985
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INTRODUCTION

Through biological evidence, we can see that a bridge wider than present day Alaska joined the Old and New worlds during a large part of the Pleistocene Epoch. The land surface of this bridge was smooth and monotonous; and large animals moved freely across it during the 80,000 years of the Wisconsin and earlier glacial stages. The bridge was created by a lowering of the sea level as water was locked up in glaciers on land. The Bering Strait is so shallow that a drop of only 120 feet in sea level would raise its bottom above the water. The large land mass resulting from the drop in sea level is now called "Beringia."

It has long been accepted that Early Man followed other grassland mammals into Beringia via the land bridge. Archaeologists have found many sites which show remnants of these early people; yet probably the best sites are now at the bottom of the Bering Sea, out of the archaeologists' reach. At any rate, archaeologists, with the help of biologists and geologists, have begun the difficult task of piecing together the history of the peopling of Beringia and the New World. This paper will present a synthesis of this information.
The objective of this first chapter is not to attempt a full scale geography of present day Alaska, but instead only to outline the general environments of the vast area so as to gain a basis for comparison with the Beringian paleoenvironment of the Pleistocene. First, we will take a brief look at the varying physiographic regions of Alaska that have been influential in shaping the history and prehistory of the state. Descriptions of northern vegetation types will follow, as well as a brief survey of the subarctic and arctic fauna found in Alaska today.

Alaska's most prominent physiographic feature is without question its mountains. Dominating the northern landscape is the impressive Mount McKinley, the highest peak in North America, which reaches a height of 20,320 feet. Mount McKinley lies within the Alaska Range, a great arcuate mountain wall, about 600 miles long, which extends entirely across the state. Throughout its great length the range is rugged and intensely glaciated. Few other peaks in the Alaska Range, however, reach such great elevations as McKinley does. In fact, fewer than twenty mountains are above 10,000 feet in elevation, and the others average only 7,000 to 9,000 feet (Wahrhaftig 1958:49). Thus, the few high mountains like Mount McKinley create an impressive towering effect in relation to the surrounding peaks.
Two contrasting types of scenery prevail in these mountains. The alpine slopes, although steep, are usually even, and only the highest summits are sharp. The adjacent rolling lowlands, on the other hand, are regions of varying plant and animal life. Timber line reaches about 3,000 feet; thus the lower slopes are blanketed with forests.

The geologic formations of the Alaska Range vary greatly and represent periods of earth history from the Precambrian to the recent Tertiary. These rocks are for the most part igneous and sedimentary. The oldest Precambrian rocks, such as the Birch Creek schist, have been subjected to repeated mountain building forces, while the youngest sedimentary rocks, Tertiary coal-bearing deposits, are so slightly consolidated that they erode easily to badlands (Wahrhaftig 1958:54). According to Wahrhaftig, the Alaska Range "is carved from a great downfold in the earth's crust—a synclinorium—in which the youngest rocks lie along the center and are flanked on the north and south by older rocks" (Wahrhaftig 1958:54).

The continuity of the Alaska Range is broken by the broad valleys of the Delta and Nenana Rivers, two streams that rise on the south side of the range and flow northward to the Tanana River Valley. The Susitna River, on the other hand, drains the south slope of the range, flowing from the mountains southward to Anchorage and the Cook Inlet. These rivers occupy flood plains that range from one to six miles in width and the bordering lowlands are dotted with glacial deposits, stream gravels and lakes.

The Brooks Range

Another dominant feature of the northern landscape is the Brooks Range, which also lies in a great east-west arc; however, it is virtually a mirrored image of the southern Alaska Range. The Brooks Range has been recognized as the northernmost and terminating section of the Rocky Mountains (West 1981:6).
While not as high as other mountain ranges in Alaska, it is the highest within the Arctic Circle, and for this reason is unique in many respects.

Although the Brooks Range is largely devoid of trees, underlain by permanently frozen ground and blanketed by snow, ice and almost total darkness during much of the year, the remaining months are marked by almost continuous sunlight and sufficient rain to change the bleak tundra into a carpet of miniature flowering plants. Many small cliff and valley glaciers setting in oversized cirques and troughs in the eastern half of the range testify to previous widespread glaciation. West of the Killick River, glaciers are almost entirely absent, partly because of the diminishing altitude in that direction. The mountains of this region are much smoother than those of the east (Gryc 1958a:112).

The Arctic Slope

Beyond the Brooks Range stretches the vast Arctic Slope, a region of largely uninhabited frozen tundra. The Arctic Slope consists of two distinct physiographic provinces, the Arctic foothills and the Arctic coastal plain (Williams 1958:119). The foothills province extends east-west from the Canning River to Cape Lisburne. It is characterized by isolated hills and ridges of sandstone, limestone, conglomerates and cherts. These rocks have been classified as Triassic, Jurassic and Cretaceous in age. The average elevation is about 1,000 feet; yet the highest altitude is Castle Mountain at 3,726 feet (Gryc 1958b:120). The Arctic coastal plain, on the other hand, is a monotonous flat region marked by thousands of lakes and swamps. Phillip S. Smith described the coastal plain as follows:

Except for minute minor details, its appearance is everywhere the same. Its slope is so slight that to the unaided eye it appears to stretch away to the horizon as an endless flat. Prominent landmarks are entirely absent. Owing to its featurelessness even minor elevations such as sand dunes 10 feet high
appear to be notable prominences; in fact, it is said that one of the earlier explorers reported a range of mountains east of the Colville where subsequent explorations have proved that only low sand dunes exist (Gryc 1958b:124).

The climate of the Arctic Slope province is surprisingly not one of perpetual snow, ice and cold. During the winter half of the year, almost continuous darkness cloaks the slope, and temperatures of 50 degrees F are common. By April, however, the sun shines, and by late May only the largest snowbanks remain. Streams and rivers usually break up during the last two weeks of May; yet many lakes remain frozen until late June.

All the major northward-flowing rivers that originate in the Brooks Range reach the ocean through the Arctic Slope region. They meander over wide floodplains, and near the coast many split into numerous distributaries, emptying into the Arctic Ocean over broad mud flats too shallow to float across even in a small canoe (Gryc 1958:124).

The Interior Highlands

The topography of the Interior Highlands Province consists of two varying classes of mountains. One group is characteristic of subdued rolling hills that reach an elevation of 2,000 feet above sea level. These low hills "extend with the monotonous regularity of ocean waves from one horizon to another" (Chapman 1958:83). The second class, however, is one of high rugged mountains with steep narrow valleys. These mountains range in elevation from 3,000 to 4,000 feet. Two mountains, Mt. Oratio and Mt. Waskey reach higher than 5,000 feet (Chapman 1958:84). Both groups trend westward. Valley glaciers have played an important role in sculpturing the topography. Those that extended southward from the Brooks Range during the closing stages of the Pleistocene epoch left behind U-shaped valleys and moraine deposits too numerous to count. Many lakes formed in morainal depressions. Prominent terraces on the sides of the many larger valleys testify to the downcutting of mountain streams as glacial conditions changed (Chapman 1958:96).
Figure 1:

Alaska’s Physiographic Regions
The Interior Highlands are bounded on the south by the meandering and braided Tanana and Yukon Rivers, on the west by the extensive swampy lowlands adjacent to the Koyuyuk River, on the north by the more rugged Brooks Range, and on the east by the Alaska-Canada border (Chapman 1958:88).

These highlands consist geologically of Mesozoic granite, quartz diorite, and other igneous rocks (Chapman 1958:92). The oldest deposits are Precambrian in age, the Birch Creek Schist (Chapman 1958:89).

The main rivers that drain this province are the Yukon, Tanana, Koyukuk, and Porcupine. Most of these rivers rise at the base of the two bordering mountain ranges, while the Yukon's source can be found hundreds of miles beyond the Canadian border.

The Western Lowlands

Much like the topography of the Arctic Slope, the Western Lowland Physiographic Province of Alaska is characteristic of slightly undulating plains dotted with low hills. Most of the floodplains and river deltas lie within 100 feet of sea level. Several hills and ridges, on the other hand, reach over 1000 feet in elevation (Black 1958:78). The Western Lowlands Province extends east-west from the Bering Strait to the Canadian border, following the Tanana, Kuskokwim and Yukon River Valleys; and it extends north-south from the Brooks Range to the Alaska Range.

The lowland geology consists largely of Quaternary deposits of unconsolidated clay, silt, sand and gravel. These deeply buried sediments are products of glacial and stream erosion. The earliest rocks—schists and gneisses—date as far back as the Proterozoic Era (Black 1958:77).

The main rivers of this province are the Yukon and the Kuskokwim. Most of their tributaries arise from the southern Alaska Range as a result of the greater precipitation there in comparison to the Brooks Range. The larger rivers
meander through wide valleys to within 100 miles of the Bering Sea Coast. Here they begin to braid into many distributaries, much like the rivers of the Arctic Slope (Black 1958:80).

**The Seward Peninsula**

Although by far the smallest physiographic region in Alaska, the Seward Peninsula is topographically distinct from any other surrounding province. This remote western projection of the Alaskan mainland lies extremely close to Asia. The shallow seas that now surround it once were dry plains which reached the Siberian coast.

The peninsula is roughly rectangular, 200 miles from east to west and 120 miles north to south. Cape Espenberg, the northernmost point, lies above the Arctic Circle. The peninsular coast is characteristic of low plains much like those found in the Western Lowlands (Hopkins 1958:105). The interior consists of lowland basins as well as extensive uplands. The highlands are made up of broad, convex hills and ridges separated by sharply descending V-shaped valleys (Hopkins 1958:105). They generally range from 1000 to 3000 feet; yet Mt. Osborn, the highest peak in the province, reaches an elevation of 4,720 feet (Hopkins 1958:105). The lowland basins, on the other hand, are dotted with lakes and floored with alluvium and glacial sediments. Apparently, the only readily traceable genetic relationship between the rocks of Alaska and Siberia is found on the Seward Peninsula. It has been argued that the lithology of the Seward Peninsula is more like that of the Chukotka Peninsula of Siberia than it is of the rest of Alaska (Hopkins 1958:76).

The two main rivers draining this area are the Kuzitrin and Koyuk.

**The Alaskan Climate**

It has been said that one of the closest links that still exists between Pleistocene Beringia and contemporary Alaska is climate. In Alaska, the dominant season is winter. At Fairbanks, the average January temperature is -11.9
Figure 2:

Climatic Zones of Alaska
(from Johnson and Hartman 1969: 63)
degrees F; and at Nome it is 6.0 degrees F (West 1981:11). Throughout the interior very little air movement occurs during the winter. Along the coasts where maritime influences come into play, however, wind chill becomes a significant factor.

Other elements bearing upon the general problem of adaptation to the extreme cold include the phenomenon of ice fog and the great seasonal variability in daylight (West 1981:12). Ice fog is a peculiar condensation of ice spicules around hygroscopic particles which generally has its onset at temperatures of about -30 degrees F (McGinness 1980:43). As temperatures drop below that point ice fog intensifies and becomes both denser and thicker until visibility becomes restricted to 15 to 20 feet. Ice fog, of course, only occurs during the winter months, a time when the hours of daylight achieve their smallest values. Because of the low angle at which the sun's rays strike the far north during the winter, twilight periods are exceptionally long while daylight periods are exceptionally short. The sum of these conditions is that intense winter cold occurs when there is minimal daylight; and its effect may be greatly enhanced by the occurrence of ice fogs.

Johnson and Hartman have divided Alaska into four major climatic zones (Johnson and Hartman 1969:55-56). The Maritime Climatic Zone is dominated by maritime influences. It is characteristic of small temperature variations, high humidity, high precipitation, and high cloud and fog frequencies. The mean annual temperature is around 40 degrees F. The Transitional Climatic Zone, furthermore, shows more pronounced temperature variations, less cloudiness, lower precipitation and humidities. The mean annual temperature in this zone generally runs from 25 to 35 degrees F. The Continental Climatic Zone, on the other hand, is dominated by continental climatic conditions. It is characteristic of great diurnal and annual temperature variations, low precipitation, cloudiness and
and humidity. The mean annual temperature ranges from 15 to 25 degrees F. The Arctic Climatic Zone, finally, is characteristic of temperature variations that are lower than the Continental Zone. Precipitation is extremely light and strong winds are not uncommon. The mean annual temperature is 10 to 20 degrees F (Johnson and Hartman 1969:55).

Mean annual precipitation ranges from less than eight inches in the Brooks Range to as much as 160 inches in Southeast Alaska, as shown by Figure 3 (Johnson and Hartman 1969:58).

Vegetation

In order to understand completely the paleoenvironments of Beringia, we must first be able to describe the present day Alaskan environment. Paleo-environments have been determined by biologists through the analysis of pollen grains found in soils and sediments. Since very few, if any, pollen types have changed within the last 20,000 years, biologists can easily compare their pollen findings with a determinant, the pollen grains taken from contemporary plants. Generally, Alaska may be characterized as supporting two major vegetation associations, tundra and taiga. A good deal of variation, furthermore, can be seen within these two categories.

Tundra. Tundra usually is described as treeless vegetation; yet many arborescent species do occur, though typically in a diminutive form. Biologists have divided tundra into four sub-groups. These are polar tundra, alpine tundra, herbaceous-shrub tundra, and moist tundra.

Polar tundra, characteristic of highest arctic and arctic-mountain regions, supports exceedingly impoverished floras with a maximum of only fifty species of vascular plants. Barren areas are very common; and the plants themselves are very low and help shape the almost bare terrain. Plant species include saxifrage, potentilla and arctic willow, among others. Virtually all of the species are only circumpolar in distribution (West 1981:16).
Figure 3

Mean Annual Precipitation in Alaska (inches)
(from Johnson and Hartman 1969:63)
Alpine tundra is a second subgroup. It is generally sparsely vegetated with low heaths, prostrate willows, Dryas, grasses, sedges and other low herbs (Ager 1975:7). It lacks one element which is so important in the remaining two subgroups, dwarf birch. Alpine tundra is found on high rocky ridgetops of the Interior Highlands and the Alaska Range.

Herbaceous-shrub tundra is characterized as a transitional subzone from alpine tundra to moist tundra, the description of which follows. Herbaceous-shrub tundra's list of vegetation reveals many species of grasses, sedges and willows. The total number of vascular species in this transitional zone varies from 150 to 250 (West 1981:17). Much more diversity in plant life occurs in this tundra than in polar and alpine tundras.

Moist tundra occurs throughout Alaska, in areas of persistent strong local winds. It includes dwarf birch, resin birch, heaths, willows, occasional patches of alders along streams, tussocks of cotton grass, sedges, grasses, Dryas, and other herbs (Ager 1975:10). Patches of shrubby moist tundra occasionally occur with scattered stunted spruce at lower altitudes (Ager 1975:7). Of all the tundra habitats moist tundra is the richest and most diversified (West 1981:18). It may support up to 200 species of vascular plants, and in some areas, such as the Seward Peninsula, the list reaches 500 (West 1981:18).

**Taiga.** Alaska's most extensive biome is that of taiga, the coniferous forest. Laroi (1967:229) defined taiga as "wooded vegetation of boreal-subarctic latitudes and subalpine elevations that occupies the climatic zone adjacent to the treeless tundra" (Ager 1975:7). The trees which characterize this subarctic environment include white spruce, black spruce, paper birch, quaking aspen, balsam poplar and larch. Biologists have further specified the taiga biome into four types of vegetation. These are the closed spruce-hardwood forest, the open spruce-hardwood forest, the white spruce-balsam poplar
closed forest and the muskeg and treeless bog.

We find the closed spruce-hardwood forests in the Yukon-Tanana Uplands and the foothills of the Alaska Range. This subgroup of taiga consists of stands of spruce, aspen, birch, willow and alder. The black spruce is most common on cool moist north-facing slopes while white spruce, aspen and birch are most common on warmer well drained south-facing slopes. By observing the amount of white spruce found at a specific locale, biologists can determine the fire history of the forest. When a closed spruce-hardwood forest is left undisturbed by fire for a great length of time, the white spruce becomes more and more abundant. When fire strikes, however, the temporary environment produced caters best to the hardwoods—the aspen, birch and willow. Groundcover in the closed spruce-hardwood forest is commonly a thick layer of mosses in stands of spruce (Ager 1975:11).

Open spruce-hardwood forests can be found blanketed over the Western Lowlands and Southeastern Alaska. These forests consist mainly of black spruce and larch (Ager 1975:11). The underbrush and groundcover commonly includes willows, roses, heaths, dwarf and resin birch, mosses, grasses and sedges (Ager 1975:11).

Closed white spruce-balsam poplar forests are found along the floodplains of Western and the interior of Alaska. The forests are characteristic of alders, willows, prickly roses and other shrubs. Groundcover usually consists of only Equisetum and various mosses (Ager 1975:11).

Bogs are found in the valley bottoms of subarctic Alaska. They are consistently underlain with permafrost; thus, drainage rarely occurs. Bogs consist of grasses, sedges, mosses and various aquatic plants. Heaths, willows, and dwarf and resin birches make up the forest cover when it exists. Muskeg taiga are basically bogs with slightly different vegetations. They are characteristic of tussock sedges, heaths, sphagnum moss, black spruce and larch.
Soils. Soils of the tundra tend to be more difficult to classify than those of the taiga. In the latter regions, under the coniferous forest, is found one of the world's most widely distributed soil groups, the northern podzols. A concise description follows:

With sufficient moisture and a relatively warm summer which as a rule characterize the climate of the taiga, the upper horizons of the soil become leached. Aluminum and iron oxides and bases are carried by soil waters from the upper to the deeper-lying horizons, where they are precipitated, enriching the lower horizons with alumina, iron oxide, and so forth, as well as with silt particles. On the other hand, in the upper, eluvial horizon, silica remains, and is accumulated, and the horizons become sandy. In cross-section, the striking feature of podzol soils is their three-color profile: the top layer is a yellow-brown color, illuvial, clayey and enriched by sesquioxides, and to some extent also by bases and humus. It is from the presence of the middle, white layer that these soils have been given the popular name of podzols ("the color of ash") (Berg 1950:34).

Variations in the podzolic soil type occur throughout Alaska in response to varying types of plant cover.

Soil scientists have identified five major soil classifications of Arctic Alaska. These are lithosols, regosols, arctic brown, tundra and bog (Drew and Tedrow 1962). Only arctic brown soils achieve full maturity, while extreme saturation and low temperatures restrain the others from becoming zonal soils.

Permafrost. Permanently frozen soil occurs all across Alaska. Permafrost can be made up of many different soil types, but they all have one thing in common, their temperature never rises above 0 degrees C. It's greatest depths are found in areas that were not covered with ice during the last glacial period.

Many parameters contributed to the formation and continuing existence of permafrost. Winters are long and cold, and daily frosting occurs for ten months of the year. The snow cover is commonly shallow and oftentimes incomplete, so that seasonal frost penetrates deeply into the soil (up to 15 feet). During the short summers, furthermore, subsoil temperatures at a depth of 4 inches rarely rise above the 40s, even when surface temperatures reach 75 degrees F. As a result, the annual thaw is commonly inadequate to melt the winter frost.
The permafrost can ultimately reach a depth of more than a thousand feet (Butzer 1976:377). The presence of permafrost has had a considerable effect upon plant and animal life and indeed may be said to be responsible for creating many of the peculiarities of the northern landscapes.

**Fauna**

**Mammals.** Archaeological sites in Beringia have been known to provide large amounts of direct evidence of faunal associations. Thus, in order to trace the skeletal remains to their original beings, we must have some knowledge of present day fauna in Alaska. With the exposing of the land bridge, many animal species found the usually closed gate open and quickly tramped across the land bridge to the new open grasslands. Mammals include grizzly bears, brown bears, black bears and polar bears, red fox and arctic fox, the wolf, weasels, wolverines, lynx, marmots and other rodents, caribou, wapiti, mountain goats and bighorn sheep, and a few other mammalian species.

**Birds.** Hundreds of bird species inhabit the north. These range from waterfowl such as geese and ducks to small songbirds like cardinals and blue jays. Of course the most impressive of the birds are the peregrine falcons and bald eagles which fly high around the peaks of the Alaskan mountain ranges.

**Fish.** Freshwater fishes include the wide ranging *Salmo* genus, which includes the salmon as well as trout species.
CHAPTER TWO

"The Beringian Paleoenvironment"

The reconstruction of past vegetation successions is of fundamental importance not only for its own place in the hierarchy of physical and biological causality, but also for its detailed inferential record of climate. Climate is a composite of meteorological phenomena that leave no direct evidence. This is, perhaps, one of the most difficult constraints under which the reconstructive scientists work. Since climate is the driving force of nature, it is the driving force of man. Thus, in order to fully understand the prehistory of the human race in Pleistocene Beringia, we must be able to comprehend the paleoenvironment, as well as how paleoenvironmental studies occur today.

For the most part, the reconstruction of the past environments are derived from the retrievable evidences of former vegetation. Although plant macrofossils discovered in frozen soils are not uncommon and oftentimes employed in studies, more full, precise, sensitive and continuous records are provided by pollen studies.
Glaciation in Alaska
(from Johnson and Hartman 1969:25)

Figure 4

Areas covered by ice during the Pleistocene Epoch.

Areas covered by existing glaciers today.
Palynology

A valuable tool for reconstructing past environments is the analysis of vertical sections of lake sediments for pollen and fossil microfauna. In order to use this method researchers must find lake basins which are relatively close to the submerged platform of Beringia. Three palynologists, Paul A. Colinvaux, Thomas A. Ager and Charles E. Schweger have found lakes which produced sediment cores dating to as far back as the Pleistocene Epoch. These lakes provide a nearly continuous record of the environment throughout the period when the land bridge was established, persisted, and was finally severed.

Methodology. Palynologists usually select their core sites with three conditions in mind. First of all, the site has to be accessible to the work crew. Since western Alaska has very few roads, flight is the most popular mode of transportation. Thus, the lake must be of sufficient size to allow the landing and taking off of a small airplane. As mentioned above, the lake must be of great age. Geological observations have to be completed so as to allow the dating of the underlying bedrock and sediments. If the stratigraphy of the lake bottom and the beaches reflect a history which reaches back to the Quaternary, palynologists can consider the lake as a possibility for their studies. The third criteria that must be met in order to successfully test an ancient and accessible lake is its depth. Wave action of extremely shallow lakes tends to cause the mixing of the bottomlying sediments. The deeper the lake, the lesser chance of different sediments mixing (Ager 1975:23).

Once the palynologists have selected a site which promises to be productive, they can then extract core samples of the sediments underlying the lake. Ager (1975:24) utilized a Livingstone Piston Sampler to drill the cores from a "portable floating platform," or raft, secured by six anchors. They lowered a sectioned aluminum casing to the lake bottom and penetrated the upper...
sediment only slightly. They then lowered the piston sampler down through
the casing and took cores in one meter increments. Each section was immedi­
ately sealed and labelled.

At the end of the field session, after all samples had been collected,
the palynologists moved into the laboratory. Before extruding the samples
from their aluminum tubes, the lab technicians X-ray each one; thus providing
a permanent record of the structures of the sediment cores prior to their
disturbance. Some of the structures, furthermore, are visible on X-rays only,
and not seen by the naked eye. Next the palynologists describe the sediments' structures, textures, and macrofossil content. Colors are recorded in terms
of the Munsell Soil Chart.

Now the cores can be subsampled for pollen analysis. Divisions 1 cm³ in
volume are removed from 10 cm intervals and placed in stainless steel boxes—
thus giving a uniform amount of material from each 10 cm section (Ager 1975:
26). The lab technicians now treat the subsamples with 7% NaOH, acetolysis and
bromoform separation. One to five tablets of Lycopodium clavatum spores can
now be added. These spores are a "spike" of a known number of exotic spores
which allow one to calculate the concentration of naturally occurring pollen
and spores per unit volume of sediment. This is achieved by determining the
ratio of introduced exotics to non-introduced pollen spores. The resulting
data is expressed as pollen and spores accumulating per cm² per year, the

The next step involves the counting of pollen grains and spores. Once
placed on slides, technicians observe the pollen at 250, 400 and 900x. 300
grains are counted and identified on each slide. In positively identifying
the grains, one must use other reference materials--pollen grains of hundreds
of taxa collected from contemporary vascular plants (Ager 1975:28-29).
Once the pollen has been analyzed, the palynologist may send samples from the cores to be radiocarbon dated (Ager 1975:27). By extrapolating the lowermost radiocarbon dates in the cores, an estimate of the age of the base of each core can be obtained.

**Imuruk Lake.** Imuruk Lake (Colinvaux 1964) is near the center of the Seward Peninsula, sixty miles south of the Arctic Circle. Bounded on the south by the 5,000 foot peaks of the Bendleben Mountains, it is 1021 feet above sea level. The area's barren appearance was caused by extensive unvegetated lava flows of Pleistocene and more recent age. Many of the lava flows, furthermore, are covered with a thick mantle of loess on which rich tussock tundra grows. The topography is undulating with small water courses, lined with willow bushes, that run between folds. The climate is cold with long winters and short, cool summers. Rainfall averages 10 to 15 inches per year (Colinvaux 1964:299).

The lake is not quite ten feet deep. It occupies a shallow basin about eight miles long which has formed by a series of lava flows (Colinvaux 1964:299). The modern vegetation of the well drained and well watered areas are made up of tussock tundra. When silty, the ground surface is covered with tussocks of cottongrass. There is a rich association of many other species. These consist of such plants as grasses, herbs (Dryas), heaths and Sphagnum. Rocky areas with thin soils are characteristic of vegetations dominated by Betula nana (birch) and a number of species of heaths. This occurs mainly on the tops of ridges (Colinvaux 1974:300). No true trees other than birch exist in the area of Imuruk Lake.

The cores that Colinvaux extracted from the lake bottom consist of alternating layers of mud and sand. The mud is rich in montmorillonite and kaolinite clays. Organic particles are scarce. As for the sand, five well-defined layers were counted. The bottom four are coarse, poorly sorted sands, while the top layer is fine, well sorted sand in a matrix of silt and clay (Colinvaux 1964:301).
Reconstructing past vegetation and climate from the sole evidence of a pollen diagram is a delicate and risky operation because the pollen rain does not bear a simple relationship to vegetation. An additional difficulty is that past vegetation can never have been quite the same as any growing now. Positive identification of fossil plants, as of species still living, permits fairly reliable conclusions about the communities in which they lived, but pollen can rarely be identified at the species level. For these reasons vegetational interpretations should be based on macroscopic plant remains whenever possible. Unfortunately, the plant remains found in the Imuruk Lake core was confined to a few moss bogs (Colinvaux 1964:301).

Colinvaux's results from the pollen analysis show that the Imuruk Lake core can be divided into three zone types. Type I represents cold, grassy tundras living in a climate as cold as the most arctic portions of contemporary Alaska. Type II corresponds to a warming trend. Dwarf birches became quite numerous, grasses declined, and cottongrass tussocks began to develop. Type III, finally, represents further warming. Tussock development reached a maximum, and an Eriophorum dominated tundra like that at Imuruk Lake today was produced. On this interpretation, the present is a warm period in the history of the lake core; and there have been two periods in the past when climates were colder than now. Colinvaux also divided the mud and sand layers into distinct geological periods. Table I shows vegetational information regarding each period. The core was radiocarbon dated at six places. The core bottom was dated to 24,000 years BP (Colinvaux 1964:308).

The vegetational history is one of a succession of tundra types. These range from a sparse grassland of very cold times, to the rich tussock tundra found in the region today. No forest or vegetation with trees has ever existed in the Imuruk Lake region. Alder and dwarf birches have never been more numerous than at present. Alder, furthermore, was absent from the tundra during the early history of the core (Colinvaux 1964:312).

The pollen evidence suggests that the lake was formed in the first interglacial period; and it quickly established a water level eight meters lower than that of the modern lake. This can be interpreted from the first sandy layer.
The climate was interglacial, somewhat drier than at the present, and warm enough to allow the growth of spruce trees along the coast of the Seward Peninsula (Colinvaux 1964:322). A prolonged period of fluctuating lake level followed, as a result of temperature changes. The interglacial period ended as gradual cooling led to extreme arctic conditions. This period, known as the Nome River glaciation, ended with a return to milder temperatures. Lake level was high in the second interglacial period, and the climate was cold and arctic-like. The second glacial period, furthermore, occurred in correlation with the widespread Wisconsin era of glaciation. This came to an end 10 to 13,000 years ago, and was followed by the final warming trend. Mammoths, bison and horses roamed the area at this time, grazing on the abundant grasses and sedges. The warming trend has continued up to the present (Colinvaux 1964:323).

Twice during the history of Imuruk Lake, therefore, there occurred glaciations capable of lowering the sea level from 300 to 450 feet. These resulted in the Seward Peninsula becoming a part of the land mass connecting Alaska and Asia, now known as Beringia. Both times that this happened, the climate at Imuruk Lake was extremely arctic. Vegetation consisted only of the most frigid form of arctic, tussockless, grassy tundra, spotted with frost scars and loess deposits. It was devoid of all trees and shrubs except willows. According to Colinvaux, only the most cold adapted animals and men could have lived in this environment (Colinvaux 1964:323).

Birch Lake. This lake, palynologically studied by Ager, lies within a small east-west trending valley of the Yukon-Tanana upland. The lake is enclosed by bedrock and deposits of organic-rich colluvium. The bedrock ridges along the north and south ends of the lake, furthermore, are composed of Birch Creek Schist and granitic intrusions, and are blanketed with loess and colluvium. The west end of the lake is formed by a dam of sand and gravel deposited by the Tanana River during the late Pleistocene (Ager 1975:33).
Ager obtained five sediment cores: two of these were used for pollen analysis and sediment grain size analysis. Core I was extracted from water 5.1 meters deep, while Core II came from water 13.8 meters deep (Ager 1975:33).

The underlying sediments were made up of Pleistocene and Holocene loess, which was transported to the lake from the nearby slopes and valley bottoms. Also, deeply weathered quartz-mica schists and granitic bedrock have contributed sediments to the lake. Biological activity within the lake contributed some organic material to the sediments. In fact, diatoms, algae, vascular plant leaves and forest litter have been identified at the lake bottom (Ager 1975:35).

Radiocarbon dating has set the age of the two cores at 10,000 years BP for Core I and 15,100 years BP for Core II.

Ager conveniently divided the cores into four zones. These are Zone 1, Zone 2, Zone 3a and Zone 3b (Ager 1975:45).

Zone 1 he called the "Gramineae-Artemisia-Salix-Cyperaceae Assemblage." It is characterized by a pollen spectra which contains no more than a few percent of spruce, alder and birch pollen, and a high percentage of grass and Artemisia pollen. No close modern analog for Zone 1 vegetation exists in present day North America. It does, however, share some traits with pollen samples from herbaceous tundra and grassland areas of Canada (Ager 1975:46).

The vegetation that produced the Zone 1 pollen spectra was neither a Barrow-type herbaceous tundra, nor a Canadian-type grassland, but does have elements included of both. It also contains some of the highest percentages of Artemisia and grass pollens yet
found in Alaska. This makes a steppe-tundra environment less speculative than previously thought (Ager 1975:47). Winters were much colder than at present in the Tanana Valley, and summers were shorter but warm. Annual precipitation was probably less than one-half of that which falls today. Permafrost, although continuous, was not close enough to the surface to contain a high water table (Ager 1975:49).

Ager named Zone 2 the "Betula-Salix-Gramineae-Cyperaceae Assemblage." It is characteristic of overwhelmingly dominant birch pollen and contains very low percentages of spruce and alder pollen. Willows, grasses and sedges were also important aspects of the vegetation (Ager 1975:45). This abrupt transition from steppe-tundra to shrub tundra vegetation about 14,000 years ago suggests a rapid climatic shift to warmer, moister conditions (Ager 1975:52). The vegetation, furthermore, remained quite stable between about 14,000 and 10,000 years ago. In fact, no further change can be seen through the palynological record (Ager 1975:53).

Zone 3a is the "Picea-Betula Assemblage," consisting of up to 80% spruce pollen, 20 to 75% birch pollen, 12% willow, 10% sedge, and 10% grass pollen (Ager 1975:45). This zone records the invasion and ultimate replacement of the regional shrub tundra by spruce-birch forests during early Holocene time, about 10,000 years BP (Ager 1975:53). Initially, the trees probably spread throughout the area along the rivers; and by 9,000 years BP, the spruce-birch forest had replaced the shrub tundra in the lowlands throughout the region (Ager 1975:54). Ager contests that two alternate interpretations exist that explain the rise of the forests. The first is that the spruce did not survive in the interior of Alaska during
late Wisconsin time; therefore, a time lag of unknown duration between the change in climate and the invasion of the spruce from a distant area would be expected. The second interpretation is that a few isolated spruce trees did survive in marginal habitats throughout late Wisconsin time in the Interior. These small populations then rapidly expanded their range as soon as climatic conditions permitted it. If this interpretation is correct, then the date of initial spruce expansion may closely date to the time of the climatic shift to warmer temperatures (Ager 1975:54).

Ager named Zone 3b the "Picea-Betula-Alnus Assemblage." It is characterized by 10% spruce, 30-80% birch, and up to 25% alder pollen. Small amounts of grass, sedge, willow and Artemisia are also apparent. This zone has been determined because of the increase in alder pollen, which occurred about 8400 years BP. The spruce population had been decreasing gradually up to 7000 years BP, being quickly replaced by birch trees. Since that time, the spruce-birch population has remained constant (Ager 1975:55). The spruce decline reflects an interval of a warmer, drier climate, when the number of forest fires substantially increased. Because of this, birch and aspen were naturally selected for. The return to moister summers around 7000 years BP explains the sudden stability in the spruce population. The last 6500 years up to the present has seen little change (Ager 1975:56).

The pollen evidence from Birch Lake suggests that the vegetation of that locale during the time of earliest human occupation was probably shrub tundra. The well drained eolian deposits were sparsely vegetated with plant types such as grasses and herbs. A major climatic and vegetational change occurred about 14,000 years
BP. Such a dramatic and rapid shift from steppe-tundra to shrub tundra could have had a considerable negative impact upon the herds of large grazing mammals that roamed the region (Ager 1975:85). Their habitat was largely eliminated; yet remnant populations survived in local marginal habitats for several thousand years. This could possibly explain the presence of man in Alaska about 10,500 years BP. Finally, however, the warmer climate eliminated all of the megafaunas' habitats, and the forest vegetation quickly spread across all of the Interior (Ager 1975:86).

Epiguruk. The Epiguruk Site lies along the Kobuk River, about fifteen miles downstream from the village of Ambler. It is on a north-facing cutbank exposure, forty meters high and 2.5 kilometers long. Cutbank outcrops display excellent stratigraphic sections that can be related to geomorphic features such as moraines or outwash terraces (Schweger 1982:99).

Schweger (1982:102) noted five sedimentary units at Epiguruk. Studies of Unit A produced coarse-grained sand with crossbeds and ripple marks. Unit B was an extremely variable deposit with dark-brown organic silt and sand, peat, and grey lacustrine silt. Radiocarbon tests dated this unit at greater than 38,000 years BP. Unit C, furthermore, was a fine-grained greyish sand and silt. Ripple marks are apparent. The radiocarbon date for this unit is between 24,300 and 16,300 years BP. Unit D was a massively bedded fine-grained sand and silt--an aeolian deposit. Finally, Unit E was a thinly laminated dark grey silt, radiocarbon dated at 8500 years BP (Schweger 1982:102). Units A and C were sterile of pollen, while Unit B was polleniferous. Schweger collected two profiles from Unit B for observation (Schweger 1982:99).
The two profiles represented lacustrine-fen and upland environments from the middle Wisconsin, at least 38,000 years in age. Profile IIa consisted of a pollen flora dominated by 20 to 80% Cyperaceae, 5 to 20% Gramineae, and 10% Artemisia. Betula and Salix were the only abundant shrubs. Profile IIb, furthermore, was dominated by 45 to 80% Cyperaceae and 5 to 20% Gramineae. Betula and Salix had risen to 15% of the pollen content; and Artemisia had fallen to only 5%. Profile IIa represented a lowland, pond fed facies, while IIb represented a nearby upland. They are nearly contemporaneous (Schweger 1982:100).

During the late Pleistocene, then, the central Kobuk Valley featured treeless vegetation that supported only scattered dwarf birch and willow shrubs. Cyperaceae was the dominant ground cover. This steppe-like element in the vegetation may have been the result of the well-drained sand substrate that to this day is very widespread throughout the central Kobuk River Valley (Schweger 1982:100).

On the basis of the pollen evidence, Schweger presented from this site, he argued that the vegetation displayed a zonation related to two of the most important factors of present day arctic vegetation, surface water and elevation. He briefly described five environmental Pleistocene strata evident from his pollen analyses.

1) Valley bottoms represented the most mesic situation. They were characterized by sedge--Salix--meadows that had a variety of open and aquatic habitats. The vegetation was never complete, due to the constantly changing river.

2) Farther up the slope on the high terraces and flats, the profiles indicated tundra meadows and arctic grasslands.

3) Still higher on the pediments and 4) foothills, a discontinuous, xeric, cold-adapted fellfield tundra had taken root.
5) The mountains were probably largely unvegetated, bearing a plant cover similar to that of polar deserts of the modern high Arctic (Schweger 1982:111).

This moisture elevation gradient that Schweger proposed, implies that rapid changes in vegetation composition, physiognomy and production occurred in most areas of eastern Beringia during the late Pleistocene. Please see the figure below.

![Vegetational Continuum of Eastern Beringia](image)

*Figure 6*

*Vegetational Continuum of Eastern Beringia*  
*(from Schweger 1982:111)*
Autecology of Beringia

Autecology refers to the relationship between an organism and its surrounding physical environment. This relationship can be thought of in terms of energy and moisture requirements and tolerances for negative factors such as cold, drought, and other disturbances. These environmental characteristics, furthermore, can be complemented with the organisms' selection pressures. When studying Pleistocene Beringia, we should apply this concept to show correlations between plants and their contemporary climatic parameters (Young 1982:184).

In doing this, Young (1982) made the following conclusions. (1) Most plant species of the Arctic have specific and predictable requirements for summer warmth. These plants will therefore not occur in an area where these minimum conditions are not met. (2) An area's summer temperature regime can be predicted on the basis of the presence of the least tolerant species that is known to occur there. (3) The presence of a single species with a known requirement for a given summer temperature regime implies the likely presence of a group of other species with similar requirements (Young 1982:184).

We should note, however, that the absence of a given species from an area does not necessarily mean that its specific temperature requirements are not met there. Along these lines, then, we cannot automatically assume that the absence of spruce in the Beringian environment is evidence for a mean summer temperature of less than 10 degrees C. In fact, evidence showing the presence of other species with summer temperature requirements similar to those
of spruce would indicate that the absence of spruce was due to some other ecological factor. "In other words," wrote Young, "the absence of spruce as a major component of the vegetation of landbridge Beringia by no means justifies the assumption that we are dealing entirely with a cold 'tundra' environment, and that vegetation types more characteristic of temperate environments could not have occurred there" (Young 1982:184).

From an autecological vantage point we can see that in general, landbridge Beringia was drier and more continental than the present area.

Syneceology of Beringia

Syneceology is the branch of ecology that deals with the relationships among individuals, populations and species in a natural or artificial environment. It involves the grouping of species into various aggregates such as communities, associations, vegetation types, and formations; and it also involves the stability of those aggregations. Certain plant and animal species do tend to occur together over broad areas and over long periods of time. Specifically, syneceology can be applied to the study of Beringia by predicting the stability of certain syneceological types through the period of time from the Pleistocene to the present (Young 1982:185).

Much of the present vegetation of Alaska is neither tundra nor boreal forests, and all indications are that, in the past, even less vegetation could be thus categorized. In fact, cottonwood stands extend over comparatively large areas in Alaska many miles beyond the Arctic timberline. Timberline is defined as the poleward limit of arborescent coniferous growth. Thus, in regard to a reconstruction of the Beringian landscape, syneceologically we should
essentially ignore the traditional concepts of tundra and boreal forest and any other climatic implications (Young 1982:185).

Young suggested that "the vegetation of land bridge Beringia consisted largely, but by no means entirely, of a mosaic of more or less mesic to xeric vegetation types that presently have modern analogs in the area" (Young 1982:186). Modern wet to mesic vegetation types, such as tussock tundra and dwarf-birch scrub, were of little significance.

Phytogeography of Beringia

Phytogeographic information comes from distributions of taxa that are disjunct, narrowly endemic, or rare and of local occurrence (Young 1982:181). Disjunction in distribution can occur in two ways. Either the taxon surmounts a barrier to its steady migration by means of long distance dispersal, or a previously continuous range is disrupted by some event such as a change in climate. Phytogeographers look for clues that tell us which of the two is most probable (Young 1982:181). If a certain plant is a recent invader of a new territory, it would actively extend its range from its initial foothold. If it is a relict from a previously more continuous population, on the other hand, its range is stable or shrinking. Phytogeographers have found intermediate occurrences. For example, a plant that has great dispersal ability but little competitive ability may repeatedly colonize an area; yet they do so unsuccessfully. The status of a species, furthermore, could oscillate between relict and active as climatic changes occur (Young 1982:182).

Young made the following assertions in regards to Beringian phytogeography.
1) An area that has become an "island" will begin losing species from its original biota. Unless replaced, the island's biota will become a diminished sample or subset of original biota.

2) The number of species will be roughly proportional to the size of the "island;" smaller islands have smaller samples.

3) What species remain in the sample is predictable to some degree on the basis of individual species requirements for critical population size and on the need for space.

4) Random extinctions are more likely among small populations, hence on small "islands."

5) It then follows that there will be an increasing dissimilarity among the biota of "islands" correlated with decreasing size of the island (Young 1982:182).

Phytogeographically, Beringia was unique in that it contained an exceptionally large number of species which were highly disjunct and existed as small populations restricted to local areas. These local areas show the above characteristics.

This evidence may be interpreted as supporting the following assertions: first, many of the disjunct plant distribution patterns in the land bridge area are considered to be the results of extinctions of previously existing populations; second, the areas that support relict populations can be considered as samples of a pre-existing vegetation, although the sample from any single location can be assumed to be depauperate; third, a pooling of data from many of the samples are useful in reconstructing a clear picture of the vegetation type of which they are remnant; and finally, fourth, the most significant relict areas appear to be those characterized by species adapted to arid or semiarid situations (Young 1982:183).
In conclusion, then, it can be said that autecological, synecological and phytogeographical information supplement the pollen analyses of ancient Beringian sediments. Palynologists have just begun to apply this vast record of information in order to gain a clearer idea of the paleoenvironment of land bridge Beringia.

Paleoclimate

While palynology reveals vivid descriptions of ancient vegetation patterns, paleoclimatology gives us insights on the overall climate of the Beringian land mass. Climate is the ultimate mediating factor that controls the nature of an ecosystem. Unless certain climatic requirements are met, soils cannot form, plants cannot grow, and animals cannot eat. It is obvious, then, that accurate information concerning the climate or paleoclimate can provide a powerful tool for predicting what an ecosystem is or was like.

Climatologists usually reconstruct paleoclimates either on a broad global scale, using general climatological/meteorological principles, or at specific sites, using detailed knowledge of proxy climatic indicators. Global scale questions are examined by applying numerical differences in atmospheric circulation and climate; yet they have only limited capability to depict regional details. Site-specific data on pollen or faunal assemblages can be converted to climatic estimates using transfer function methods. This enables spatial paleoclimatic reconstructions to be made at a specified time horizon if a suitable network of core sites exists. This transfer function method, however, becomes unreliable when fossil assemblages are non-existent in the modern environment (Barry 1982:195).
A third procedure has been developed to determine paleoclimates. This method entails the outlining of possible empirical and modeling approaches to paleoclimate reconstruction. These factors include the nature of the general circulation and the radiation inputs appropriate to the period involved, the differences in regional geography due to sea level changes, and, finally, the microclimatic factors related to local terrain, vegetation cover and permafrost (Barry 1982:196).

Barry (1982) found that during the last period of Beringian exposure, a regime of cold, dry winters existed, especially in the interior valleys and in the vicinity of the Bering Strait. Summers appear to have been much drier and cooler than they are today, allowing more of the annual precipitation to fall as snow. Local climatic differences may have existed, thus explaining the variety of habitats strewn across eastern Beringia (Barry 1982: 203-204).

Paleoclimatology, however, is a relatively new science, and many shortcomings have been realized. This discipline, however, is crucial to the fuller understanding of Pleistocene Beringia; thus, we must continue suggesting ways in which improved paleoclimatic reconstructions might evolve.

Paleontology

Paleontology is, of course, the study of fossils. Fossils are the remains or traces of animals or plants which have been preserved by natural causes in the earth's crust. In the process of fossilization, preservation of organic remains depends chiefly upon quick burial in a protective medium and some kind of hard part, whether it be a shell or a bone (Moore 1952:1). Paleontolo-
gists, furthermore, have divided fossils into two rather large groups--microfossils and macrofossils.

Macrofossils of plants, for example, provide valuable additional insights to the past vegetation of Beringia. Since many seeds can be identified to genus and species, they oftentimes offer a better source of floristic information than does pollen evidence (Matthews 1982: 133). Fossil insects, furthermore, contain an abundance and diversity of species that live near or in water. Bark beetles and ants, for example, are characteristic of very wet areas. Tundra beetles and weevils conversely live in dry and scantily vegetated areas (Matthews 1982:138).

Fossils representing North American megafauna also tend to be important to paleoenvironmental studies of Beringia. Subarctic and arctic mammals were less provincial and taxonomically more complex during the Pleistocene than they are at the present (Matthews 1982:139). With the exception of a few purely American mammals, such as porcupines, raccoons, and deer, the mammals of Pleistocene Beringia were of Asiatic origin. Paleontologists studying the megafauna from this period have placed the Asiatic mammals into two subgroups. One group consists of species now living in North America which have remained very similar to species in eastern Siberia. These include forest bison, musk-ox, snow sheep, moose, elk or wapiti, brown bear, weasel, wolf, red fox, lynx, arctic hare, and voles. The second group consists of closely related mammals which differ from Asian fauna specifically or generically. These include plains bison, bighorn sheep, mountain goat, grizzly bear, black bear, coyote and bobcat. This second group first migrated into North America during an earlier glacial period and moved further south, isolating themselves from other fauna which came later (Flerow 1967:275).
Conclusions

While paleontological and paleoclimatic studies greatly add to our knowledge of Pleistocene Beringia, they cannot alone explain the paleoenvironment. Instead, we need the results of pollen studies performed by palynologists throughout the state of Alaska. Imuruk Lake, Birch Lake, and Epiguruk, for example, offer three such pollen studies.

Through looking at these studies, we are able to make the following assertions about the environment of Beringia from 18,000 to 8,000 years BP.

1) Climate, relationships between land and sea areas, and the distribution of continental ice changed continuously during the time of our interest; vegetation was probably in a constant state of flux.

2) The area is of enormous geographic extent and physiographic and climatic complexity; it cannot be presumed to have supported a uniform vegetation in the past, any more than it does at present.

3) The vegetation of an area at any given moment is the result of the interaction of a unique combination of many processes, both currently acting and historical. Any vegetation system is qualitatively as well as quantitatively distinct from any of its precursors or derivatives (Young 1982:180).

In sum, all present evidence indicates that the climate of late Pleistocene Beringia was very cold and very arid. Given the immense size of the subcontinent, it is probable that continental effects dominated the climate during high sun periods as well as low. This suggests that summers were mild but brief. Since summer temperatures were warm enough to sustain arctic plants, then the only reasonable explanation for the absence of arboreal forms seems to lie in aridity.

As for vegetation, Arctic Alaska during late Pleistocene times was endowed with a xeric steppe tundra which gave way, around 12,000 years ago, to the shrub tundra that continues to characterize that region today.
CHAPTER THREE

"The Archaeology of Beringia"

Beringia was almost certainly the gateway by which man first entered the Americas, and therein lies one of the bases for the contemporary interest in ancient Beringian landscapes, climates and archaeology. Hundreds of archaeological sites have been excavated in Alaska, the Yukon and Siberia. Of these, we will take an in-depth look at only three. Unfortunately, I found it extremely difficult to find actual reports of archaeological excavations, a statement which cannot be true in regards to the reports on pollen and other environmental studies.

Archaeological and paleontological research during the past fifteen years in eastern Beringia has begun to reveal a complex and interesting record of human occupation in a changing landscape in Alaska and the Yukon Territory. We still do not know when mankind first entered the region, but we have begun to see the potential for a continuous record of human occupation beginning in early Wisconsin time and extending into the Holocene. Since no stone tools have been found dating to the early Wisconsin, it becomes difficult to perceive a meaningful pattern in the scattered and poorly dated but apparently early occurrences of fossilized bone, antler and ivory artifacts in eastern Beringia (Morlan 1978:92). The earliest evidence to come to light thus far is in the interior basins of the northern Yukon Territory, which have yielded radiocarbon dates from 50,000 to 28,000 years BP. The Old Crow basin has yielded serrated
end-of-the-bone fleshing tools and antler wedges that unfortunately are widespread in time and space (Morlan and Cinq-Mars 1982:377). It is difficult, then, to use this as evidence indicating the presence of man in North America prior to 15,000 years BP. The following three sites, however, have been successfully radiocarbon dated and do show relative dates due to excellent stratigraphic records.

Dry Creek

The Dry Creek Archaeological Site lies in central Alaska, about 90 miles southwest of Fairbanks. Flanked on the south by the Alaska Range, the Dry Creek site sets upon a late Pleistocene outwash terrace/bluff overlooking the Nenana Valley. The site was discovered in 1972 by C. E. Holmes; and intensive excavation occurred during the digging seasons of 1973 and 1974 (Powers and Hamilton 1978:72).

The three archaeological components that Powers identified at the site are buried within a two meter section of eolian sediments and paleosols, which overlay glacial outwash deposits. "The absence of severe postdepositional disturbance of the sediments," wrote Powers, "has helped make Dry Creek an optimal locality for the study of human adaptation to late Quaternary environments in the North" (Powers and Hamilton 1978:72).

Archaeological Component I has been radiocarbon dated at 11,120 years BP. The depth of this occupation layer is from 170 to 190 cm below the datum. A total of 310 artifacts have been recovered. These consist of 282 flakes, 3 retouched flakes, 2 burins, 1 large blade-like flake, 1 flake core, 1 small triangular biface in three pieces, 1 chopper and 6 scrapers, 10 stones and 3 bone fragments. The majority of these findings were found away from the edge of the bluff (Powers and Hamilton 1978:75).

Component II has been radiocarbon dated at 10,690 years BP. The depth of this second occupation layer ranges from 130 to 160 cm below the datum.
Powers’ crew recovered a total of 1,791 artifacts from this zone. They consist of 1,716 flakes, 6 retouched flakes, 11 microblades, 5 blades, 3 blade-like flakes, 6 side scrapers, 1 end scraper, 2 choppers, 4 elongate bifaces, 2 biface fragments, 2 wedge-shaped microblade cores, 1 asymmetrical lozenge-shaped edge ground point, 10 bone specimens, 19 large stones, 2 anvil stones, and 1 hammer stone. These artifacts have been recovered from all areas of the site; but they seem to be concentrated in two major areas. Area One is along the edge of the bluff where Powers’ crew found an accumulation of microblades. Area Two is situated back away from the bluff near the rear of the trench, centered around a pile of cobbles with diffusely scattered charcoal throughout. This clearly is the remnants of the site’s hearth. Furthermore, a great deal of skeletal material was found in this area, such as a bison mandible and several horse teeth (Powers and Hamilton 1978:75).

Component III has been radiocarbon dated at 8,355 years BP. The stratigraphic depth of this zone ranges from 100 to 200 cm below the datum. A total of 578 artifacts were recovered at this depth. They consist of 573 flakes, 1 blade-like flake, 3 blades, and 1 biface. Like the second component described above, these artifacts are concentrated at the same two areas (Powers and Hamilton 1978:75).

The two areas of accumulation undoubtedly signify two areas of activity. The area near the cliff is characteristic of a workshop, since mainly flakes were found there. The second area further from the bluff, however, shows signs of being the ancient habitation area. This contrast in areas is most striking in Component II (Powers and Hamilton 1978:75).

The Dry Creek Early Man Site, then, has been successful in supplying archaeologists with information on the late Pleistocene cultural traditions of Beringia. The findings, furthermore, tend to compare with the Akmak and Denali Complexes also covered elsewhere in this report. The artifact assemblages, how-
ever, do differ to a great degree with the Gallagher Flint Station and Chindad complexes. This furthers the evidence that substantial cultural variability did in fact exist in Alaska as early as the late Paleolithic (Powers and Hamilton 1978:76).

Onion Portage

The Onion Portage Archaeological Site is located along the banks of the Kobuk River 125 miles upstream from the Chukchi Sea, in northwest Alaska. It is bounded by steeply cut banks to the east and a long natural levee to the west, upstream and downstream respectively. A sandy knoll dominates the wooded landscape of the site. Early men sat atop this hill to view the migrating caribou, who forded the Kobuk River at this point (Anderson 1968:27).

The remains of human occupation at Onion Portage were buried in distinctive strata, thus giving the investigators a unique opportunity to date the site reliably. In fact, the site has not been radically altered during the last 8,000 years (Anderson 1968:24). The meandering river has covered the site several times, forming three feet thick layers of sand. High spring floods have also added occasional thin layers of silt. In all, the site's stratigraphic section is twenty feet thick. Through the excavation of this sequence, archaeologists have found artifactual evidence reflecting three distinct cultural traditions inhabiting Onion Portage up-until 13,000 years BP (Anderson 1968:27).

We are here concerned with the earliest of these traditions.

Anderson named the first complex "Akmak," which in northern-Alaskan Eskimo language means chert. The artifacts from this complex are older than 8,500 years and range stratigraphically from six inches to two feet below the surface.

The Akmak artifacts consist of bifaces, microblades and burins. The bifaces, which generally have the form of a disc, were made by first striking the sides of a slablike core. The detached flakes left scars which ended at the center of the disc. The ancient manufacturer then chipped away small flakes
around the edges of the biface in order to give it a sharp edge. The biface
found at Onion Portage had never before been seen in North America. It
conversely, closely resembles Pleistocene bifaces manufactured in Asia. Micro-
blades average one inch long and one-quarter inch wide. These were struck from
a small core which was prepared like microblades in Siberia and Mongolia. Paleo-
Indians further made them into rectangular chips by breaking off both ends of
the blade. These were set in wood or bone shafts as razor sharp weapons which
would cut quickly and wickedly. Burins are specialized stone tools with a
sharp corner for making grooves in antler and bone. They were constructed by
striking a blow that left a chisel-like point at one corner of the flake. The
burins found at Onion Portage show signs of wear at both the tip and along the
edge; thus they were probably also used for cutting (Anderson 1968:28-29).

The Akmak Period lasted from 15,000 to 8,500 years BP. The resemblances
seen between artifacts of the same period from Onion Portage and Asia reflect
the exposure of the Bering Land Bridge at this time. Many significant differ-
ences, however, do exist. These show that a long period of isolated regional
development occurred during the late Pleistocene. Because of these differences,
Anderson titled the artifact assemblage from the Akmak Period the "American
Paleo-Arctic Tradition" (Anderson 1968:29).

In conclusion, the stratigraphic record at Onion Portage has cast much
light on relations between various poorly dated and undated Arctic archaeological
assemblages.

At the start we see Arctic peoples with cultural roots in Si-
beria adapting themselves to a life of hunting on the treeless tun-
dra of interior Alaska, and later to hunting along the treeless
coast. As we can infer from the abundance of microblade edge in-
sets found at Onion Portage, a part of this adaptation involved the
efficient use of materials other than wood for weapons, among them
antler spearpoints edged with stone (Anderson 1968:30).
Figure 7

Archaeological Sites Covered in Text
The Tangle Lakes and the Denali Complex

The Tangle Lakes lie among the Ampitheater Mountains along the southern slopes of the Alaska Range, approximately 150 miles south of Fairbanks. The lakes form the headwaters of the northward flowing Delta River, which traverses through the Alaska Range to the Tanana River. The Tangle Lakes lie at an altitude of about 850 meters, while the Ampitheater Mountains reach 2,000 meters (West 1981:114).

The Tangle Lakes region is exceedingly rich in archaeological remains. Among them are sixteen sites that West (1981:113) considers to be members of the Denali complex. Characteristic of the Denali complex assemblages are wedge-shaped microblade cores with blade removals unidirectional or from one edge only, burins, biconvex bifaces which probably functioned as knives, flat topped end scrapers on flakes, and large blades and blade-like flakes. West (1981:112) concluded that this Denali complex did not appear to occur outside Alaska and that its closest affinities can be found in Siberia. On the basis of these comparisons, the complex was dated from 15,000 to 8,000 years BP.

Microblades constitute the most frequently occurring artifact (West 1981:123). Microblade cores show a superficial appearance of some variability which may be engendered in part by the type of blank utilized for the core. Otherwise, these microblade cores are highly coherent in terms of technology (West 1981:115). Platform preparation involved the removal of a short segment of the core top. In doing this, the manufacturer removed a single short flake, struck so as to hinge up to about a third to one-half of the distance behind the faceted edge. Rejuvenation of the platform was performed in the same manner (West 1981:122).

Burins are unifacial and manufactured on nondescript flakes. They make up another distinctive part of the Denali industry, showing a high frequency of multiple spall removals (West 1981:124).
Large blades recovered from the Tangle Lakes area also tend to characterize the Denali Complex. The source of these artifacts remains unknown (West 1981:125).

The Denali complex assemblages that West has recovered from the Tangle Lakes are of sufficient size to hold a full range of stone tool types, which incidentally, are remarkably similar. "There are, to be sure, certain differences, from site to site and these will be, presumably, ascribed to temporal differences, seasonality, or to the differing character of economic activities" (West 1981:126). Given the observation that a sizeable percentage of Beringian sites in Alaska is represented in these Tangle Lakes Denali complex sites, it seems reasonable to infer that there must have been peculiarly attractive environmental conditions.

At any rate, it appears as if the first Denali hunters entered the region as early as 13,000 years BP; and they were well established by 11,000 years BP (West 1981:137). At about the same time, West believes, hunters in Siberia were manufacturing the same tool assemblages. Mochanov has found extremely similar artifacts at Dyuktai, Siberia. In fact, West goes as far as saying, "There is no doubt that were these sites of Denali and Dyuktai found in closer proximity they would be classified as the same culture or complex" (West 1981:153). It is appropriate, therefore, that we describe the general morphological pattern of the Dyuktai-Denali assemblages as the Beringian Upper Paleolithic. It seems as if the archaeological connection has finally been made between western and eastern Beringians. Future excavations can only push this connection further back in time; but at the present, it is safe to assume that man was in North America around 13,000 years BP.
CHAPTER FOUR

"The Migration Routes of Early Beringians"

Asian peoples crossed the Bering Land Bridge into America prior to 14,000 years BP. Studies of the rocks, fossils, geography, climates, and vegetations of prehistoric Alaska have begun to unfold the fascinating story of the probable circumstances and conditions under which man first made the crossing to the New World. We can safely assume that the migration occurred as man followed his food to new grasslands. Paleontological evidence proves that the game animals on which he depended had preceded him over into eastern Beringia. The new Beringians tended to not enter the New World en masse, but instead in a series of pulsations continuing over a long period of time. "Presumably he found in the New World a life not very different from that in the Old: the ecological conditions were much the same as those he was accustomed to and most of the animals were probably quite familiar" (Solecki 1973a:21).

There were only three periods within the late Pleistocene during which direct overland contact was possible between Siberia and central North America. The first took place during an undatable interval that coincided with the colder part of the middle-late Pleistocene; the second occurred during an interval between about 28,000 and 23,000 years BP; and the third took place during a shorter and possibly interrupted interval from about 13,000 to 10,000 years BP (Muller-Beck 1967:381).
During the first late Pleistocene opening of the land bridge, at least 40,000 years BP, technological developments on the northern plains of Europe and in western Siberia had reached a stage that is now represented by archaeological sites such as Salzgitter-Lebenstedt and Volgograd. No counterparts to the findings at these sites have been recovered in North America (Muller-Beck 1967:398). The next stage of technological development occurred at the end of the middle-late Pleistocene in the northern Eurasian plains. Archaeologists have found numerous varieties of projectile points; and at one site, Kostynki I, they unearthed artifacts that closely resemble the American Llano complex. These assemblages would have reached Beringia by the end of the middle-late Pleistocene by migration and/or diffusion. The makers of these points easily followed the reindeer, bison and mammoth; and would have crossed over together with them (Muller-Beck 1967:399).

Contrary to what had long been thought, archaeological evidence indicates that the main route was not through southern Alaska but along the northern coast, over the very top of the continent. For example, in 1947, a Folsom point dated to 10,000 years BP was found by a U. S. Geological Society investigative party (Solecki 1973:21). At Cape Denbigh, furthermore, J. Louis Giddings (1964) unearthed an early man site which displayed numerous Folsom and Yuma points. Giddings and Solecki believe that the Paleo-Indians next migrated along the Arctic Slope across Northern Alaska into the present day Yukon Territory where they reached the Mackenzie River Corridor. This waterway remained open during the late Pleistocene glacial advance; thus allowing the Beringians to move southward into the heart of Canada and the Great Plains (Solecki 1973b:22).

According to Solecki, Early Man had available to him two eastward routes to the Mackenzie River. These routes lay on either side of the Brooks Range.
The northern route followed the Arctic Coastal Plain province, while the second more elevated, interior route followed the river systems of interior central Alaska eastward over the divide into the Mackenzie River drainage system. Solecki favors the northern route because the east-west trending foothills made movements extremely easy for both man and animal. Today its treeless terrain is preferred by the caribou herds, and we can assume that they did so in the past along with larger herbivores like the bison and mammoth (Solecki 1973b:86).

Concerning this population expansion and movement, it is the general opinion that there was no compulsive direction or flow toward the east and down the Mackenzie corridor. It was undoubtedly a movement geared to the expansion of hunting territories that led man eastward (Solecki 1973b:87).

While many archaeologists believe the interior migration described above to be the only feasible route available to Early Man, others, such as Knut R. Fladmark, theorize differently. Fladmark (1978) feels that perhaps the early Beringians followed the northwest coast of the Pacific Ocean along Southeastern Alaska and Western British Columbia.

Archaeologists have found evidence showing the use of small watercraft in northeastern Asian and Beringia as far back as 30,000 years BP. Many thus feel that it was quite possible for Paleo-Indians to cross the Bering Strait during an interval of glacial retreat when the landbridge was submerged. Once settling in the New World, it seems reasonable that the coastal tribes would continue to inhabit the coastal area of southern Alaska. In fact, archaeological evidence has been found that backs this assumption. Population expansion would soon occur, causing eastward coastal migrations.

Two main factors have been employed as arguments against the suitability of the Northwest Coast as a migration route for Early Man: (1) intensely rugged terrain; and (2) severity of late Pleistocene glaiations and associated changes in sea level (Fladmark 1978:119).
Figure 8

Migration Routes

A: Probable Overland Interior Routes
B: Probable Northwest Coastal Routes
Recent geological explorations, however, have found strong indications that Wisconsinan ice did not completely cover the entire continental shelf in areas that today are British Columbia and Southeast Alaska (Fladmark 1978: 123). These ice-free areas, furthermore, did have environments capable of supporting human populations. While some food sources may have been lower than at present times, such as salmon and sea mammals, a variety of molluscs would have existed in great numbers—numbers that would have easily fed small village populations (Fladmark 1978:124).

The overall climate of this area during the late Pleistocene was undoubtedly much milder than the continental ice-free corridors of equivalent latitude. The north Pacific remained unfrozen and there is every reason to suspect that climatic circulatory patterns occurred then as today, bringing warmer water to the edge of the continental shelf off the Northwest Coast (Fladmark 1978:126).

At any rate, it does seem feasible that Early Man could have migrated to the lower areas of North America via the Pacific Coast. Very few archaeological sites, however, have been located which give evidence to this theory.

Thus, two migration routes have been proposed that explain the peopling of continental North America. It is impossible to say at the present which of these routes was actually used, if both were used, or perhaps, if neither were used.
BIBLIOGRAPHY

Ager, Thomas A. *Late Quaternary Environmental History of the Tanana Valley, Alaska*. Columbus: Ohio State University, 1975.


